New Energy Solutions Optimised for Islands

NESOI

EUROPEAN ISLANDS FACILITY

D1.4: Regulations and sustainable business models on islands

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Technical references

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Table of contents

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 864266

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 864266

List of Tables

List of Figures

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 864266

List of Acronyms

RES	Renewable Energy Source
LINKY	French smart meter technology
PV	Photovoltaics
RE	Renewable Energy
DSO	Distribution System Operator
LV	Low voltage
MV	Medium voltage
HV	High voltage
TSO	Transmission System Operator
PPP	Public Private Partnership
EV	Electric Vehicles
DLMS/COSEM	Standard for utility meter data exchange (IEC 62056 / EN 13757- 1)
OBIS	Object Identification System
P2P	Peer-to-Peer
BM	Business Model
CEP	Clean Energy Package
CE	Community Energy
NRA	National Regulatory Authority
DR	Demand Response
DSM	Demand Side Management
TFRM	Transitory Flexibility Remuneration Mechanism
EMS	Energy Management System
BEMS	Building Energy Management System
DER	Distributed Energy Resource
DH	District Heating
DC	District Cooling
ESCO	Energy Service Company
EPC	Energy Procurement Contract
PPA	Power Purchase Agreement
EaaS	Energy-as-a-Service
OCTs	Overseas Countries and Territories
SMGW	Smart Meter Gateway
V2G	Vehicle-to-Grid
BRP	Balance Responsible Party

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1 Introduction

1.1 Objective

The EU Island Facility NESOI (New Energy Solutions Optimised for Islands) is a four-year Horizon 2020 project funded under call topic LC-SC3-ES8-2019 (European Islands Facility – Unlock financing for energy transitions and supporting islands to develop investment concepts). It began on October 1st, 2019 and will finish on September 30th, 2023 and is made up of a multi-disciplinary consortium consisting of 10 partners from seven EU member states. It has a total budget of €10 million of which approximately €3 million is dedicated to a cascade funding mechanism to provide direct financial support to EU Islands

Coupled to consortium capacity building activities, the facility aims to mobilise more than €100 million of investment in sustainable energy projects to an audience of 2,400 inhabited EU islands by 2023, giving the opportunity to test innovative energy technologies and approaches in a cost-competitive way and leading to an expected 440 GWh/year in energy savings.

Task 1.4 of NESOI project therefore aims to provide a comprehensive overview of regulatory situations and sustainable business models on islands.

1.2 Scope

This report provides a comprehensive overview of the regulatory situation on EU islands. The status quo of the energy generation and distribution of the islands is being investigated on high level technical, commercial and regulatory side, in order to enable

the implementation of detailed solutions in later stages of the project.

Sustainable business models have been identified, where appropriate and feasible for the different technological solutions to be implemented.

Constraints and limitations are investigated for the islands, taking into account the relevant barriers and considering enabling actors such as ESCOs, local authorities, etc.

1.3 Methodology

In order to be most effective in linking information and ensuring the topics covered would be most relevant for the NESOI project, T1.4 was divided into 8 subtasks:

T1.4.1 Ideation of Innovative Business Models

This subtask would involve selecting various business models which could be interesting for the case of islands.

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T1.4.2 Validation of Innovative Business Models
The selected business models would be validated against the initial findings from the national showcases (below), highlighting any barriers and ensuring they are realistic for consideration in the NESOI project.

T1.4.3 National Showcase Assessment Methodology (Part 1)
This aimed to define a list of questions to be answered, that would provide a general overview of technical, commercial and regulatory topics across 6 chosen member states: Germany, Greece, France, Croatia, Spain and Italy.

T1.4.4 National Showcase Assessment (General)
The general assessment would answer the questions defined in T1.4.3 and would also assess the general tendering requirements per member state.

T1.4.5 National Showcase Assessment Methodology (Part 2)
Based on the selected business models, more detailed/refined questions are to be defined to give a more in-depth overview of the technical, commercial and regulatory topics across the specified member-states.

T1.4.6 National Showcase Assessment (Specific)
The more specific questions defined in T1.4.5 would be answered in this subtask.

T1.4.7 Lessons Learned, Constraints and Limitations
The significant differences and similarities between the findings of national showcase would be highlighted and described in order to understand potential implications for other member-states in Europe.

T1.4.8 Consolidation and Report Writing
All findings from the business model and national showcase assessments would be put together in a way that allows for easy reference to the relevant information.

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2 National Showcase Assessments

This section outlines executive summaries of the status quo of the energy generation and distribution of islands investigated on high level technical, commercial and regulatory side, in order to enable the implementation of detailed solutions in later stages of the project. The full national showcase assessments can be found in Annex 1.

2.1 Energy Generation

2.1.1 Who can produce energy?

Member State	Summary of national showcase assessment
Croatia	Any person or entity properly licensed by the regulator (HERA). License not required for generation facilities below 1 MW of installed capacity.
France	According to the Energy Code, everybody (both domestic as industrial actors) can generate electrical energy. However, large units have to comply with the multi-annual energy planning ("Programmation Pluriannuelle de l'Energie – PPE"). For small units, for instance rooftop PV panels, a declaration must be done at the municipal authority and specific urban constraints must be checked.
Germany	Any domestic or industrial actor under consideration of the network codes and respective technical standards.
Greece	Individuals with citizenship of a Member State of the EU or Legal Entities or Joint Ventures with headquarters in a Member State of the EU. They can submit application for license of energy production, or they can produce, even without license, depending on the energy production technology and the maximum power, they envision to produce.
Italy	Electricity production is a liberalized activity that in recent years has been characterized by a remarkable development also as a result of the regulations recently issued at European and National level aimed at promoting the use of renewable sources and energy saving. In this context, numerous new operators are born which start operating on the free market, in the field of electricity production. It is necessary that a producer, before going on to undertake the production and sale activity electricity, know the numerous regulatory and non-regulatory aspects that relate directly or indirectly to this activity.
Spain	Energy production is regulated over a free competition basis since 1997. Producers must comply with the rights and duties included in the Electric Sector Law. In the case of self-consumption, it is considered as a production if the facility feed surpluses into the feed.

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2.1.2 Which innovative technologies are regulated (and not)?

Member State	Summary of national showcase assessment
Croatia	Advanced innovative technologies, such as blockchain metering models, different models of electricity storage and load balancing are not regulated in detail. Simple models (e.g., prosumers) are regulated.
France	Smart metering is fully regulated. Furthermore, the recently adopted Energy-Climate Law intends to facilitate the deployment of innovative technologies.
Germany	Smart metering and feed-in management for RES are fully regulated, while innovative technologies such as EMS, market-based demand response or aggregation of generation are still pending due to the implementation of the Clean Energy Package.
Greece	Smart metering is foreseen and promoted as technology but there is not a strict regulatory framework regarding their operation, data management and usage.
Italy	Currently, in Italy, the following innovative technologies are regulated: • Smart metering as explained at point 4 • Feed-in management for RES generation during times of network congestions • Aggregation of generation – UVAM (Unità Virtuali Abilitative Miste – decree 422/2018 of ARERA) • Self-Supply of energy (SDC – Sistemi di Distribuzione Chiusi, SSPC – Sistemi Semplici di Produzione e Consumo) • Energy Communities and collective self-consumption (D. Lgs. 162/19 art. 42bis) Currently, planning and/or implementation of new regulations to be in line with the EU energy policies, are foreseen.
Spain	Currently, the Spanish Energy Sector is going through a major update following The Energy and Climate Integrated National Plan 2021-2030 (PNIEC). Self-consumption, smart metering are fully deployed, and new roadmaps are expected for storage and marine wind energy, for example. The relevant legal framework derived from the Clean Energy Package is still under development and shall be provided until Jan 2021 at latest.

2.1.3 How are prosumer and/or blockchain metering models allowed?

Member State	Summary of national showcase assessment
Croatia	Blockchain metering models are not regulated. Prosumer metering is governed within the general rules applicable to eligible producers.
France	Prosumer model is facilitated thanks to the deployment of the LINKY smart meters which allow for bidirectional communication (metering of consumption and generation). Collective self-consumption (energy communities) is facilitated since

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	the publication of the self-consumption decree in 2017. Several experiments of collective self-consumption based on blockchain are ongoing.
Germany	The prosumer metering model is realized by the mandatory functionalities outlined in the FNN basic meter and smart meter gateway requirement specifications.
Greece	Prosumers are allowed through the Energy Communities, which have been established under the law 4513/2018. There as is no legislation for Blockchain metering models.
Italy	In Italy prosumers and/or blockchain metering models are allowed but not regulated so far. Italy has time till 2021 to incorporate the related European legislation into the National codes.
Spain	Smart meters have already been fully deployed in Spain. Self-consumption modalities with surpluses consider economic compensations for the prosumer. There is not specific regulation related to blockchain metering models, but any model must follow Unified Electricity System Measurement Points Regulation (RD 1110/2007).

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2.1.4 Which RES can link to the grid?

Member State	Summary of national showcase assessment
Croatia	All most common RES sources (wind, PV, solar, biogas, biomass) can connect to the grid.
France	RES that can link to the grid are hydropower, wind energy, photovoltaic, biogas (methanisation of non-hazardous waste, raw vegetable matter, urban or industrial wastewater), geothermal energy.
Germany	RES that can link to the grid are Hydropower, Landfill gas, sewage gas, mine gas, Biomass, Geothermal energy, Wind energy and Photovoltaic.
Greece	Hydropower; Landfill gas, sewage gas, mine gas; Biomass; Biofuels with/without gasification; Geothermal energy; Wind energy; Photovoltaic; Electrical Solar Thermal Systems (with/without storage); All other RE compatible with EU laws
Italy	All most common RES sources (wind, PV, solar, biogas, biomass) can connect to the grid.
Spain	Three categories of RES are regulated by the RD 413/2014: (1) Cogeneration and electric generation form other residual energies, (2) energy valorization of waste, and (3) Renewable Sources (solar, wind, hydro, thermal, biomass, biofuels from biomass and biogas from landfills).

2.1.5 Which metering models are allowed (front of, back of, etc.)?

Member State	Summary of national showcase assessment
Croatia	Most final customers still use standard metering devices. The DSO must install electricity meters with a possibility of distanced reading and other advanced features at the customer's request.
France	In France, all electricity consumers shall be equipped with a smart meter by 2024. The same smart meter, called LINKY, is being installed at every consumption site. The smart meters belong to the DSO, who is in charge of maintaining them.
Germany	In Germany, the metering model is determined by the Metering Act which generally distinguishes between a smart (intelligent) metering system, and a modern meter. All customers shall be at least equipped with modern meters until 2032.

Greece	• Type
	  ○ Electromechanical Meters (only installed in LV)
	  ○ Electronic Meters without remote control
	  ○ Electronic Meters with remote control
	• Voltage Level
	  ○ Load Meters (LV, MV, HV)

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	○ Production Meters (LV, MV, HV) • Data collection ○ Remote Data Collection ○ Non- Remote Data Collection • Energy Data Logging ○ Hourly loggers. ○ Non-Hourly loggers. • Position ○ Meters in the Network-User border ○ Internal Meters, in the user local grid. The next 2 categories are valid only for the non-interconnected islands • If the production is higher than 2 MVA, a second alternative meter (validation meter) is required • In Power Production Plants, other meters might be required to measure for example enthalpy of steam, fuel, etc. for clearance purposes.
Italy	Italy was the first European country to introduce electric smart meters on a large scale for low voltage end customers and is still the first country in the world for the number of smart meters of electricity in service (over 35 million). According to a recent report from the European Commission, the Italian smart metering system, with the replacement of traditional meters since 2001, has been the most efficient in Europe. According to ARERA (the Energy Authority) in Italy the smart metering development foresaw two generation of smart metering: - a first generation of smart metering (2001-2011) - a second generation of smart metering (2G) with several benefits with respect to the first generation that is therefore to be replaced at the end of its life cycle. Actually, the roll-out of the second generation of smart meters is ongoing.
Spain	The Measurement Device Regulation (RD 1110/2007) stablishes that meters should be installed at the frontier between the DSO grid and the users' internal grid. This position enables to bill for the net energy received by the consumer after deducting distribution losses. Meters and self-generated energy excess poured into the grid.

2.1.6 How is energy price determined (free, regulated, etc.)?

Member State	Summary of national showcase assessment
Croatia	As a general rule, domestic consumption-based electricity prices are determined depending on the tariff model used by a final customer.
France	Two systems co-exist in France: regulated prices and free market offers. Today, only small consumers with a peak consumption lower than 36 kVA have the right to subscribe such regulated electricity price.

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Germany	In Germany, the average domestic consumption-based electricity price beginning of 2020 is 31,37 ct. per kWh, thereof 16,48 ct. taxes and fees (regulated), 7,71 ct. grid costs incl. metering and billing (regulated) and 7,18 ct. energy procurement (unregulated).
Greece	In Greece the domestic tariffs is composed by a non-regulated part regarding energy (currently 0.11~0.12 €/kWh) and regulated parts regarding transmission, distribution, social policy, RES compensate and another smaller part.
Italy	In Italy, the average domestic consumption-based electricity price beginning of 2020 (April) is 16,08 ct. per kWh and it takes into account energy procurement, transport and counter management, grid costs and taxes.
Spain	Spain has a free wholesale market for the mainland (both Spain and Portugal) and connected islands that determines the hourly energy price. There are three markets to trade in (1) Day-ahead market, (2) Intra-day market and (3) Continuous intra-day market. In extra peninsular territories (Canary Islands, Balearic Islands, Ceuta and Melilla), even though consumer pay similar prices by law, there is a regulated market to compensate energy producers.

2.1.7 Do small islands have a different status/regulatory set up?

Member State	Summary of national showcase assessment
Croatia	While the government in principle promotes the sustainability of islands, no specific status or regulatory set-up applies for small islands.
France	There is a specific status for non-interconnected areas (ZNI - “zones non interconnectées”). Furthermore, specific multiannual energy programs have been set up for each non-interconnected area.
Germany	There is no specific regulatory setup for generation on islands.
Greece	There is a distinction between interconnected and non – interconnected islands with the mainland. The non-interconnected islands have in most cases different status, for energy production licensing and tariff. For consumption, energy cost is the same as the interconnected network (for each energy provider)
Italy	There is no specific regulatory setup for generation on islands. Minor islands are not connected to the national grids (as in the case of Sardinia and Sicily) and have autonomous electricity production, most of the time from non-renewable sources, despite the big amount of RES (wind and solar). Concerning the regulatory framework, it is worth to be mentioned the “Decree of minor islands” which defines objectives and incentive methods for renewable energy in the smaller Italian islands not interconnected with the electricity grid of the continent. Specifically, it establishes the minimum development objectives for the production of electricity and thermal energy from renewable sources to be reached by 31 December 2020 and the methods for supporting the investments necessary for the realization. Resolution

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	no. 558/2018 / R / EFR defines the tariffs for the remuneration system for electricity and thermal energy produced from renewable sources in the non-interconnected islands and the related access methods, in implementation of the provisions of the Ministerial Decree 02/14/2017. To GSE is assigned the task of carrying out the technical and administrative evaluation for the provision of the incentive.
Spain	Yes. Activities for the supply of electricity carried out in non-mainland territories may be subject to a unique regulation that will consider the specificities arising from their territorial location and their isolated nature (art. 10 Law 24/2013). Such systems are Balearic Islands, Canary Islands and autonomous cities Ceuta and Melilla.

2.1.8 Grid connection cost?

Member State	Summary of national showcase assessment
Croatia	Payable by new user who wants to connect to the electricity grid or the existing user of a grid who wants to increase the connection capacity. The costs are based on a common methodology and are typically determined as either their actual cost or a factor of unit price and connection power.
France	For renewable installations, 60% of connection and extension costs are borne by the applicant; the rest and 100% of reinforcement costs, if applicable, are borne by the network operator and supported by network tariffs.
Germany	Based on the Energy Act, system operators are obliged to provide grid connections to their under appropriate, non-discriminatory and transparent conditions. The costs of grid connection depend on the voltage level to which the generator is connected.
Greece	If Consumer: The final customer pays a portion of the grid connection. There is a Minister Decision that regulates the costs and the days required for each type of connection. The final prices are provided by the DSO considering for a) the voltage level, b) Phases, c) type of use d) area in Greece, e) distance from connection point etc. If Producer: For PV there is a certain cost based on installed power, voltage connection level and number of phases.
Italy	The costs of grid connection in Italy depend on the voltage level to which the generator is connected (minor differences may be detected concerning the ranges of voltage level) as provided below: • Low voltage (<1 kV) connected generators • Medium to high voltage (>1 e <30 kV) connected generators • High voltage (>30 <150 kV) connected bulk generators >100 MW
Spain	Every producer feeding into the grid is charged 0,5 €/MWh (IET 3586/2011). Every consumer is subject to a fixed tariff proportional to the contracted supply power, regulated by the Electricity System.

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2.2 Energy Distribution

2.2.1 Who owns the networks?

Member State	Summary of national showcase assessment
Croatia	The DSO owns the distribution grid and the TSO owns the transmission grid.
France	In France, the public distribution networks are the property of municipalities, which may delegate all or part of their competence as the granting authority to regional syndicates. If they do not manage their distribution networks themselves, through specific public companies, the granting authorities entrust it to a distribution network operator (DSO).
Germany	Distribution networks incl. all assets are owned by the relevant DSOs based on concessions. According to the Energy Act, municipalities shall generally make their public routes available for the installation and operation of electrical lines in a non-discriminatory manner.
Greece	In Greece there are 2 DSOs and 1 TSO. The whole of the Greek distribution network assets is owned by the PPC but the network is operated by the Greek DSO (HEDNO). HEDNO pays rent to PPC. The Athens International Airport (AIA) distribution network is owned by AIA and is responsible for the distribution on electrical power in the airport and supporting areas. Transmission Network assets are owned by the Greek TSO (IPTO). In the non-interconnected islands HEDNO is responsible for Transmission Networks.
Italy	In Italy, the transmission service manager is Terna Rete Italia S.p.A. of the Terna Group S.p.A. The head of the distribution service is the competent distribution company (DSO) in the area of interest to which the plant is connected. Distribution networks incl. all assets are owned by the relevant DSOs based on concessions. The provisions related to the services of electricity transmission and distribution are defined in Annex A to deliberation 654/2015 / R / eel containing "Integrated text of the provisions for the provision of electricity transmission and distribution services - Provisions for the period 2016-2019 (TIT) "; these provisions are effective from January 1, 2016.
Spain	The high voltage transport network is owned by Red Eléctrica Española (REE), half private – half public and is responsible for the development and expansion of the grid, for its maintenance, for managing the transit of electricity between external systems and the Iberic Peninsula and for guaranteeing third party access to the transmission grid in equality conditions.

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2.2.2 Who can intervene through tech investments on the network?

Member State	Summary of national showcase assessment
Croatia	Grid investments are borne by the operators (both DSO and TSO).
France	Only DSOs and TSOs can intervene on the network.
Germany	The intervention on networks depends on the smart grid asset type under consideration, more specifically related to both DSO and TSO, but in some cases also the owner/operator of generation, storage or EV.
Greece	Only the system operator (both DSO and TSO) under approval of the regulator.
Italy	Mainly the owner of the network (that is the DSO) can intervene through tech investments.
Spain	Only grid owners are accountable for grid investment, enhancements and maintenance.

2.2.3 How are grid investments remunerated?

Member State	Summary of national showcase assessment
Croatia	Grid investments are mostly financed through connection fees, grid usage fees and EU funding.
France	The forecast programs for planned investments on the distribution networks are drawn up at regional conferences organised under the aegis of prefects. The distribution network tariff is determined in particular by the investment trajectory as forecasted by DSOs and covers all the capital costs of the investments for the entire investment program.
Germany	The remuneration of grid investments is driven by the mechanisms of the Incentives Regulation. The basic principle is the definition of revenue caps for system operators, based on a comprehensive cost examination and benchmarking.
Greece	For the Greek TSO (IPTO) according to their annual financial statements the new investments are covered by the consumers and grands. For the Greek DSO (HEDNO) the grid investments are approved by the Regulatory authority and then they paid with a regulated price for recovering the required capital
Italy	The remuneration of grid investments is driven by the mechanisms of the Incentives Regulation. The basic principle is the definition of revenue caps for system operators, based on a comprehensive cost examination and benchmarking, which sets the target for grid fees within a regulatory period of 4 years. More efficient system operators are allowed to keep additional revenue which should provide more motivation for

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	further cost reduction. System operators with <25,000 electricity customers fall under the de-minimis rule and are allowed to apply a simplified process for efficiency grade determination.
Spain	Grid investments are paid by the Electricity system, as a regulated part of the supply tariff paid by the consumers. This regulated part of the bill born by the consumers comprises both a fix tariff and a variable tariff. The principle for this retribution mechanism is to compensate the costs of the distribution activity for an efficient and well organised company.

2.2.4 Who can be DSO and what is the procedure to become one?

Member State	Summary of national showcase assessment
Croatia	The DSO must be properly licensed by the regulator. Activities of a DSO must be performed as a public service (except in cases of closed distribution systems) and are thus subject to requirements of security and quality of supply, tariff calculations, protection of end customers etc.
France	Delegation contracts are negotiated independently by each municipality (owner of the network). The organisation which is granted the role of DSO then has the monopoly for this activity during the contract duration (often 30 years). If they do not manage their distribution networks themselves, through specific public companies, municipalities are obliged to delegate it to ENEDIS or to a local distribution company.
Germany	DSO can be any legal person that fulfils the technical and procedural requirements of the Energy Act and its related regulations. This applies to both public and closed distribution systems.
Greece	The Greek Law (4001/2011) with all the relevant updates, regulates this issue. In general, any Physical or Legal Person can become a DSO and the license is provided by the Regulatory Energy Authority. The Greek laws are in accordance with the EU Directive 2009/72 and 2016/1388. In Greece there is the National Greek Distribution Grid, which is operated by HEDNO. HEDNO operation is regulated by Regulatory Energy Authority. The DSO for the Athens International Airport is granted a special license with the law 4001/2011 Other DSOs may exist in closed/private networks interconnected with the Transmission Grid which is a monopoly.
Italy	In Italy, the distribution and delivery of electricity in the 1960s was carried out under a public monopoly by Enel. With the Bersani Decree of 1999, the sale activity was liberalized while the distribution activity is reserved to the State which assigns it in concession to various companies (DSO). The first part of the electricity grid, that is the long-distance transmission that takes place at high voltage, is now managed by a single operator: Terna. Currently each area of the Italian territory is given under concession to a single operator under a natural monopoly.

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Spain	Any company may become a DSO on the basis of open free market competition. The Law 24/2013, of 26 December, some administrative authorizations are required for the commissioning of new transportation, distribution, production facilities and direct lines or modification of the existing ones.

2.2.5 Can there be more DSOs on the same network?

Member State	Summary of national showcase assessment
Croatia	Distribution system can only be operated by one DSO.
France	In France, a distribution system can only be operated by one DSO.
Germany	A distribution system can only be owned and operated by one DSO based on the concessions obtained.
Greece	There is not a clear answer, but the network operator and the owner can be different. For the case of the National Greek Distribution Grid, when the operator (HEDNO) fails to correspond to the duties, another operator can take over.
Italy	In Italy, at Regional and Province level there can be more DSO on the same network while at the level of Municipality there is only one DSO managing the network.
Spain	Any company may become a DSO on the basis of open free market competition. The Law 24/2013, of 26 December, some administrative authorizations are required for the commissioning of new transportation, distribution, production facilities and direct lines or modification of the existing ones.

2.2.6 Which metering and storage and load balancing technologies are admitted by the regulator?

Member State	Summary of national showcase assessment
Croatia	Very few technologies are governed in detail under Croatian law.
France	In France, demand response is well developed. It can be valued as energy or as capacity. There is a clear framework on the status of independent aggregators and their role and responsibilities in the market. Services provided by storage at generation and consumption level are not regulated. Services provided to transmission and distribution operators must be done in a competitive environment.
Germany	Metering technologies are well regulatory defined, while there is no regulatory limitation of storage or load balancing technologies.
Greece	The meters have to be compatible with the DLMS/COSEM protocol in the application layer using OBIS codes. After an extensive survey, no special limitation has been

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	found for storage technologies. Special care (e.g. licensing procedure, tariffs) is provided to hybrid systems in non-interconnected islands and specially in pumped storage hydropower technologies
Italy	In Italy mainly the Smart Metering is regulated while other load balancing technologies (e.g. energy management systems) or other Demand Response services (e.g. vehicles to grid or P2P) are not regulated.
Spain	Any company may become a DSO on the basis of open free market competition. The Law 24/2013, of 26 December, some administrative authorizations are required for the commissioning of new transportation, distribution, production facilities and direct lines or modification of the existing ones.

2.2.7 Who is the regulator?

Member State	Summary of national showcase assessment
Croatia	Croatian Energy Regulatory Agency (HERA).
France	The regulator is "Commission de Régulation de l'Energie" (CRE). It is made of 2 independent bodies: the Collegial Board, which determines the main orientations and adopt decisions and opinions based on expert assessments; the Dispute Settlement and Sanctions Committee, which is tasked with settling disputes concerning access to and use of the public electricity and gas networks between operators and users, and also with penalising infringements of the Energy Code.
Germany	The regulator is the Federal Network Agency (Bundesnetzagentur) located in Bonn.
Greece	The regulator for Greek Energy Systems is the Regulatory Energy Authority located in Athens. www.rae.gr
Italy	The Italian Regulatory Authority for Energy, Networks and Environment (ARERA) carries out regulatory and supervisory activities in the sectors of electricity, natural gas, water services, waste cycle and district heating. It is an independent body established under Italian Law No. 481 of 14 November 1995 for the purposes of protecting consumer interests and promoting the competition, efficiency and distribution of services with adequate levels of quality, through regulatory and control activities.
Spain	Any company may become a DSO on the basis of open free market competition. The Law 24/2013, of 26 December, some administrative authorizations are required for the commissioning of new transportation, distribution, production facilities and direct lines or modification of the existing ones.

2.2.8 Do small islands have a different status/regulatory set up?

Member State	Summary of national showcase assessment

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Croatia	There is no specific regulatory set-up for energy distribution on islands.
France	Islands which are not connected to the mainland have a specific set up ("zones non interconnectées" - ZNIs). For instance, in ZNIs the electricity system is still vertically integrated. The incumbent operator (EDF) is in charge of electricity generation, distribution and commercialisation. Therefore, EDF's Insular Electricity Systems Division (EDF SEI) is the DSO in Corsica and most of the French overseas territories.
Germany	There is no specific regulatory setup for islands in general. According to the Electricity Tax Act the energy tax of 2,05 ct./kWh does not apply for the islands Helgoland and Büsingen.
Greece	In the non-interconnected islands there is a different status. The electrical energy transmission is managed by the distribution operator as well. Specific rules apply and a different management code.
Italy	There is no specific regulatory setup for small islands in general. Nevertheless, it is worth to be mentioned the last decree for the smaller islands: Ministerial Decree 14 February 2017 - Coverage of the needs of the smaller islands not interconnected through energy from renewable sources.
Spain	Insular electricity systems for generation and distribution is regulated by RD 738/2015 about the generation, distribution and dispatch of electricity in the non-peninsular territories (Balearic Islands, Canary Islands, cities of Ceuta and Melilla). Extra costs of non-peninsular electricity systems are charged 50 % to all system consumers as a fixed yearly fee proportional to the contracted power, and 50 % to the National Treasure through the annual Estate's General Budget.

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3 National Procedural Assessments

3.1 Permitting

Permitting strongly depends on the specific implementation of real-life projects in Member States and also on regional/local legislation. The following clusters of permissions generally apply to energy projects in all EU Member states:

General

- General planning permits
- Transport permits
- Permits for storage of materials and goods
- Permits related to assigned experts

Civil engineering/construction

- Building permits
- Demolition permits
- Static permits
- Geological permits
- Historic preservation
- Official requirements from local/regional authorities

HSE

- Emission permits (mainly related to air pollution, vibrations and noise)
- Pollutants and harmful substances handling
- Waterway permits (fresh and wastewater)
- Fire protection permits
- Permits for working in heights
- Landscaping
- Flora-Fauna-Habitat

Grid connection

- Grid connection permits
- EMC permits (may be part of the grid connection permits)
- Permits for electro-magnetic fields

Operation

- Operation permits
- Official requirements from local/regional authorities

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3.2 Tendering

This section outlines the most common tender procedure, as regulated under national law. However, due to many specific scenarios which may occur, additional deadlines and / or obligations may apply. A full assessment of the national showcases for tendering is provided in annex A.

The below showcased timelines apply exclusively to the high-value tenders over the defined EU thresholds. The EU thresholds are generally renewed every two years and published on the European Commission's website:
https://ec.europa.eu/growth/single-market/public-procurement/rules-implementation/thresholds_en

Currently, these are listed under the 2014 directives on concessions, general procurement and utilities.

Classical Directive 2014/24/EU on public procurement

Central Government authorities	Works contracts, subsidised works contracts		€5,350,000
	All services concerning social and other specific services listed in Annex XIV		€750,000
	All subsidised services		€214,000
	All other service contracts and all design contests		€139,000
	All supplies contracts awarded by contracting authorities not operating in the field of defence		€139,000
	Supplies contracts awarded by contracting authorities operating in the field of defence	Concerning products listed in Annex III	€139,000
		Concerning other products	€214,000
Sub-central contracting authorities	Works contracts, subsidised works contracts		€5,350,000
	All services concerning social and other specific services listed in Annex XIV		€750,000
	All other service contracts, all design contests, subsidised service contracts, all supplies contracts		€214,000

Table 1 - Directive 2014/24/EU on public procurement

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Directive 2014/23/EU on the award of concession contracts:

- All works or services concessions: €5,350,000

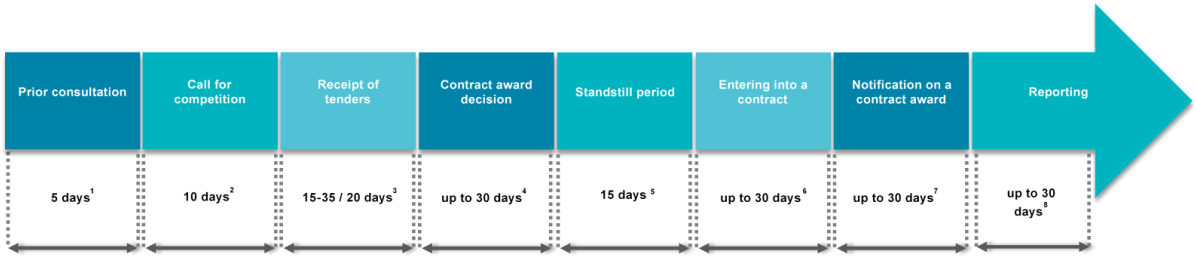
Directive 2014/25/EU on procurement by entities operating in the water, energy, transport and postal services sectors:

- Works contracts: €5,350,000
- All services concerning social and other specific services listed in Annex XVII: €1,000,000
- All other service contracts, all design contests, all supplies contracts: €428,000

3.2.1 Croatia

The below showcased timelines apply exclusively to the high-value tenders over the defined EU thresholds.
It should be noted that the below timelines do not apply to procurement of: (i) goods and services with an estimated value of less than HRK 200,000.00 (approx. 27,000.00 EUR), and (ii) works with an estimated value of less than HRK 500,000.00 (approx. 67,000.00 EUR).
In addition, it should be noted that economic operators may appeal any decision on their individual rights, as well as other actions, decisions, procedures and omissions of the contracting authority / entity which should have been performed or are violating their rights, within the period of 10 days.

Public Sector – Open procedure



Notes:

[1] The contracting authority must submit a description of the subject of tender, technical specifications, selection criteria and other special conditions for the execution of the contract to prior consultation with the interested economic operators for a minimum period of 5 days.

[2] Within 10 days from the day of the call for competition was published, economic operators may file an appeal in relation to the content of the call or tender documentation. While the appeal to tender documentation has suspensive effect if filed, the contracting authority is not required to suspend any of its activities during the10-day period.

[3] The actual minimum time period depends on whether (i) the tenders are submitted electronically; (ii) contracting authorities published a prior information notice ("**PIN**") before the contract notice ("**CN**") was sent.

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The 15-35 day range shall apply for high-value tenders, and the minimum of 20 days applies only in case of low-value tenders.

[4] The contract award decision should be rendered within 30 days from the expiration of the deadline for receipt of tenders, unless a longer deadline is set out by the tender documentation.

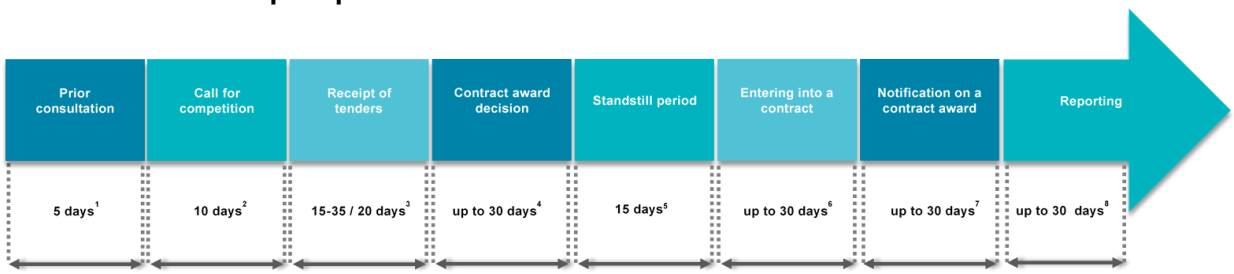
[5] After the contracting authority has delivered the contract award decision to all bidders, it must permit a 15-day standstill period for filing appeals before it enters into the contract with the preferred bidder.

[6] The contract should be concluded within 30 days from when the award decision becomes enforceable.

[7] Contract award notice should be issued within 30 days from the day the contract is concluded.

[8] Contracting authority should compile a written report on the tender within 30 days from when the contract award notice was issued.

Utilities sector - Open procedure



Notes:

[1] Contracting entity must submit a description of the subject of tender, technical specifications, selection criteria and other special conditions for the execution of the contract to prior consultation with the interested economic operators for a minimum period of 5 days.

[2] Within 10 days from the day of the call for competition was published, economic operators may file an appeal in relation to the content of the call or tender documentation. While the appeal to the tender documentation has suspensive effect if filed, the contracting authority is not required to suspend any of its activities during the 10-day period.

[3] The actual minimum time period depends on whether (i) the tenders are submitted electronically; (ii) the contracting entities published a periodic indicative notice before the CN was sent.

[4] The contract award decision should be rendered within 30 days from the expiration of the deadline for receipt of tenders, unless a longer deadline is set out by the tender documentation.

[5] After the contracting authority has delivered the contract award decision to all bidders, it must permit a 15-day standstill period for filing appeals before it enters into the contract with the preferred bidder.

[6] The contract should be concluded within 30 days from when the award decision becomes enforceable.

[7] Contract award notice should be issued within 30 days from the day when the contract is concluded.

[8] Contracting authority should compile a written report on the tender within 30 days from when the contract award notice was issued.

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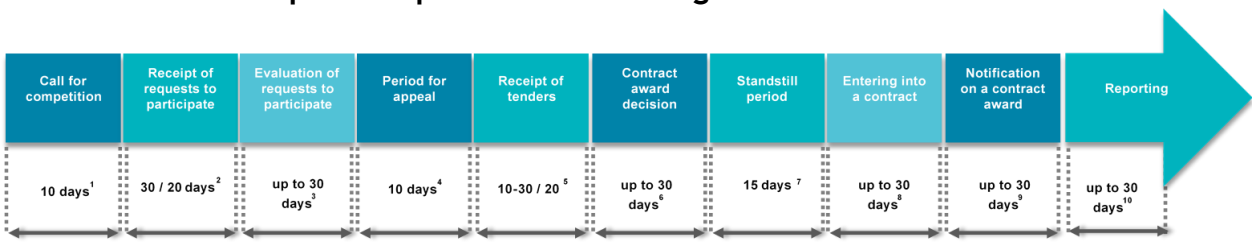
Public Sector - Competitive procedure with negotiation



Notes:

[1] Within 10 days from the day of the call for competition was published, economic operators may file an appeal in relation to the content of the call or tender documentation. While the appeal to the tender documentation has suspensive effect if filed, the contracting authority is not required to suspend any of its activities during the 10-day period.

[2] The minimum of 20 days applies only in case of a low-value tenders.

[3] The contracting authority must render the decision on the inadmissibility of participation within 30 days from the expiration of the deadline for receipt of requests to participate, unless a longer deadline in provided in the tender documentation. This will not preclude the contracting authority to continue the proceedings with the admissible participants immediately after their evaluation and before the expiry of the 30-day deadline. However, if the decision on inadmissibility is appealed, the proceedings must be suspended. If the appeal is upheld, the bid submission deadline must be extended to allow the appellant equal opportunity to participate in the tender.

[4] Economic operators may file an appeal within 10 days from the receipt of the decision on inadmissibility of participation. The appeal has suspensive effect, but the contracting authority is not required to suspend any of its activities during the 10-day period.

[5] The actual minimum time period depends on whether (i) the tenders are submitted electronically; (ii) contracting authorities published a PIN before the CN was sent. The 10-30 day range shall apply for high-value tenders, and the minimum of 20 days applies only in case of low-value tenders.

[6] The contract award decision should be rendered within 30 days from the expiration of the deadline for receipt of tenders, unless a longer deadline is set out by the tender documentation.

[7] After the contracting authority has delivered the contract award decision to all bidders, it must permit a 15-day standstill period for filing appeals before it enters into the contract with the preferred bidder.

[8] The contract should be concluded within 30 days from when the contract award decision becomes enforceable.

[9] Contract award notice should be issued within 30 days from the day the contract is concluded.

[10] Contracting authority should compile a written report on the tender within 30 days from when the contract award notice was issued.

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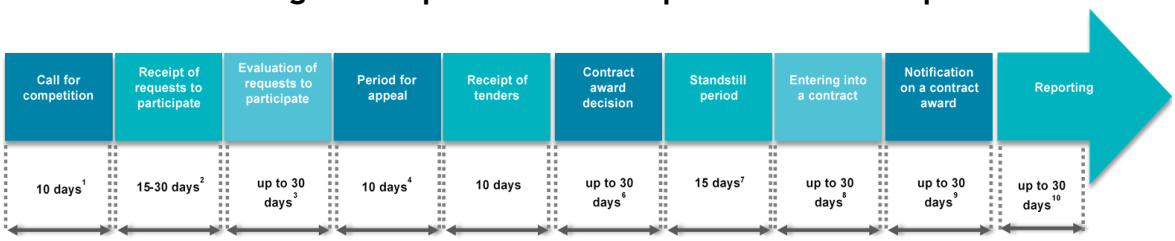
Utilities Sector - Negotiated procedure with prior call for competition



Notes:

[1] Within 10 days from the day of the call for competition was published, economic operators may file an appeal in relation to the content of the call or tender documentation. The appeal has suspensive effect.

[2] As a general rule the minimum time period for receipt of the requests to participate should be fixed at no less than 30 days, and should in any event not be less than 15 days.

[3] The decision on the inadmissibility of participation should be rendered within 30 days from the expiration of the deadline for receipt of requests to participate, unless a longer deadline in provided in the tender documentation. This will not preclude the contracting entity to continue the proceedings with the admissible participants immediately after their evaluation and before the expiry of the 30-day deadline. However, if the decision on inadmissibility is appealed, the proceedings must be suspended. If the appeal is upheld, the bid submission deadline must be extended to allow the appellant equal opportunity to participate in the tender.

[4] Economic operators may file an appeal within 10 days from the receipt of the decision on inadmissibility of participation. The appeal has suspensive effect, but the contracting authority is not required to suspend any of its activities during the 10-day period.

[6] The contract award decision should be rendered within 30 days from the expiration of the deadline for receipt of tenders, unless a longer deadline is set out by the tender documentation.

[7] After the contracting entity has delivered the contract award decision to all bidders, it must permit a 15-day standstill period for filing appeals before it enters into the contract with the preferred bidder.

[8] The contract should be concluded within 30 days from when the contract award decision becomes enforceable.

[9] Contract award notice should be issued within 30 days from the day the contract is concluded.

[10] Contracting entity should compile a written report on the tender within 30 days from when the contract award notice was issued.

3.2.2 France

According to the French Public Procurement Act (“Code de la Commande Publique”), the following tendering procedures can apply:

1. Formalised procedures
2. Adapted procedures (for instance, for contracts which value is below thresholds or for specific services)
3. Public contracts negotiated without prior advertising or competition (for instance, for emergency reasons or for renewal of previous contracts).

Here, we focus on formalised procedures only, which include the following:

a. Public call for tenders

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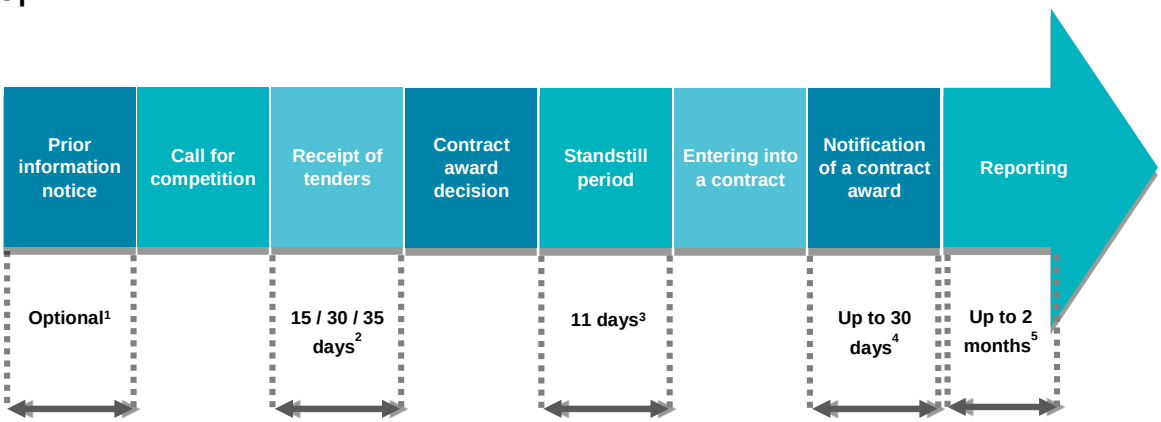
i. Open call for tenders: every economic operator can apply;
ii. Restricted call for tenders: only pre-selected economic operators can apply;

b. Competitive procedure with negotiation: when precise specifications cannot be defined by the buyer, for instance for innovative solutions; however, utilities can freely apply this procedure (no conditions);
c. Competitive dialogue: for co-developing solutions to a need that cannot be precisely defined.

Open call for tenders



Notes:

[1] Contracting authorities may make known their intention to award a public contract through the publication of a prior information notice drawn up in accordance with the model set out in the European Commission Regulation establishing standard forms for the publication of notices in connection with the award of public contracts.

[2] Contracting authorities shall define the time-limits for receipt of tenders, taking into account the complexity of the public contract and the time needed by economic operators to prepare their applications. This time-limit cannot be lower than 35 days. If the buyer has published a prior information notice which has not been used as a notice of invitation to tender, this minimum period may be reduced to 15 days if the following conditions are met:

- The prior information notice was sent for publication not less than 35 days and not more than 12 months before the date on which the contract notice was sent;
- The notice contains the same information as that contained in the contract notice, provided that such information is available at the time it is sent for publication.

Furthermore, the buyer may reduce the minimum time-limit to 30 days if tenders are or may be sent by electronic means.

Additional information on the consultation documents shall be sent to the economic operators not later than six days before the closing date for the receipt of tenders.

[3] After the contracting entity has delivered the contract award decision to all bidders, it must permit a 15-day standstill period for filing appeals before it enters into the contract with the preferred bidder.

[4] Contract award notice should be issued within 30 days from the day the contract is concluded.

[5] No later than two months after the contract award notice, the buyer shall offer free, direct and complete access to the essential data relating to the public contract and the data relating to its award: nature and purpose

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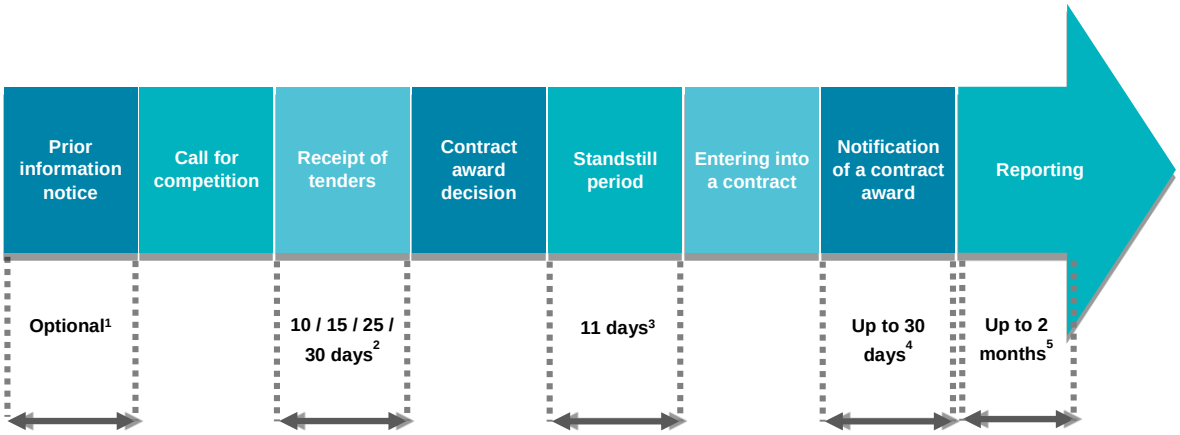
of the public contract; the procurement procedure used; the principal place of performance of the services or works covered by the public contract; the duration of the public contract; the amount and principal financial terms of the public contract; identification of the contractor.

Restricted call for tenders



Notes:

[1] Contracting authorities may make known their intention to award a public contract through the publication of a prior information notice drawn up in accordance with the model set out in the European Commission Regulation establishing standard forms for the publication of notices in connection with the award of public contracts.

[2] The minimum deadline for submitting the application is

- 30 days for public sector buyers
- 15 days for utilities.

The time-limit for submitting tenders shall be 30 days from the date on which the invitation to tender is sent (25 days if sent by electronic means). It may be reduced to 10 days in cases of urgency or if the purchaser publishes a prior information notice at least 35 days before publication of the call for competition.

[3] After the contracting entity has delivered the contract award decision to all bidders, it must permit a 15-day standstill period for filing appeals before it enters into the contract with the preferred bidder.

[4] Contract award notice should be issued within 30 days from the day the contract is concluded.

[5] No later than two months after the contract award notice, the buyer shall offer free, direct and complete access to the essential data relating to the public contract and the data relating to its award: nature and purpose of the public contract; the procurement procedure used; the principal place of performance of the services or works covered by the public contract; the duration of the public contract; the amount and principal financial terms of the public contract; identification of the contractor.

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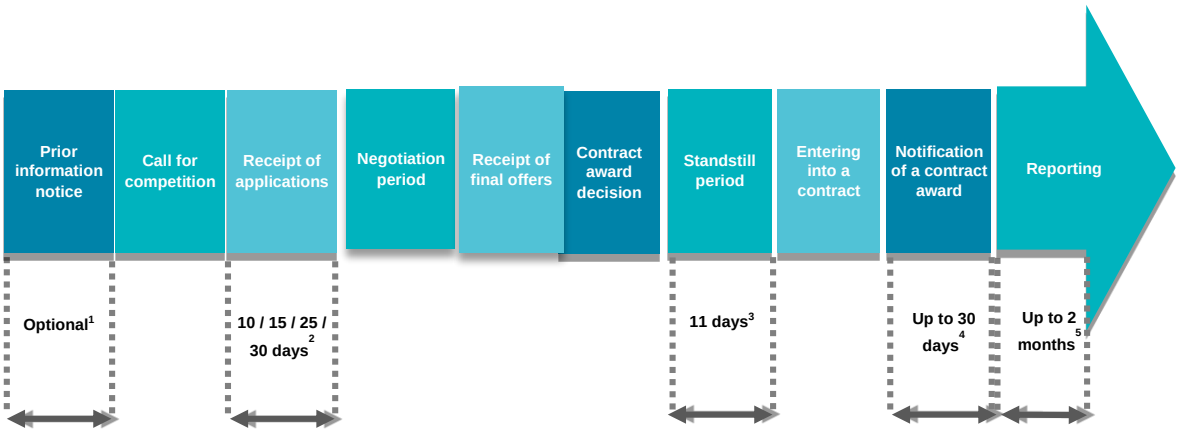
Competitive procedure with negotiation



Notes:

[1] Contracting authorities may make known their intention to award a public contract through the publication of a prior information notice drawn up in accordance with the model set out in the European Commission Regulation establishing standard forms for the publication of notices in connection with the award of public contracts.

[2] The minimum deadline for submitting the application is

- 30 days for public sector buyers
- 15 days for utilities.

The time-limit for submitting tenders shall be 30 days from the date on which the invitation to tender is sent (25 days if sent by electronic means). It may be reduced to 10 days in cases of urgency or if the purchaser publishes a prior information notice at least 35 days before publication of the call for competition.

The contracting authority negotiates with all tenderers their initial and subsequent bids. It may not negotiate the final tender. It may, however, award the contract on the basis of the initial tenders without negotiation if it has indicated in the contract notice or in the invitation to confirm interest that it reserves the right not to negotiate. When the contracting authority wishes to conclude the negotiations, it shall inform the remaining tenderers and set a common deadline for the submission of any new or revised tenders.

[3] After the contracting entity has delivered the contract award decision to all bidders, it must permit a 15-day standstill period for filing appeals before it enters into the contract with the preferred bidder.

[4] Contract award notice should be issued within 30 days from the day the contract is concluded.

[5] No later than two months after the contract award notice, the buyer shall offer free, direct and complete access to the essential data relating to the public contract and the data relating to its award: nature and purpose of the public contract; the procurement procedure used; the principal place of performance of the services or works covered by the public contract; the duration of the public contract; the amount and principal financial terms of the public contract; identification of the contractor.

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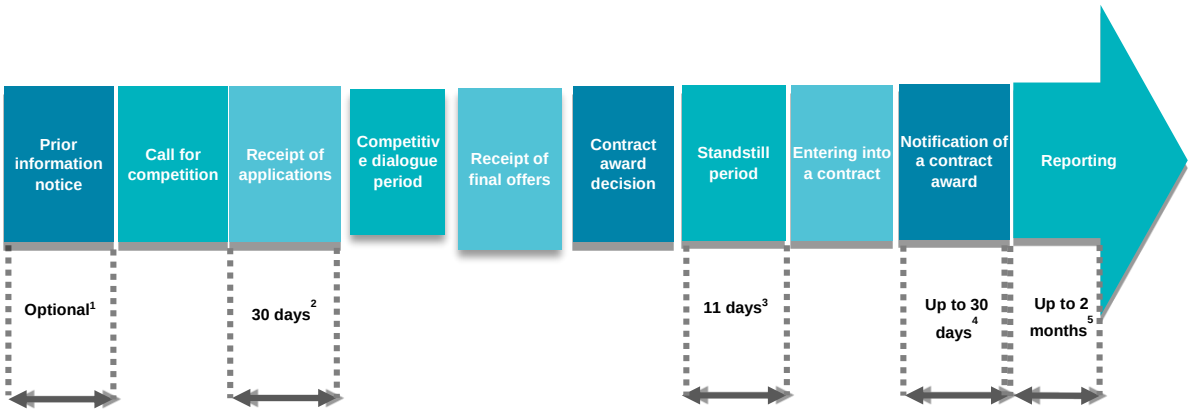
Competitive dialogue



Notes:

[1] Contracting authorities may make known their intention to award a public contract through the publication of a prior information notice drawn up in accordance with the model set out in the European Commission Regulation establishing standard forms for the publication of notices in connection with the award of public contracts.

[2] The time-limit for submitting tenders shall be 30 days from the date on which the invitation to tender is sent.

The dialogue is then opened until the contracting authority is able to identify the solution(s) that can meet its need. It then invites applicants to present their final offer.

[3] After the contracting entity has delivered the contract award decision to all bidders, it must permit a 15-day standstill period for filing appeals before it enters into the contract with the preferred bidder.

[4] Contract award notice should be issued within 30 days from the day the contract is concluded.

[5] No later than two months after the contract award notice, the buyer shall offer free, direct and complete access to the essential data relating to the public contract and the data relating to its award: nature and purpose of the public contract; the procurement procedure used; the principal place of performance of the services or works covered by the public contract; the duration of the public contract; the amount and principal financial terms of the public contract; identification of the contractor.

3.2.3 Germany

The below showcased timelines apply exclusively to the high-value tenders over the defined EU thresholds.

The deadlines depend on the specific tendering scheme, meaning whether the Regulation on the Award of Public Contracts (VgV) or the Procedures for the Award of Contracts for Construction Services (VOB/A) is applied. All the provided deadlines are minimum deadlines which may be extended due to specific reasons as stated in § 20 VgV and § 10 VOB/A.

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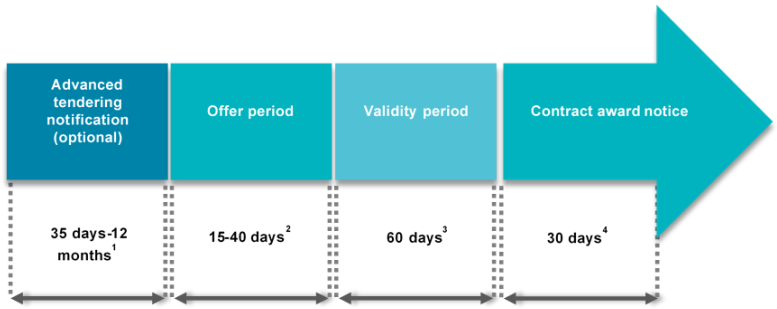
Public Sector – EU open procedure



Notes:

[1] Optional advanced tendering notification issued ≥ 35 days / ≤ 12 months prior to the contract notice or invitation to tender.

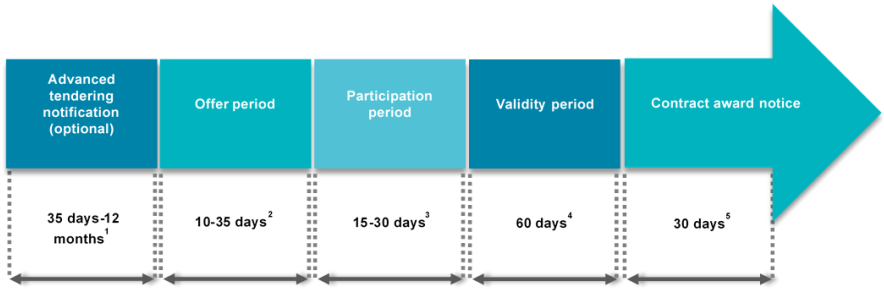
[2] Starts with the day after the contract notice or the invitation to tender. Standard period is 35 days, but can shortened or extended to:

- 40 days in case of non-electronic tendering procedures with special security requirements
- 30 days in case of electronic tendering procedures
- 15 days in case of demonstrated urgency of the tender or advanced tendering notification was issued ≥ 35 days / ≤ 12 months prior to the contract notice or invitation to tender

[3] Starts with the termination of the offer period.

[4] Contract award notice should be issued within 30 days from the day the contract is concluded.

Public Sector – EU non-open procedure



Notes:

[1] Optional advanced tendering notification issued ≥ 35 days / ≤ 12 months prior to the contract notice or invitation to tender.

[2] Starts with the day after the contract notice or the invitation to tender. Standard period is 30 days, but can shortened or extended to:

- 35 days in case of non-electronic tendering procedures with special security requirements
- 25 days in case of electronic tendering procedures
- 10 days in case of demonstrated urgency of the tender, advanced tendering notification was issued ≥ 35 days / ≤ 12 months prior to the contract notice or invitation to tender or upon mutual agreement by all applicants

[3] Starts with the day after submission of the contract notice. Standard period is 30 days, but can shortened to 15 days in case of demonstrated urgency of the tender.

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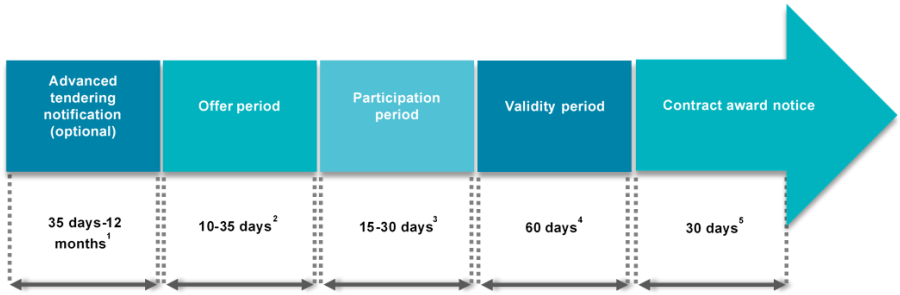
[4] Starts with the termination of the offer period.

[5] Contract award notice should be issued within 30 days from the day the contract is concluded.

Public Sector –EU Negotiated procedure with call for competition



Notes:

[1] Optional advanced tendering notification issued ≥ 35 days / ≤ 12 months prior to the contract notice or invitation to tender.

[2] Starts with the day after the contract notice or the invitation to tender. Standard period is 30 days, but can shortened or extended to:

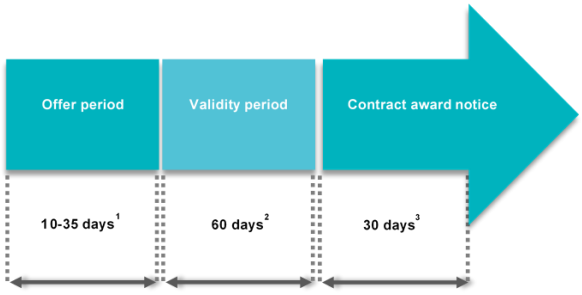
- 35 days in case of non-electronic tendering procedures with special security requirements
- 25 days in case of electronic tendering procedures
- 10 days in case of demonstrated urgency of the tender, advanced tendering notification was issued ≥ 35 days / ≤ 12 months prior to the contract notice or invitation to tender or upon mutual agreement by all applicants

[3] Starts with the day after submission of the contract notice. Standard period is 30 days, but can shortened to 15 days in case of demonstrated urgency of the tender.

[4] Starts with the termination of the offer period.

[5] Contract award notice should be issued within 30 days from the day the contract is concluded.

Public Sector –EU Negotiated procedure without call for competition



Notes:

[1] Starts with the day after the contract notice or the invitation to tender. Standard period is 30 days, but can shortened or extended to:

- 35 days in case of non-electronic tendering procedures with special security requirements
- 25 days in case of electronic tendering procedures

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- 10 days in case of demonstrated urgency of the tender or upon mutual agreement by all applicants

[2] Starts with the termination of the offer period.

[3] Contract award notice should be issued within 30 days from the day the contract is concluded.

3.2.4 Greece

The illustrations below outline a typical course of the tender procedure, as regulated under Greek law 4412/2016. This law incorporates the EU directives 2014/24 EU and 2014/25 EU. However, due to many specific scenarios which may roll out, additional deadlines and / or obligations may apply.

The below showcased timelines are usually depend on the value of the tender. High-value tenders are considered over the defined EU thresholds. The EU thresholds are generally renewed every two years and published on the European Commission's website.[1] In general, for tenders below thresholds the national law (and not the European regulation) is applied are for common public sector works:

- 5,350,000 € for works contracts
- 139,000 € for products, services and for technical studies from central governmental authorities or 214,000 for non-central governmental authorities.
- 750,000 € for services for social or other special reasons.

The lower thresholds for specific authorities (utilities related with gas and heat, electrical power, water, transportation, airports and ports, post services, coal, oil and gas mining) are:

- 5,350,000 € for works contracts.
- 428,000 € for products, services and technical studies.
- 1,000,000 € for services for social or other special reasons.
- For procurement cost up to 60,000 € then concise tenders maybe used.
- For procurement cost up to 20,000 € then direct assignments maybe used.

[1]Link:
https://ec.europa.eu/growth/single-market/public-procurement/rules-implementation/thresholds_en

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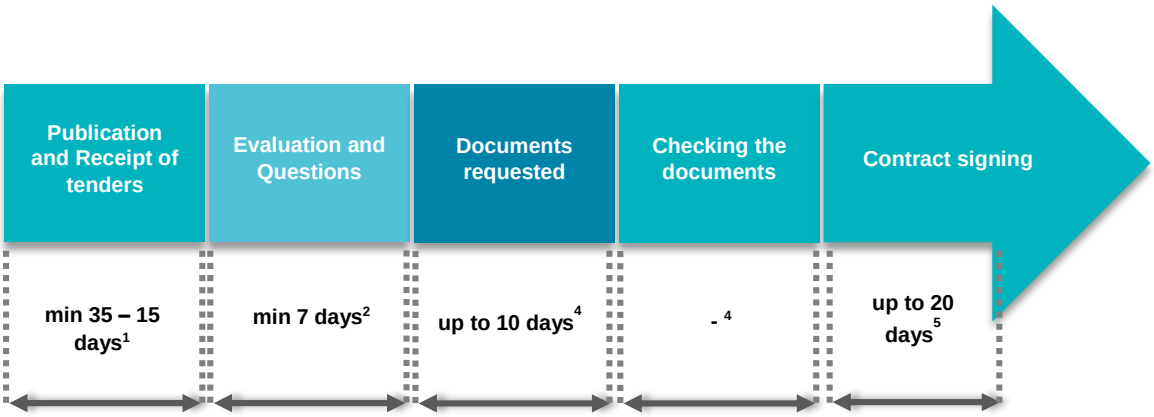
Public Sector and Utilities - Open procedure



Notes:

[1]For cost above the thresholds described in the general comment, the tender is sent for publication in the EU newspaper (TED) and this consider to be the starting time for receipt of tenders. The minimum duration for receipt of tenders is 35 days for non-electronic submission and 30 days for electronic submission. When prior information notice has been issued or in case of emergency this can be limited to 15 days. Additionally, it has to be published in the webpage of the contracting authority.

For cost bellow the thresholds described in the general comments, the tender is published in the «ΚΗΜΔΗΣ» platform and this consider to be the starting time for the receipt of tenders. The minimum duration for the receipt of tenders is 15 days. Additionally, it has to be published in the webpage of the contracting authority for 10 days.

For costs bellow 60,000 € the tender is published in the «ΚΗΜΔΗΣ» platform and this consider to be the starting time for the receipt of tenders. The minimum duration for the receipt of tenders is 10 days.

[2] The contract authority may ask in written form for additional information, data or revisions in estimations that might have been emerged in the evaluation action.

[3] The contract authority will declare a Temporary Concessionaire and will ask from him to provide all the documents that will proof its eligibility for be the final Concessionaire within 10 days.

[4] The duration of the check of the documents is not mentioned in the Greek law.

[5] The contract will be signed within 20 days of the notice award of the tender

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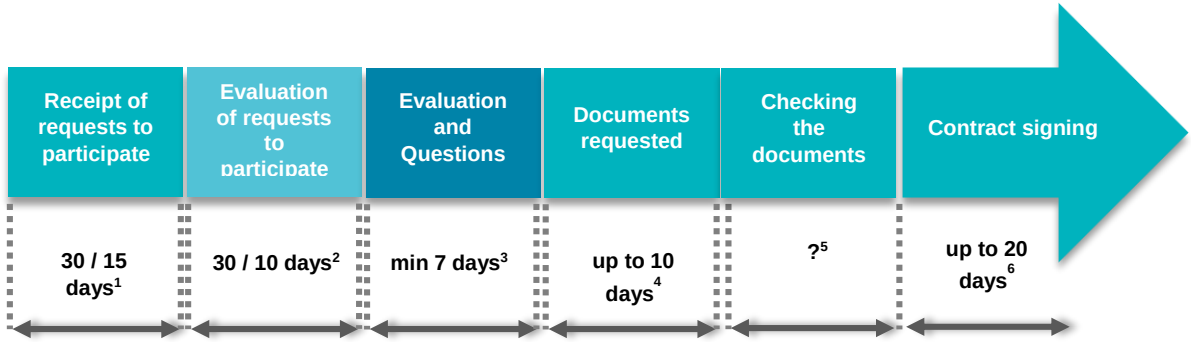
Public Sector and Utilities - Competitive Procedure with Negotiation



Notes:

[1]The duration is 30 days from the day of sending the tender for publication, 15 days in case of emergency

[2]The duration is 30 days from call and 10 days in case of emergency

[3] The contract authority may ask in written form for additional information, data or revisions in estimations that might have been emerged in the evaluation action.

[4] The contract authority will declare a *Temporary* Concessionaire and will ask from him to provide all the documents that will proof its eligibility for be the final Concessionaire within 10 days.

[5] The duration of the check of the documents is not mentioned in the Greek law.

[6] The contract will be signed within 20 days of the notice award of the tender

3.2.5 Italy

According to the Italian "Regulation for the discipline of public contracts for works, services and supplies stipulated by the electricity and gas authority", the following tendering procedures can apply:

1. Formalised procedures
2. Adapted procedures (for instance, for contracts which value is below thresholds or for specific services) such for example the negotiated procedure with or without publication of the tender notice
3. As a form of negotiated procedure of the economy system, the procedure for choosing the contractor through direct administration or via procedure for minor piecework contracts.

Here, we focus on formalised procedures only, which include the following:

i. Open call for tenders: every economic operator can apply;
ii. Restricted call for tenders: only pre-selected economic operators can apply.

Open procedure

The open procedure is a tender procedure in which all those in possession of the requisites required for participation and contemplated in the tender notice and in the documents attached to it can participate. The tender notice constitutes an invitation to submit offers under the conditions contemplated by it and represents the fundamental act of the

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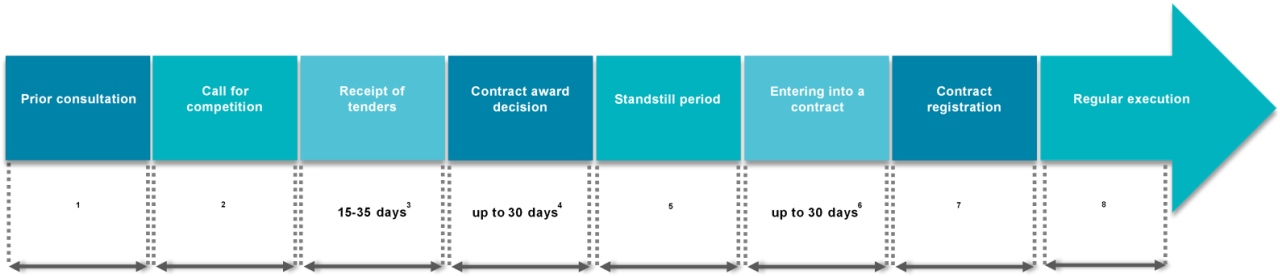
procedure and its conditions, also reported in the tender documents attached to it, constitute the rules governing the tender procedure.
The Authority normally uses the open procedure for all contracts equal to or higher than the Community thresholds and, preferably, for all contracts whose estimated value is higher than the thresholds for the implementation of the system in economy.



Notes:

[1] Preliminary, propositional and preparatory activities of the acts necessary for the negotiation at the head of the Director of the Authority's Management: the contracting authority must formulate the proposal constituting the subject of the hypothetical contractual relationship, assisted and supported by the General Affairs and Contracts Unit of the Personnel, Administration and Finance Department of the 'Authority. The Authority must identify the essential elements of the contract and the criteria for selecting economic operators and of the related offers, according to the procedures set out in the Italian Regulations. This information must be reported in the call for tender or in the invitation letter and in any case published on the online portal http://www.autorita.energia.it/bandi_gara.htm.

[2] Economic operators may file an appeal in relation to the content of the call or tender documentation. While the appeal to tender documentation has suspensive effect if filed, the contracting authority is not required to suspend any of its activities during this period.

[3] The actual minimum time period depends on whether (i) the tenders are submitted electronically (The minimum deadline for receiving offers is thirty-five days from the date of transmission of the tender notice); (ii) contracting authorities published a prior information notice ("**PIN**") before the contract notice ("**CN**") was sent (in this case the minimum deadline is 15 days if particular conditions are respected).

[4] The contract award decision should be rendered within 30 days from the expiration of the deadline for receipt of tenders, unless a longer deadline is set out by the tender documentation according to the level of complexity of the work, process or services of the tender.

[5] After the contracting authority has delivered the contract award decision to all bidders, it must permit a standstill period for filing appeals before it enters into the contract with the preferred bidder.

[6] The stipulation of contracts is handled by the Personnel, Administration and Finance Department through the General Affairs and Contracts Unit and should be concluded within 30 days from when the award decision becomes enforceable.

[7] The General Affairs and Contracts Unit of the Personnel, Administration and Finance Department of the Authority takes care of the registration of contracts, if applicable, at the time of stipulation of the contracts themselves.

[8] Regular execution and management of the contract.

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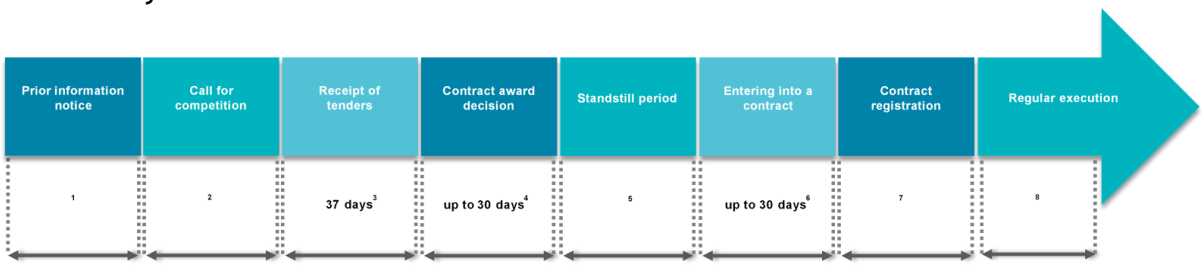
Restricted procedure

The Authority normally uses the restricted procedure when, in relation to the subject of the contract, it is deemed appropriate to proceed with a preliminary selection of the bidders on the basis of the specific provisions contained in the tender documents, for all contracts equal to or above the Community thresholds and, preferably, for all contracts whose estimated value is higher than the thresholds for the implementation of the system in economy.



Notes:

[1] The restricted procedure is a tender procedure in which only companies that have passed the pre-qualification phase following the publication of the tender and have therefore been invited by the Administration to submit offers can participate.

[2] Invited economic operators may file an appeal in relation to the content of the call or tender documentation. While the appeal to tender documentation has suspensive effect if filed, the contracting authority is not required to suspend any of its activities during this period.

[3] The actual minimum time period for receiving offers is thirty-seven days from the date of transmission of the tender notice.

[4] The contract award decision should be rendered within 30 days from the expiration of the deadline for receipt of tenders, unless a longer deadline is set out by the tender documentation according to the level of complexity of the work, process or services of the tender.

[5] After the contracting authority has delivered the contract award decision to all bidders, it must permit a standstill period for filing appeals before it enters into the contract with the preferred bidder.

[6] The stipulation of contracts is handled by the Personnel, Administration and Finance Department through the General Affairs and Contracts Unit and should be concluded within 30 days from when the award decision becomes enforceable.

[7] The General Affairs and Contracts Unit of the Personnel, Administration and Finance Department of the Authority takes care of the registration of contracts, if applicable, at the time of stipulation of the contracts themselves.

[8] Regular execution and management of the contract.

3.2.6 Spain

The below showcased timelines apply exclusively to the high-value tenders over the defined EU thresholds.

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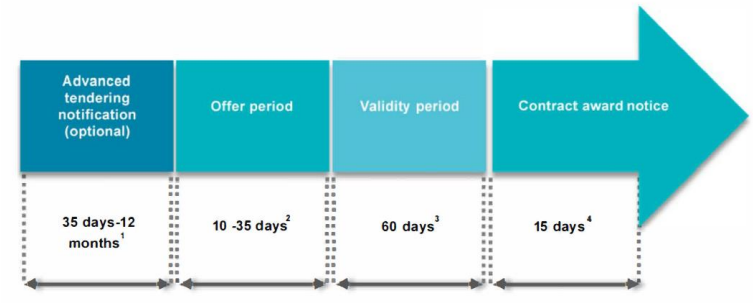
The deadlines depend on the specific tendering scheme as defined in Ley 9/2017. All the provided deadlines are minimum deadlines which may be extended due to specific reasons.

Public Sector – EU open procedure



Notes:

[1] Optional advanced tendering notification issued ≥ 35 days / ≤ 12 months prior to the contract notice or invitation to tender.

[2] Starts with the day after the contract notice or the invitation to tender. Standard period is 35 days, but can shortened or extended to:

- 30 days in case of works and services procedures
- 5 days less in case of electronic tendering procedures
- 15 days in case of demonstrated urgency of the tender or advanced tendering notification was issued ≥ 35 days / ≤ 12 months prior to the contract notice or invitation to tender

[3] Starts with the termination of the offer period.

[4] Contract award notice should be issued within 15 days from the day the validity period is concluded.

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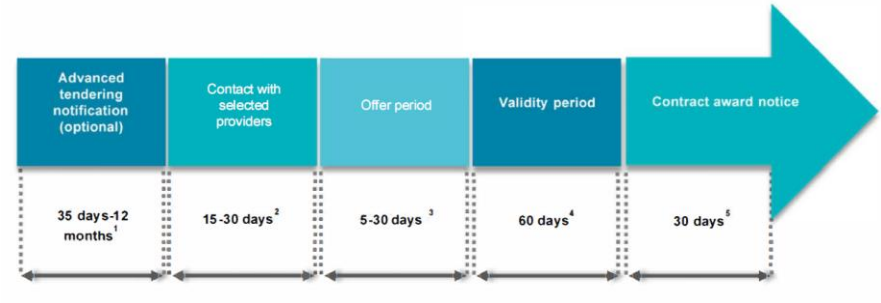
Public Sector – EU non-open procedure



Notes:

[1] Optional advanced tendering notification issued ≥ 35 days / ≤ 12 months prior to the contract notice or invitation to tender.

[2] Starts with the day after the invitation to tender. Standard period is 30 days, but can shortened to 15 in case of urgency.

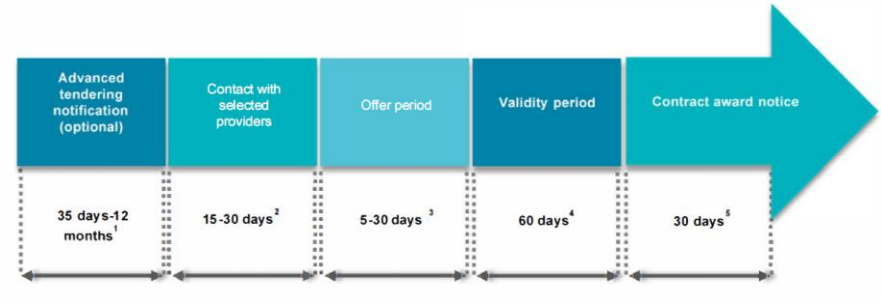
[3] Starts with the day after solicitation of offers and provider selection. Standard period is 30 days, but can shortened to

- 10 days in case advanced tendering notification was issued
- 5 days less in case of electronic tendering procedures

[4] Starts with the termination of the offer period.

[5] Contract award notice should be issued within 15 days from the day the validity period is concluded.

Public Sector –EU Negotiated procedure with call for competition



Notes:

[1] Optional advanced tendering notification issued ≥ 35 days / ≤ 12 months prior to the contract notice or invitation to tender.

[2] Starts with the day after the invitation to tender. Standard period is 30 days, but can shortened to 15 in case of urgency.

[3] Starts with the day after solicitation of offers and provider selection. Standard period is 30 days, but can shortened to

- 10 days in case advanced tendering notification was issued
- 5 days less in case of electronic tendering procedures

[4] Starts with the termination of the offer period.

[5] Contract award notice should be issued within 15 days from the day the validity period is concluded.

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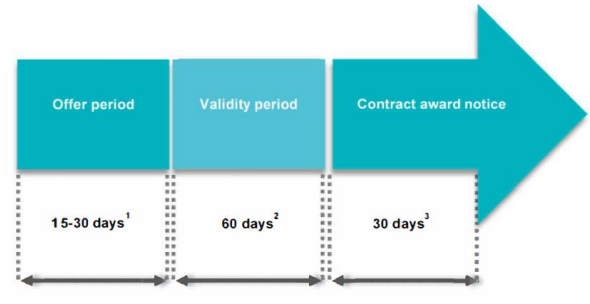
Public Sector –EU Negotiated procedure without call for competition



Notes:

[1] Starts with the day after the invitation to tender. Standard period is 30 days, but can shortened to 15 in case of urgency.

[2] Starts with the termination of the offer period.

[3] Contract award notice should be issued within 15 days from the day the validity period is concluded

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4 Sustainable Business Models

T1.4.1 of NESOI project aims to define innovative business models applicable on islands and archipelagos. Several technologies have been selected to be developed in the islands' locations such as Solar PV, Plasma gasification, District Heating, among others. In addition, potential related barriers and additional specific issues have been identified based on national showcase assessments and presented below each business case. In case of blank entries, no potential related barriers and additional specific issues have been identified.

At the same time, the model expectations of economic and energy savings that would be achieved with their installation have been analyzed.

Both, the positive and negative perspectives of its development have been analyzed in detail, taking into account the following criteria:

- Technical
- Environmental
- Social-Economic
- Regulatory framework

From the economic point of view, some innovative financing options present in the market such as Crowdfunding, are detailed as alternative financial tools to bank financing.

For these are innovative business models, it is essential to address regulatory issues and legal regulations of the system; differentiating the legislative requirements at European Union, state and local levels.

In order to attract investment and financing facilities, it is necessary to consider the aid and subsidies offered by public institutions under the renewable energy development commitment.

With the collaboration of public authorities, the population will receive more guidelines and awareness about the importance of sustainability. Social awareness and responsibility are needed to encourage citizens to take efficient measures.

The development and installation of innovative energy efficiency and distributed generation measures have a sustainable and environmental objective achieve to reach efficient systems, energy independence and reduction of gas emissions to the atmosphere as a corrective and mitigating method of the consequences of climate change.

Barriers to the business models have been identified as part of each of the national showcase assessments, which have been summarized in each business model subsection. The tables show varying levels of information per member state, due to the current regulatory relevance and level of information available for that member state. In some cases, where there is no summary included, this is an indication of no specified information available that suggests that there are any clear barriers for that business model.

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4.1 Cluster 1: New Business Models driven by regulations (Clean Energy Package)

4.1.1 Prosumers

Prosumer is the combination of producer and consumer, that is, a person who produces and consumes a product. In this particular case, an energy prosumer, is the person who both consumers and produces electricity. Almost all people are energy consumers but just a few are also producers.

There are generally two groups of energy prosumers as shown in the table below:

Connected to the grid	Self-sufficient
• Energy is consumed primarily from own sources. When the generated energy is not enough to cover the needs, the system begins to consume energy from the grid. • The excess of energy generated can be stored in batteries or fed back to the grid. • These kinds of systems are becoming very popular as they require relatively low investments and interesting payback periods. • The capacity to feed back the excess energy to the grid, the purchase and sell price and other aspects affecting this kind of systems, are highly regulated and varies among different countries.	• Not connected to the grid (due to economic reasons, lack of infrastructure, etc.) • Dependent on the energy source (sun, wind) • Usually requires a battery for energy storage • It may need back-up systems such as generators to cover the shortage of energy in certain conditions • Higher installed capacity to cover consumption • They are becoming very popular in isolated areas with no access to the grid. • It can be scaled up to give access to electricity in villages with no access to the grid

The prosumer scheme is available for everybody: individuals at home, private companies, public institutions, and even complete geographical areas, as is the case of the islands and it has numerous advantages for all of them:

1. Ability to have electricity in remote locations without expensive infrastructure: This is especially important in the islands, as the energy transmission infrastructure can be extremely expensive or even impossible.
2. Capacity to use own resources like sun and wind –which are usually available in islands all around the globe– to generate electricity. This produces a decrease on the dependency of fossil fuels and therefor in the variability of electricity prices. Also, in most cases, it reduces or eliminates the external dependency from oil producing countries.
3. Environmental benefits derived from the substitution of traditional energies for clean energies and from eliminating the need for infrastructure in the case of islands and remote locations.

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4. Economic savings: The payback period is around 6 to 10 years for solar systems and 7 to 10 for wind energy. After this period, the cost of producing energy is close to cero. It is important to notice that the cost of maintenance in renewable energy plants is quite reduced, especially compared with traditional sources of energy.

Several business models can be developed for the prosumers scheme, as shown in the following table:

Model	Value proposition	Revenue stream
Residential buildings	• Ability to freely chose the living location without depending on energy availability • Involvement of citizens in the energy market • Awareness related to energy efficiency and energy consumption	• Better distribution of population • Higher life quality • Economic saving in energy • Participation in the renewable energy transition
Companies	• Involvement of companies in the energy market • Awareness related to energy efficiency and energy consumption	• Economic saving in energy • Participation in the renewable energy transition
Public institutions	• Involvement of public entities in the energy market • Exemplariness of the public administrations towards energy transition • Awareness related to energy efficiency and energy consumption	• Economic saving in energy • Participation in the renewable energy transition

Over the time, the development of the prosumers scheme has been influenced by different drivers and has greatly varied among countries. For some years, the European Union has sought to stimulate consumers to become prosumers and therefore is developing the legal framework to regulate the prosumers in the electricity market.

The objective is to prioritize the grid connected prosumers over the self-sufficient, as the grid costs remain shared among the same number of users. This also have advantages for the prosumer, as they avoid the high cost of battery storage systems and backup systems. In order to fulfill this objective, the EU should guarantee that prosumers benefit from participating in the electricity market.

In most European countries, becoming a prosumer is quite easy, and prosumers do need to obtain neither a license to generate renewable energy, nor a building permit, to carry out an energy impact assessment. Big projects (for instance, in Spain those with more

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than 100 kW, in Italy for more than 20 kW) need for the permission of the Distributed System Operator (DSO), whenever energy surpluses are sold to the grid to do so. All projects need to be authorized by the DSO, to change their status from a user to a consumer.

There are a number of available tools to help prosumers estimate the power production which they can obtain from solar PV systems, by evaluating the solar irradiation of the place to install the facility. Although most countries have their own tools, the European tool PVGIS (Photovoltaic Geographical Information System), developed by the European Commission Joint Research Centre is particularly useful, and includes access to maps and information for every country and region.

The prosumer scheme is already a reality in the EU, with many examples of both individual houses and companies joining this initiative every day. A report by the CE Delft estimates that the number of prosumers within the EU in 2016 was around 6 million and it will increase up to 7 million in 2030 and over 264 million by 2050.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: This business model is not fully regulated in Croatia.	• Lack of regulation on battery storage.
France	• N/A	• N/A
Germany	• R: Grid connected prosumers need installations above 7 kW capacity for mandatory smart grid rollout and thus to benefit from suitable, flexible tariff schemes. • R/C: Currently no effective incentives available for grid supporting behavior though consumption-based tariffs, thus grid connected prosumers pay only a small share of the total grid costs for their back-up connection compared to conventional consumers.	• BM for grid connected prosumers strongly influenced by Smart Metering use cases, especially • Suitable, flexible tariff schemes • Remote switching of controllable loads and generation/DER
Greece	• C: Excess energy in Net-metering model is not compensated. • R: Physical persons cannot use virtual net metering (production and demand has to be in the same area). Only legal organizations have this possibility.	• Andros and Tinos (interconnected) islands have an absolute total limit for PV installed power of prosumer and/energy communities

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<table>
<tr>
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<td>

R: Maximum PV size 20 kWp or max 50% of the arranged/rated power (if >20kWp)
(For Non-interconnected island the limit is 10 kWp. For Crete's grid the limit is 20 kWp)
T: Maximum PV size 5 kWp in 1ph Systems
T: Maximum PV size 100 kWp in LV
R/T: For Non-Interconnected islands the following maximum Limits are applied per power plant

<table>
<tr><th></th><th>Public Purposes (kWe)</th><th>Private/Other (kWe)</th></tr>
<tr><td>Crete</td><td>300</td><td>100</td></tr>
<tr><td>Rhodes</td><td>300</td><td>100</td></tr>
<tr><td>Kos Complex</td><td>100</td><td>50</td></tr>
<tr><td>Lesbos Complex</td><td>100</td><td>50</td></tr>
<tr><td>Thira Complex</td><td>100</td><td>50</td></tr>
<tr><td>Chios Complex</td><td>100</td><td>50</td></tr>
<tr><td>Samos Complex</td><td>100</td><td>50</td></tr>
<tr><td>Other systems</td><td>100</td><td>20</td></tr>
</table>

R/T: Systems in Crete and Rhodes > 100kWe and in other non-interconnected islands >50kWe should be able technically to be curtailed

</td>
<td>PV systems equal to 30 MWe and 10 MWe respectively</td>
</tr>
<tr>
<td>Italy</td>
<td>

At the beginning of 2017, around 1200 utility-scale systems (> 1 MW of power) and over 700,000 prosumer systems were installed in Italy.
The new energy paradigm characterized by renewable (non-programmable) sources and distributed generation inevitably leads to a new complexity in the management of the electricity grid and in the balancing and capacity services necessary to meet demand and its performance.
The final perspective is represented by many more and more self-sufficient units that will ask the electricity grid for an even lesser amount of energy but responds very quickly to peak needs.

</td>
<td>

The new complexity of energy flows, both internal to consumption units (homes and factories) and external (national electricity grid), is that they will have to be governed by intelligent systems capable of responding in real time and managing huge quantities of variables. Digitization of energy flows will be essential for management.
Storage systems and artificial intelligence represent the key

</td>
</tr>
</table>

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		technological trends in the near future of energy.
Spain	• R: Following EU direction, in 2018 Spain eliminated all barriers to self-generation of energy. • C: Grid costs are paid in a significant way by the power term instead of the energy term. Therefore, the back-up connection remains expensive.	

4.1.2 Net Balance

Following the increase in the number of prosumers during the last years, arose the question of how to compensate the excess of electricity generated by prosumers. It is a topic greatly affected by the different governments and their policies and it has significantly differed among EU members. Some of these options varied from not compensation at all (e.g. Greece), making the prosumers look for battery storage options, to high incentives and feed-in-tariffs where becoming a prosumer presented an interesting economic benefit (e.g. Italy, Germany). Other countries, such as Croatia, have intermediate models, not providing incomes to the prosumer, but discounts in the energy bill.

As the options to compensate the excess energy were uneven, the EU seems to have found a fair and advantageous solution that fits all stakeholders involved. This option is the net balance.

The net balance is a form of compensation in which the prosumer feeds the excess of generated energy into the grid and it can be used in another moment when there is no generation (during the night in the case of solar energy). It is easy to imagine the net balance as a big battery where the prosumer can storage his energy excess to consume when its needed.
In some countries, the system is slightly different, as the excess of energy is priced (set or according to market) and discounted from the electricity bill.
The net balance offers some interesting advantages:

- It is a fair option for the prosumer
- The prosumer makes a better use of the energy generation system, as all the energy is consumed, either in the moment or later when its needed.
- The installed capacity of the system can be adapted to the average daily consumption instead of having enough capacity for peak periods. Therefore, the size and cost of the generation system are reduced.
- As the prosumer is connected to the grid, there is no need of a battery or a backup system, reducing again the cost of the project and the environmental impact of the batteries.

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- It is a great promotion of the prosumers scheme, enabling a higher share of renewable energies in the market.

Several business models can be developed through for this system, as shown in the following table:

Model	Value proposition	Revenue stream
Residential buildings	• More clear regulation • Eliminate the need of batteries and back-up systems • Maximized installed capacity • Increase in energy security • Fair system • Involvement of citizens in the energy market • Awareness related to energy efficiency and energy consumption	• Easier access to self-generation • Decrease in the investment • Economic saving in the project and the energy bill • Participation in the renewable energy transition
Companies	• More clear regulation • Maximized installed capacity • Fair system • Involvement of companies in the energy market • Awareness related to energy efficiency and energy consumption	• Easier access to self-generation • Economic saving in in the project and the energy bill • Participation in the renewable energy transition
Public institutions	• Involvement of public entities in the energy market • Exemplariness of the public administrations towards energy transition • Awareness related to energy efficiency and energy consumption	• Economic saving in energy • Participation in the renewable energy transition

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: Suppliers of electricity are obliged to take over excess electricity generated within the	

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	facilities of up to 500 kW total connected power at one metering point.	
France	• In France, excess electricity (non self-consumed) must be sold to the incumbent operator and is paid at a predefined tariff.	
Germany		• Rather small inland system especially with high PV penetration and timely consumption might need a battery.
Greece	• C: Excess energy in Net-metering model is not compensated and clearance take place every three years.	
Italy	• Main barriers consist on one hand on the lack of specific know-how to implement the business model and support the related investment for making it effective, on the other hand on the DSO monopoly. Both types of barriers bring to a very high economic investment for the BM.	
Spain	• R: Real Decreto 244/2019 doesn't allow for a net energy balance. It defines a discount in the bill from excess energy for installations of less than 100 kW. Installations of more than 100 kW have to sell their excess energy to a market agent. • R: The electricity sale price is calculated according to the market price minus diversion costs. It is published daily by REE (Spanish TSO).	

4.1.3 Local and renewable citizen energy communities

In the most basic definition, renewable energy communities are groups of citizens, private companies and public authorities that partially or totally own renewable energy generation facilities.

With the development of solar energy, many families have started to install solar panels in their houses. When these initiatives involve a joint group of local stakeholders like companies, public authorities, or other entities, the benefits are higher as they can work together in larger scale installations that could not be achieved by the individual players.

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The first considered renewable energy community was created in 1978 in the community of Ulfborg (Denmark), when a wind turbine was built and installed for a community of hundreds of people.

In some countries like UK, Germany and Denmark, these communities are especially strong, with a notorious percentage of ownership in the installed capacity of the country. However, even with the growth of renewable energies in the EU during the last years, the renewable energy communities remain forgotten in most countries.

Renewable energy communities allow a large number of people to participate in the energy market and in the energy transition.

Several business models can be developed for this initiative, as shown in the following table:

Model	Value proposition	Revenue stream
Social	• Allow all stakeholders to participate in the energy market and the energy transition • Improves people access to renewable energy • Promotes clean energy awareness • Involvement on the local community • Creation of local jobs	• Ownership feeling • Regional/national/international recognition • Improves energy security • Enhance attractiveness of the area
Economic	• Investment on community owned generation facilities • Return on the investment • Possible benefit from selling excess energy	• Decrease in the energy price • Local benefits promote further collective effort and collaboration • Re-investment of benefits in new projects
Environmental	• Power is generated and consumed where is needed • Reduction of pollution • Zero emission goal • Diversified energy sources	• Decrease on the need of energy transmission infrastructure • Air quality and environmental improvement

The number of benefits of the renewable energy communities is very high. However, there are also some challenges that need to be taken into consideration:

- **Lack of promotion:** The first problem is that these kinds of initiatives are scarce and not well known among the general public. However, in general public authorities do know renewable energy cooperatives.

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- **Regulatory issues:** Land management, planning regulations and energy laws can be major obstacles to the development of renewable energy communities. There does not exist a suitable legal framework developed for energy communities. It is under development and will derive from the Clean Energy Package. In most countries, it is expected to come into force by January 2021 at latest.
- **Leadership:** The members of the community need to be gathered, organized and coordinated. This task requires management, legal and administrative knowledge.
- **Culture:** Not all cultures have the same feeling about community ownership. While some countries have a long tradition for cooperative ownership, other may present some resistance.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: Regulatory framework for Local and Renewable Citizen Energy Communities is not yet implemented in the sense of the Clean Energy Package. • R: General regulation prescribed for citizen representation may apply.	
France	• Local and Renewable Citizen Energy Communities have just been introduced in the legal framework (Energy-Climate Law)	
Germany	• R: Regulatory framework for Local and Renewable Citizen Energy Communities is not yet implemented.	
Greece	• R: For Non-Interconnected islands, production and demand has to be in the connected in the same grid and in the same regional unit • R: All the demand and production have to be registered with the same supplier • R: Maximum PV installed power can be equal to the arranged/rated power demand. • R/T: For Non-Interconnected islands the following maximum Limits are applied per power plant of energy community	• T: Andros and Tinos islands have an absolute total limit for PV installed power of prosumer and/energy communities PV systems equal to 30 MWe and 10 MWe respectively.

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	<table><tr><td></td><td>Energy Community (kWe)</td></tr><tr><td>Crete</td><td>500</td></tr><tr><td>Rhodes</td><td>500</td></tr><tr><td>Kos Complex</td><td>300</td></tr><tr><td>Lesbos Complex</td><td>300</td></tr><tr><td>Thira Complex</td><td>200</td></tr><tr><td>Chios Complex</td><td>200</td></tr><tr><td>Samos Complex</td><td>200</td></tr><tr><td>Other systems</td><td>100</td></tr></table> • R-T: Systems in Crete and Rhodes> 100kWe and in other non-interconnected islands >50kWe must be able to be curtailed	
Italy	• Italy is characterized by a relatively low CE sector development, being an Italian CE sector still at its niche level, characterized by small initiatives largely dependent on national photovoltaics (PV) policy support. Only larger initiatives, able to operate at national scale, developing multiple projects and differentiating their activities have managed to continue growing at the time of discontinuity of policy support and contraction of the national renewable energy market. Recent EU and national legislative development might support revived development of CE initiatives in Italy. • Barriers in Italy may be the same mentioned by Deloitte, as reported below: ○ Lack of promotion: The first problem is that these kinds of initiatives are scarce and not well known among the general public. ○ Regulatory issues: Land management, planning regulations and energy laws can be major obstacles to the development of renewable energy communities. ○ Leadership: The members of the community need to be gathered, organized and coordinated. This task requires management, legal and administrative knowledge. ○ Culture: Not all cultures have the same feeling about community ownership.	• After decades of inaction the CE sector in Italy has experienced a new growth between 2008 and 2013 with the development of initiatives aimed at people engagement in the energy transition. The majority were local energy community projects, mostly developing PV plants generally of a size below 100 kW, and only very few were initiatives with wider territorial scope and able to develop megawatt size plants or different projects summing up to several hundred of kilowatts. Despite the prevalence of the local dimension, only a few initiatives (the 24%) have been developed with a bottom up approach, hence characterized by strong involvement of citizens or other types of grassroots organizations in the initiation and

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	While some countries have a long tradition for cooperative ownership, other may present some resistance. • In addition to those general barriers there could be the difficulty to reconcile the national, larger size of CE business models with the dynamics of community engagement at the local level, including the possibility of guaranteeing a high level of participation of their members in the decision processes. • Energy communities were first mentioned within the Italian legislation and regulatory framework by the Italian Energy Strategy in 2017 and, subsequently, by the National Energy and Climate Plan in 2018. However, they were both legislative framework documents which did not imply any concrete measure to support the implementation of community energy initiatives in the country. In 2018, the Piedmont region implemented a law on energy communities, which has mainly been a declaration of intent, although politically relevant, being the first legislative initiative explicitly dedicated to the Italian CE sector. A recent call for proposal launched by RSE (a public company devoted to research on the energy system) is also acting as showcase and test of pilot projects of energy communities, here intended as local, collective self-consumption initiatives. The conclusions of these pilot experiences are likely to provide the supporting evidence for the design of new incentive schemes currently under discussion.	development of the project. The majority have been developed with a top down approach, i.e., with an institution (i.e., a local authority or a private company) leading the process, defining structural features of the project and facilitating citizens' involvement. Among those, the role of municipalities and municipal utilities is nonetheless remarkable, which have often acted as promoters or as facilitators of the initiatives. • Only a few CE initiatives have been developing renewable energy plants after the cancellation of the FiT in 2013, the larger ones and with a national scope in their activities or promoted by commercial actors: Moreover, those still operating after 2013 have rarely developed new renewable energy plants and mostly focused their activity on acquiring operating PV plants on the secondary market, which are still benefiting from the FiT support. • In conclusion, the national evolution of the regulatory framework for energy communities joint with the renewed national support to renewable energy, implemented in July 2019, will

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		progressively shape the CE sector in Italy, which might be on the verge of a profound evolution. As of February 2020, only a first step has been taken by the national legislators (Law 8/2020), which enables small scale initiatives (below 200 kW). Which other CE implementation models that will be supported by the legislator will depend on the policy decisions that will be taken in the future steps of the EU Directive implementation process. Whether this will lead to a revival of local, small-scale experiences as those developed in the 2008-2013 period or will reinforce the national paradigm developed by the larger Italian CE initiatives (or a combination of both) is an open question worthy of analysis and discussion in the future.
Spain	• R: Regulatory framework for Local and Renewable Citizen Energy Communities is not yet implemented. • Prosumer regulations set a framework for shared energy generation plants but limit the distance between consumer and generator to 500 meters and only considers for now an energy distribution by fixed coefficients.	

4.1.4 District heating

District heating, also known as urban heating is a system of domestic hot water supply and heating (and in some cases also refrigeration), in which the heat or thermal energy is

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produced in a plant (such as a large heat factory) and is It distributes through an urban pipeline network, in the same way that it is done with the rest of the services we use in our homes, that is, gas, water, electricity or telecommunications.

The concept of district heating is not new. In fact, it was already used in the roman age (4th century b. C.), where the hot water for the public baths was heated in external "boiler rooms", and hot water circulated through the open channels until it reached the buildings where it was used.

New York, with its representative fog coming out from some sewers or tunnels under the streets, and Reykjavik with its modern geothermal heating system, are very good examples of urban heating.

The district heating system consists of the following components:

- **The thermal power plant:** It is the place where the water or another fluid is heated and conducted to residential buildings to be used in heating, for sanitary hot water, and as steam in some businesses such as dry cleaners, ironing, etc. The thermal power plant can operate from gas, coal and other fuels but also with renewable sources such as biomass, geothermal and solar power. The thermal plant is usually located in an exclusive area out of the city, like a factory,
- **The distribution network:** Once the hot water or steam has been generated, it is distributed to the different buildings by means of a network of thermally insulated pipes, which partially prevent heat loss. This heat transport line consists of two pipes, one for the outward and one for the return. In new urban constructions, the District Heating system reduces the cost of the work, since the hot water distribution network replaces the gas distribution network and takes advantage of the ditches in the water supply network.
- **Thermal transmission substations in buildings**: They are located in the buildings or groups of buildings and connected to the thermal power plant in parallel. Their mission is to assure that all buildings have the same supply conditions, that is, no quality or heat is lost due to being closer to the thermal power plant. They have a heat exchange system, without fluid or pressure exchange, through which heat is transferred to the terminal elements for the heating and domestic hot water service of homes. These substations allow the combination with other heat sources to contribute to heating and domestic hot water, such as the thermal solar energy system in the building.

The district heating has a great number of advantages:

- Lower building cost as there is no need of gas network, boiler systems and related safety devices.
- Lower building time
- Increase of available space in the building as there is no need for boilers.
- The thermal power plants have a better efficiency in the heat production than the individual/building boilers
- Better reliability than individual/building boilers and heating systems

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- Noise reduction due to the absence of boilers.
- Safety increase as there is no presence of gas or other fuels in buildings
- Great economic savings due to all mentioned advantages: higher efficiency, lower maintenance, reduced installation cost, etc.
- Improves the air quality in the city, as the thermal power plant is separated from the city.
- Reduces CO2 emissions and greenhouse effect gases, as the burning efficiency is higher than individual systems.
- Global energy efficiency improvement.
- It allows the use of biomass or biogas and cogeneration with clean energy sources such as solar and geothermal. Many district heating systems are based on renewable energies.

Several business models can be developed for district heating, as shown in the table below:

Model	Value proposition	Revenue stream
Citizens	• Involvement in the development of energy efficiency. • Environmental awareness. • Sense of environment cooperation. • Beneficiaries of the decrease in heating cost • Beneficiaries of the air quality improvement.	• Acceptance of the infrastructure installed • Beneficiaries of the better life conditions of the city
Public authorities	• New market and regulatory framework. • Compliance with committed energy efficiency objectives. • Compliance with committed air quality measures in cities. • Renewable energy cogeneration	• Development of new projects. • Development of the infrastructure network • Beneficiaries of the improvement of the city attractiveness

There are more than 70,000 km of distribution network pipes in Europe. Some of the most important are Marstal, Odense and Copenhagen (Denmark), Dresden and Berlin (Germany), Aberthal (Austria) and the biggest one in Paris (France).

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

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Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: General regulation for District Heating exists but is not tailored to a small scale of local installations. • T: Lack of previous experience with such BM on islands. • T: Small size of many islands.	
France		
Germany		
Greece	• R: No new business models have emerged from Clean Energy Package. Regulatory framework exists • R: Complex licensing procedure.	• For RES enabled DH in non-interconnected island (being constructed in the Island of Agios Efstratios) a special law was passed to prioritize the licensing and to remove barriers from the electrical code of the non-interconnected island.
Italy	Potential technical barriers due to capillary gas distribution, that is always the preferred solution. Moreover, the presence of many historic centers in Italy makes DH installation difficult, also for the high costs to build the infrastructure. *Source*: • Italian district heating association	
Spain	• No barriers. Is not very common in Spain but there are already good examples, like the example of Soria, with an installation of 18 MW, 28 km of pipes and providing service to 16.000 users.	• It is being promoted and developed but there is no specific regulation on the matter.

4.1.5 Procurement of flexibility by DSOs

Given the increase of distributed renewable generation (DRE) installed, the energy generation is being transformed, showing itself as a more variable and intermittent energy source, which needs to be properly managed. Additionally, the demand is becoming more active, emphasizing consumer empowerment and engagement, while new consumption profiles are emerging, largely caused by electric vehicles.

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All these changes are forcing the electrical system to evolve and transform to face these new challenges. For all these reasons, the adequate management of available flexibility, both on the generation side and on the demand side, must compensate for the uncertainty of renewable sources and the increase in consumption with new types of loads without compromising the state of network.

The DSO flexibility allows a faster transition to renewable energy and enables the development of prosumer, integrating in the system the distributed renewable energy.

Some of the most important objectives of the flexibility are:

- Improve the efficiency the network development and operation
- Avoid grid expansions whenever its possible, allowing the DSO to have lower grid costs and therefore to offer more competitive tariffs.
- To manage local congestions in the networks and solve technical problems like voltage control or reactive power.

Several business models can be developed for DSOs flexibility as shown in the following table:

Model	Value proposition	Revenue stream
Public authorities	• New market and regulatory framework. • Encourage the development of flexibility • Integration of DSOs regulatory framework • Consideration of local issues	• Promotion of flexibility • Solutions adapted to specific local needs • Faster transition to renewable energy • Allow to increase the number of prosumers
DSOs	• Decide on flexibility vs grid expansion • Implement a higher level of flexibility • Implementation of flexibility technologies like energy storage	• Improve energy efficiency • Cost reduction • Strengthening of electricity network
European regulators	• Open to a range of models that enable a higher use of flexibility by DSOs • Combination of different solutions adaptable to local situations.	• Higher use of flexibility • Faster transition to renewable energy • Allow to increase the number of prosumers

DSOs are highly regulated by the government and in many countries, they are not allowed by law to own storage technologies, but at the same time, they are obligated to provide

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a safe and quality supply of electricity. Therefore, it is necessary to update the power grid management resources and thus demonstrating that current technologies and solutions are already available. In addition, there are some barriers, such as regulatory ones, that public authorities, starting at EU level, should solve to respond to the new challenges that the energy transition requires.

DSOs are highly interested in this technology and in some European countries they are already participating in pilot plant projects of flexibility.

In general, flexibility services only exist currently for large scale consumers. However, the development of the prosumer concept will enable the extension of flexibility services to all consumers.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: Framework and platform for market-based procurement of flexibility by DSO is not yet implemented.	
France		
Germany	• R: Framework and platform for marked-based procurement of flexibilities by DSOs is not yet implemented.	
Greece	• R: DSO is regulated by the government.	• New energy market model (Target Model) in Greece (to be in operation in Sept 2020) will enable new business models for all actors.
Italy	• DSOs are highly regulated by the government and in many countries, they are not allowed by law to own storage technologies, but at the same time, they are obligated to provide a safe and quality supply of electricity. Therefore, it is necessary to update the power grid management resources and thus demonstrating that current technologies and solutions are already available. In addition, there are some barriers, such as regulatory ones, that public	• In most European countries, the National Regulatory Authority (NRA) sets the allowed revenue (revenue cap or price cap) for a DSO in a regulatory period (whose length may vary depending on the national regulations), and the DSO

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	authorities, starting at EU level, should solve to respond to the new challenges that the energy transition requires.	sets the network tariff and connection charges accordingly. In some countries, such as in Italy, the NRA has even more control, also defining the level and the structure of the individual network tariff for each regulatory period. Considering the penetration rate of Distributed Energy Resources, the focus of the DSO will not be only on adjusting the network for the expected long-term peak. Additionally, there will be the need for investing in operational measures that allow a high penetration level of DERs while ensuring the quality of supply.
Spain	• R: Framework and platform for marked-based procurement of flexibilities by DSOs is not yet implemented. • T: The Spanish industry is ready for this technology	

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4.2 Cluster 2: Commercially driven business models

4.2.1 Demand response (DR)

Demand response is an initiative that consist in changing the electricity consumption of a costumer to better match the demand for power with the supply.

For any market, but especially for the energy market, it is necessary to maintain a permanent balance between supply and demand. In this sense, the Demand Response is a key factor to improve the efficiency of electrical systems by allowing demand to become active and participate in the market.

Until the recent increase of electricity storage technologies, the electricity system adapted the production to the demand by increasing or decreasing the activity of thermal power plants. However, this represents an issue from the producer perspective, as some power plants may require a long time to reach full power or slow down the production rate. In addition, demand can be higher than all available capacity.

With demand response technologies, it is possible to adjust the demand of power instead of adjusting the supply.

There are already some technologies available and some other are under development. In general, they are automatic demand-response devices than can turn on or off certain appliances like heating, air conditioning, water boilers, etc. Another interesting initiative on this regard is the daily charge of electric vehicles.

As the demand response technologies offer significant advantages to the supplier but not apparent benefit for the consumer (they can even generate slight inconvenience), the consumers need incentives to demand this option, usually in the way of tariff discounts.

Indeed, currently demand response is only offered to wholesale clients. It is expected that in the future, when small consumers will become prosumers and smart meters are installed in all households (and householders begin to use them), demand response will be used by a wider range of customers.

Several business models can be developed for demand response as shown in the following table:

Model	Value proposition	Revenue stream
Home consumers	• Increase their participation in demand response technologies	• Low inconvenience • Tariff incentives

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Industrial consumers	• Increase their participation in demand response technologies • Implementation on energy consumption control infrastructure	• Tariff incentives • High impact on demand • Better consumption planning and control
Supplier	• Increase the demand response technologies	• Higher network stability • Peak demand reduction • Cost reduction

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: Regulatory framework for DR in the sense of the Clean Energy Package is not yet implemented.	
France	• In France, demand response is well developed, in particular in the industrial and commercial sectors, but also in the residential sector.	

Germany	• R: Regulatory framework for DR in the sense of the Clean Energy Package is not yet implemented.
	• T: Low utilization and slow implementation of smart meters which are required for DR uptake
	• T: Low level of standardization; Market fragmentation especially in the final customers' domain makes it challenging to create market interoperability.
		• BM should clearly differentiate between
		  ○ DR according to (EU) 2019/944
		  ○ Redispatch of DR (the 'former DSM') according to (EU) 2019/943 Art 12,13

Greece	• R: Demand Response is currently enabled for large scale and industrial consumers through TFRM (transitory flexibility remuneration mechanism)	• The importance of the human factor to demand flexibility is not to be neglected as, in renewable energy-based electricity systems, co-evolution of technology and society is imperative [1] • New energy market model (Target Model) in Greece

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		(to be in operation in Sept 2020) is expected to enable DR services for consumers.
Italy	• C: Demand response is not particularly regulated as a service in Italy and it is still in a testing phase mainly due to the DSO monopoly. It is mainly considered for high peak of power. In the testing phase in Italy (the only UVAM test procedure based on auctions)	• It is considered a quite innovative Business Model; the only UVAM procedures implemented is carried on based on local contracts; e.g. Agreements with AXPO for bilateral contracts to involve residential communities to offer UVAM-like services (for example to manage the peak for managing the overload related to second homes-> this new BM foresees a "soft version" (which is for the benefit of the customer) and a "hard" version (which is for the benefit of the grid but better remunerated))
Spain	• C: For small users, there is a lack of a specific market for DR • R: The Demand Response scheme is still not legal in Spain, except for intensive electricity consumers. With the transposition of EU Regulation 2019/943 and Directive 2019/944 in the coming months, this illegality should come to an end.	• The aggregator is a crucial player to put the flexibility of the consumer at the energy market.

4.2.2 Optimization of Time of Use pricing

Time-of-use pricing is an innovative initiative to set rate structures for consumers. The objective of Time-of-use pricing to incentivize energy consumption during the hours when generating cost is low, and to disincentive the consumption then the energy cost is higher.

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Unlike the usual nightly rates, which have been on the market for many years and set a fixed time of peak and valley tariffs, time-of-use adjust the rate you pay for electricity over the course of the day. When both the cost of generating electricity and demand for electricity are low (for example during the night), the electricity rate is very low. However, when both the cost of generation and demand for electricity are high, the electricity price higher.

Time-of-use rates can have variations depending on the, weekends vs weekdays, holiday periods, and across multiple periods over the course of an individual day.

In general, the European population seems to be willing to modify their electricity consumption, according to changing prices of electricity. However, this measure would need for some aware-creation actions, since some activities cannot be shifted to other hours.

Several business models can be developed for demand response as shown in the following table:

Model	Value proposition	Revenue stream
Home consumers	• Align offer and demand of electricity • Promote consumption in high production and low demand times • Show the consumer the actual price of electricity generation	• Reduction of electricity cost • Environmental responsibility
Industrial consumers	• Align offer and demand of electricity • Promote consumption in high production and low demand times • Show the consumer the actual price of electricity generation	• Reduction of electricity cost • Environmental responsibility

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: Low utilization and slow implementation of smart meters which are required for effective Time of Use pricing and related tariffs.	

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France	• Time of Use pricing is not implemented yet in France, but some debates and consultations are preparing the grounds for it: https://www.cre.fr/Documents/Consultations-publiques/contrats-d-electricite-a-tarification-dynamique	
Germany	• T: Low utilization and slow implementation of smart meters which are required for effective Time of Use pricing and related tariffs	
Greece	• R/C: It is not currently offered in Greece	• New energy market model (Target Model) in Greece (to be in operation in Sept 2020) will enable new business models for all actors.
Italy	• This business model, also known in Italy as load shifting / load shaping, aims to drive consumption when there is availability of renewable energy or less energy costs. It is not particularly regulated as a service and not so much implemented due to big DSO monopoly.	• Also in this case the only way to overcome barriers is by mean of smart bilateral contract and discounted rates.
Spain	• R:The Spanish government is going to change during 2020 new schemes of peak-valley tariffs, more adjusted to offer and demand. It will be within the Ley de Cambio Climático y Transición Energética (LCCYTE). Still the optimization of time of use pricing is not yet regulated.	

4.2.3 Energy management systems (EMS)

Organizations and companies constantly seek to improve their management. To achieve this goal, they establish strategies to increase and improve their efficiency while reducing costs.

While this have been done in areas such as service, supplies, sales, structure or people, currently, many companies are also focusing on energy efficiency, seeking produce more with less or reduce the energy consumption and cost.

The concept of energy management is born from the finding that many energy efficiency initiatives that are implemented, do not have continuity in time and therefore, they do

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not generate value or consistency over time. So, the potential benefits from such initiatives, like emission reduction or energy savings, prove to have low durability.

Based on this, there was a need for mechanisms which ensure that the benefits from energy efficiency initiatives were durable and continuous. The application energy management systems, allow a culture of awareness in energy efficiency is spread, understood, and shared by all the members of an organization.

The ISO 50001 standard for Energy Management Systems (EMS) was created in 2011 with the objective of establishing minimum requirements that guarantee the continuous improvement of energy performance of the organization. Furthermore, it promotes organizations meeting these requirements to continuously seek to reduce their energy consumption, increasing their energy efficiency and identifying the best and most suitable way of using the energy necessary to make their activities viable.

The main objectives of ISO 50001 are:

- Support organizations in establishing the most appropriate initiatives for energy consumption.
- Create easy and transparent communication regarding the management of energy resources.
- Promote best energy management practices.
- Support the evaluation and implementation of energy efficient technologies.
- Promotion of energy efficiency throughout the supply chain.
- Allow integration with other organizational management systems, such as quality, environmental, health and security.

Some business models can be developed for this initiative, as shown in the following table:

Model	Value proposition	Revenue stream
Companies	• Promote the implementation of Energy Management Systems • Show the capability for integration with other management systems	• Energy savings • Reduce of energy cost • Contribute to energy efficiency and environmental improvement • Improvement of corporate image • Show the involvement in environmental and sustainable development • Demonstrate environmental awareness • Competitivity improvement

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The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• T: We are not aware of any particular issues in line with implementation of the EMS.	
France		
Germany		
Greece	• R: No special regulatory framework exists for the EMS and BEMS systems. In Building Energy Audits, they are considered as beneficial. • Directive 2012/27/EE is incorporated in the Greek legislation	
Italy	• This BM in Italy is very well regulated but is led by few main players that still share the market well (e.g. BTICINO, SCHNEIDER, SIEMENS). The provision of this service is quite popular also because it is linked to the appointment of the appointment of the Energy Manager (EGE) that is now very well defined and regulated (unlike in the past where the criteria for becoming EGE were unclear). In the industry sector the service works well, the application to the public sector still needs to be encouraged.	• Metering e monitoring systems for providing the service are quite common. The residential sector is now the sector where this BM is trying to be applied and fostered in the future.
Spain	• T: Successful deployment in Spain, but still some barriers such low cost of energy in the total cost breakdown, or organizational issues within the companies.	

4.2.4 Load balancing

In any energy network, it is necessary to balance production and consumption. With the rapid growth of renewable energy and their intermittent production, load balancing is becoming even more critical for an efficient management of the network.

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The TSO (Transmission System Operator) is responsible for the balance at a high voltage level while the DSO (Distribution System Operator) manages the low voltage level taking place locally.

The energy feed from the low level into the high voltage grid can cause load balancing problems for the TSO. In addition, this feed into the TSO grid can lead to significant energy losses.

To avoid these problems, there is an initiative to manage the load balancing at a local level by the DSO, so the energy produced from renewable sources can be consumed locally, significantly reducing the transmission losses.

To be able to perform a good load balancing, the DSO needs a good forecast of energy supply and demand. Technologies such as machine learning, information technology and artificial intelligence can be extremely useful to analyze the local weather forecast and other data to predict the potential renewable production and the estimated consumption. This technology has shown a great potential. However, it is still in an early stage and it needs the involvement of all parts to achieve a correct development. Several business models can be developed for this initiative, as shown in the following table:

Model	Value proposition	Revenue stream
Public Authorities	• New market and regulatory framework. • Encourage the development of DSOs local load management • Integration of DSOs regulatory framework • Consideration of local issues	• Promotion of load balancing • Solutions adapted to specific local needs • Faster transition to renewable energy • Allow to increase the number of prosumers
Network operators	• Implement a higher level of DSOs load management • Adapt existing technologies such as machine learning, information technology and artificial intelligence to load management	• Improve energy efficiency • Reduce transmission losses • Strengthening of electricity network
European regulators	• Develop a regulatory framework to promote the DSO local load management • Combination of different solutions adaptable to local situations.	• Higher use of load management • Faster transition to renewable energy • Allow to increase the number of prosumers

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The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: DSO is generally not allowed to carry out balancing actions (the balancing is provided by the TSO).	
France	• In France load balancing is performed at transmission level.	
Germany	• R: DSOs are generally not allowed to carry out balancing actions, only TSOs (see also (EU) 2019/943)	
Greece		• New energy market model (Target Model) in Greece (to be in operation in Sept 2020) will enable new business models for all actors.
Italy	• On the regulatory side there are regulations but not yet the needed incentives and the implementation decrees for actuating and implementing such Business Models (e.g. it seems for example that there will be foreseen incentives on batteries in the future Italian Decree "Rilancio"). • From a technical point of view, an ESO (Energy System Operator) is needed to provide the BM, as the TSO (Terna) is also favorable. Nevertheless, the monopoly of DSO shall be a relevant barrier and, for this reason, the few success stories are available at local level. • In some other cases, like "vehicles to grid", even if the technology of vehicles and the charging stations are ready under a technical perspective, the infrastructure of the network is not ready at all.	
Spain	• R: Legal barriers as this technology is not yet regulated.	

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	• T: Technological challenged associated to the oversizing of electric systems/circuits	

4.2.5 Crowdfunding

This technology allows companies and start-up companies to ask for and arise capital from the general public (i.e. citizens), necessary for the development of renewable energy and energy efficiency projects in their early stages, avoiding the use of public funds, business investments and bank lending. Instead of this, they can opt for virtual financing alternatives.

Crowdfunding is a financial system that needs for a social network where entrepreneurs and crowdfunders interact together through virtual platforms. The owners of the project establish direct contact with users, who could be potential investors, across a virtual platform.

There are two different ways of carrying out crowdfunding investments:

- **Collective investment financing**, where companies that request capital sell their shares and holdings virtually by issuing capital or debt. In this case, crowdfunders (investors), by providing financing to these companies, become owners or shareholders and have a potential financial return.
- **Crowdfunding-donation**, in which crowdfunders provide a total amount needed to develop a new project. It usually corresponds to charitable projects whose final beneficiary is not the crowdfunder. While this business model will not be very common in this project, it can be interesting in some cases, such as disadvantaged families.

The main benefits of this innovative financing system are the acceleration of the growth of renewable energy projects through the enhancement of collective microfinance, promoting the collective mobilization of funds for projects and initiatives that are both economically and environmentally sustainable.

Several business models can be developed by combining the intervention of project developers, investors and users of crowdfunding through citizen contribution, collaboration of public entities (local authorities), private investments, as well as the participation of environmental non-governmental organizations. Some examples can be found on the following table:

Model	Value proposition	Revenue stream
Project owners	• Increasing the volume of renewable energy projects. • Establishing direct contact with investors (stakeholders).	• Possibility of requesting the full amount of the investment. • Reducing or avoiding indirect costs such as management fees. • Reducing or avoiding bank fees and interest or profit sharing.

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	• Avoiding administrative procedures and risk analysis required for bank financing or business investors.	• Lower rates of return.
Crowdfunders (investors)	• In the case of crowdfunding-donation: feeling of ownership and cooperation. • Cooperation for the development of sustainability projects and support for climate change mitigation.	• In the case of collective investment financing: ○ Owners or shareholders of the company. ○ Financial return.
Citizens	• Involvement in the development of renewable energies. • Environmental awareness. • Sense of environment cooperation. • Beneficiaries of the electricity distribution network.	• Acceptance of the infrastructure installed. • Beneficiaries of the economic development and, consequently, of the increase in jobs in the area.
Public authorities	• New market and regulatory frameworks. • Compliance with committed environmental sustainability objectives.	• Development of new projects. • Reduction of energy dependence. • Development of electricity grids to solve the problem of isolated electrical systems. • Profits from the business tax benefits of the activity.
Crowfunding platform	• Establishing contact between investors and project owners. • Cooperation in the development of new projects. • Development of new financing routes with transparency and cyber security. • Elimination of administrative procedures.	• Revenues from the following fees: - Charged to the Project owner for receiving the loan. - Charged to the Crowdfunder for the management of the client portfolio.

This is a financial system which is characterized by its transparency, social collaboration and reliability; but there are also possible barriers or negative impacts of their operation:

- No secondary market option for investors to trade investment transactions.
- Investment limit: €5 million, established by the European Securities and Markets Authority.
- Potential problems like the unproven technology, along with the cybersecurity risk.
- Substantial guarantees through the development of regulatory standards.
- Political instabilities, changes in currency convertibility or breach of contract by the government.

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The acceptance and success of crowdfunding, as a source of funding for the development of renewable energy projects, has led to the development of the European Commission's own platform: CrowdFundRES. This platform aims to promote the microfinance of renewable energy projects to increase their achievement and development, through the Horizon 2020 objectives.

Case studies

- Renewable Energy Bond (United Kingdom) [2]:
  - Installed capacity: 64 MW, including previous projects.
  - Technology: Wind, solar, biomass and hydro.
  - Amount raised: £10 million.
  - Investors: 947.
  - Interest rate p.a.: 5%.
  - Term period: 7 years.
- Saint-Varentais Wind Park (Thouars Metropole, France) [1]
  - Installed capacity: 24-36 MW pre-construction raise.
  - Technology: Wind.
  - Amount raised: €50,000, covering a small part of the investment cost of the project.
  - Investors: 36.
  - Interest rate p.a.: 5-7%.
  - Term period: 2 year.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: Regulatory framework for Crowdfunding is not yet implemented. • T: Lack of awareness of such BM and its feasibility.	
France		
Germany		
Greece	• R: There is a regulatory framework from 2016 limited to equity-based crowdfunding [2]. It is expected to be updated/replaced with the new 2019 EU regulations [3, 4]	

[2] Source: "A practical guide for Crowdfunding Platforms, Project Developers, Investors and Policy Makers". CrowdFundRES Project Consortium (European Commission).

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Italy	• No code of conducts in Italy available • Really implemented at a private level	
Spain	• No barriers, the Ley 5/2015, de 27 de abril, de fomento de la financiación empresarial regulates this mechanism.	

4.2.6 P2P

4.2.6.1 P2P (Energy trading)

Peer to peer (P2P) energy network trading as a new power system operation, allows people to generate their own energy and share the stored energy from renewable energy sources (RES) in homes, industries, office buildings or any property or land that they own.

The integration of the distributed energy resources (DERs), through the possibilities of renewable energy in residences, will make traditional energy consumers become prosumers, enabling them to both generate and consume energy by a cyber-grid electricity network.

Figure 1- P2P Electricity network.

The main barrier is that distributed generation is unpredictable and intermittent. When prosumers have an excess of energy production (mainly from PV installations), they can store it in energy storage devices, or they can also supply their energy to others that show energy deficit. This generates the type of trade known as Peer-to-Peer (P2P).

This is a community-based model, where the people who supply electricity to others act as producers and suppliers, reducing the number of intermediaries and simplifying the model, generating an internal trade. That situation is illustrated in the following diagram:

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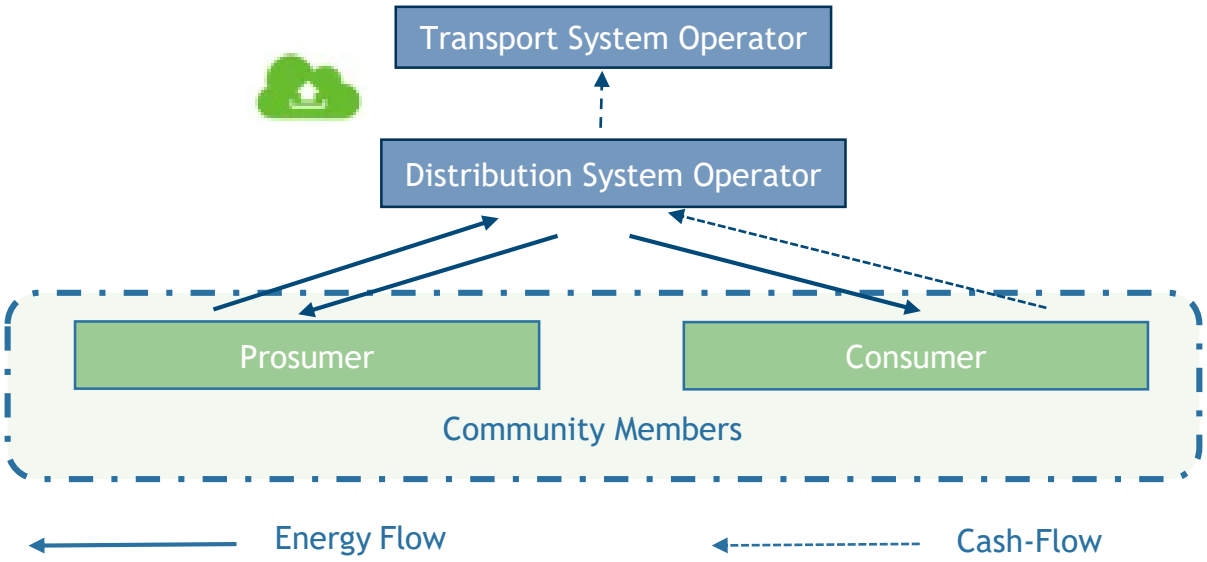

Figure 2 - Community-based model

To develop the business model for the electricity sector, it is necessary to design the communication and control networks for P2P energy trading, within or between local microgrids.

The following table describes the business models related to this technology:

Model	Value proposition	Revenue stream
Prosumers	• Sale of excess energy generated and stored in special devices. • Energy independence, self-consumption.	• Higher economic margin in addition to the energy sales price.
Consumers	• Avoiding the energy deficit of intermittent self-consumption.	• More competitive electricity price.
P2P Network	• Entrance and exit of members. • Distribution rules. • Billing process. • Bid-based as for P2P trading platforms.	• P2P trading platforms based on blockchain and crypto-currencies.

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With P2P systems, for a PV installation, for example, the cost associated with the electricity distribution is avoided. This cost is estimated at ~75 €/MWh[3] for an average household with a fixed-price electricity contract (200€/MWh) is eliminated. This amount will be distributed between the prosumer and the consumer as following:

- €52.5/MWh to the prosumer [75% of transport cost][3], which allows for an additional margin of € 24/MWh.
- €22.5/MWh [30% of transport cost] [3] for the consumer, which reduces the electricity bill by -11%.

Selling the excess of stored electricity to the members of the community, would increase the profit by +74% (76 euros/year with the P2P model) [3] to the prosumer.

It would also increase the internal rate of return (IRR) of the investment made by 1.8% with the Green Certificate system and 1.9% without it[3].

It is necessary to emphasize that there are certain barriers or risks such as:

1. Regulatory challenges:
   - Partnership with the traditional supplier (traditional electricity market).
   - Legal responsibilities of each person involved (prosumers, consumers, network platform).

   In relation to the regulatory framework on this technology, each country has its own state or local regulations where it determines relations and legal framework in the event of possible conflicts of interest between consumers and market agents.
2. Technical barriers:
   - Optimal electricity transfer networks.
3. Organizational challenges:
   - Network members (Registration and unsubscription of members).
   - Rules of electricity distribution.
   - Price of electricity.

<u>Case studies</u>

- Power Ledger in Busselton y Fremantle (Western Australia)[4]
  The Power Ledger system tracks and controls the generation and consumption of all trading members and settles energy transactions according to predetermined and agreed upon terms and conditions, in near real time.
  This is an integrated network, such as residential blocks of flats or housing estates, where residents can exchange their PV energy with each other in a semi-regulated environment, that interface with smart meters.
  The network platform enables interoperability between several market/price management mechanisms and electricity units (kWh) by pre-purchased tokens, called “Sparkz”, linked to the local fiat currency.
- AGL Solar Exchange in Victoria (Canada)[4]

[3] Source: Peer-to-peer (P2P) energy: A threat or an opportunity for traditional suppliers? Author: Sia Partners. Insight. P2P Energy. September 2018.
[4] Source: 100% Renewables Business consulting.

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This is a virtual marketplace that allows solar homes to market their excess stored solar energy through solar tokens, which can then be sold to other AGL customers who also reside in the city of Victoria.
A consumer could buy tokens at a lower price than buying energy from the Grid. In contrast, a solar-powered home could sell stored solar tokens at a higher price than the solar tariff.

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: Regulatory framework for P2P Energy trading is not yet implemented. • T: Lack of awareness of such BM and its feasibility.	
France	• Several pilot projects conducted in France based on blockchain technology.	
Germany	• T: Low utilization and slow implementation of smart meters which are required for effective P2P trading • T: Lack of P2P related harmonized information models widely introduced on the market (blockchain or alternative solutions with isolated availability) which results in low market interoperability • C: network fees, taxes etc. will still be charged when utilizing public grids • C: Many RES still under the renewable funding scheme which is more profitable, easy and reliable than P2P models (lack of market resources).	
Greece	• R: No regulatory framework exists • C/T: Smart meters are installed mostly in the MV consumers	
Italy	• In Italy, actually there is no particular system regulating P2P but only isolated cases without big DSO (such Enel). There are many virtual tests (Virtual Power Plant simulating the energy trading)	• This business model shall be fostered in the industrial districts, or in small energy communities (e.g. apartments) or at local level (islands).
Spain	• For the moment, the Spanish legal framework does not contemplate this technology	

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4.2.6.2 P2P (Crowdlending)

Peer to peer (P2P), also known as Crowdlending, is an alternative financing option that consists on the development of the investments where the participants procure economic resources, without intermediaries.

The funding, in this case, is through debt loans. The process is carried out through an online platform, in which people who contribute money (lenders or investors) receive a monetary compensation, that is, a previously agreed upon interest, and the intermediary crowdlending platform gets a commission.

This new finance instrument has arisen because of:

- Multiple barriers to access to bank financing today.
- Development of new technologies, especially on the Internet.
- Emergence of collaborative economy.

It is managed as follows:

1) The Project owner has to make the request of the loan indicating the loan principal and its maturity date. Also, it will also be necessary to detail the objective for which the monetary contribution will be destined, providing the documentation required by the platform.
2) Then, this information will be analysed and classified depending on the risk of the transaction.
3) Participants (crowdlenders) will decide how much money they want to contribute.
4) If the transaction achieves the objective amount, the borrower receives the loan for the amount requested and the obligation to pay a monthly interest loan agreed. if the amount requested is not reached, the loan will not be carried out and every lender gets its money back.

Certain business models can be developed through this financing instrument, as we can see in the following table:

Model	Value proposition	Revenue stream
Project owners	• Collect the amount of money needed to carry out the project • Avoiding detailed bank procedures and risk analysis.	• Possibility of obtaining 100% financing amount to make the investment. • Establishment of interest rates of return of the loan agreed with the crowdlender, being more flexible.
Crowdlenders (investors)	• Decision-making power on the amount to be invested.	• Return on investment by setting monthly interest rates to the owner.
P2P platform	• Project risk analysis and assessment.	• Revenues from the following fees:

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	• Responsible for ensuring the cyber security of the operation. • Responsible for carrying out legal procedures in case the owner does not gets the agreed return to the crowdlender.	○ Charged to the Project owner for receiving the loan- ○ Charged to the crowdlender for the management of the client portfolio.

There are the same or similar barriers or negative impacts of its operation as in the Crowdfunding alternative, because it is an option that has been developed based on it.

Case studies

- Upper Pitforthie Windgen proyect (Aberdeenshire, United Kingdom)[5]. Crowdlending required to allow rollover of investment:

  Construction stage:

  - Installed capacity: 500 kW.
  - Technology: Wind.
  - Amount raised: £ 2.175 million.
  - Investors: 408.
  - Interest rate p.a.: 12%.
  - Term period: 1 year.

  Project finance:

  - Amount raised: £ 2.3 million.
  - Investors: 605.
  - Interest rate p.a.: 7.3-8,5%.
  - Term period: 17 years.

- Viladamat Town Hall in Gerona (Spain) [6]

  The Viladamat City Council wanted to improve its energy efficiency with a solar PV installation for self-consumption.

  ECrowd! developed the crowdlending platform, setting the lowest contribution a resident could make at €50 and the maximum contribution at €500.

  The financing was quick, in a few days the project had already secured all the necessary capital, with contributions from 22 residents.

  The council will save up to 1000 euros per year and will reduce its CO_2 emissions by 2.5 tons per year.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

[5] Source: "A practical guide for Crowdfunding Platforms, Project Developers, Investors and Policy Makers". CrowdFundRES Project Consortium (European Commission).
[6] Source: Ecrowd! Invest, Plataforma de Financiación Participativa S.L.

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Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: Regulatory framework for P2P Crowdfunding is not yet implemented. • T: Lack of awareness of such BM and its feasibility.	
France		
Germany		
Greece	• R: No regulatory framework exists [5]	
Italy	• The lending-based crowdfunding activity is allowed only in compliance with the limits set forth by the Bank of Italy, focusing on incentivizing prosumers and RES	• Example in Italy: EnelTOcrowd
Spain	• C: Each participatory financing project through crowdlending is not subject to authorization or supervision by the National Securities Market Commission (CNMV) or by the Bank of Spain. The information provided by the platforms has not been reviewed by any of the regulatory entities. • C: Market barriers as the interest rates in Spain are very low, hence the banks are able to offer very competitive financial products.	

4.2.7 Renting

This is a long-term financial instrument. Renting is applied to energy projects in cases such as generation facilities or energy efficiency measures, such as switching from conventional lighting systems to LED technology, by means of rental contract for goods (equipment) and/or energy-related services.

The company that rents usually buys the property or the site where the installation will be located and makes it available to the developer on a rental basis.

The rental company maintains the property of the asset. Initially, the purchase option is not contemplated. It is necessary that the rental company fully understands the technology and relies on the technology provider. For this reason, agreements are usually signed between the technology provider and the rental company.

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This alternative allows the project developer to use an asset without having to pay for the entire investment. The developer pays an agreed fixed fee at the beginning of the financing.

Through this financing instrument and lease option, certain business models can be developed, as we can see in the following table:

Model	Value proposition	Revenue stream
Project leader (Tenant)	• It is not necessary to acquire the property to develop the project. • The option is available for both individuals and companies. • Renting improves the company's liquidity and allows it to benefit from the asset without having to get into debt.	• No specific regulation. Everything must be fixed by contract, in some cases tailor-made. • Renting operations are non-financial business operations, so it is not necessary to reflect them on the company's balance sheet.
Renting company (Lessor)	• The company usually buys the property and makes it available to the developer on a rental basis	• Maintenance of the active (retain the ownership of the good). • Income from rental fees.

Once the rental contract has expired, the project leader may choose to:

1) Buy the property.
2) Continue with the renting (novation of the contract).
3) Continue with renting (contract renewal) and include new services.
4) Ending the contract and returning the asset.

To enhance the Renting financing method, certain European countries allow tax deductions to generate greater attraction for both private clients and companies, because the renting fee is considered a recurring expense. Said tax deductions or privileges are reflected, for example, in the following taxes and tax contributions: Corporate Tax, Personal Income Tax and reduced VAT.
Not all countries incorporate these tax attraction measures. These are particular measures depending on the tax system of each European country.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: General regulation prescribed for renting applies. There is no tailored regulation which	• Need additional information on innovative

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	would provide for specific / beneficial requirements in energy field on islands.	elements of this business model, if any.
France		
Germany		
Greece		• Short term renting for conventional systems is used by the Greek DSO and Energy Authority in order to secure electrical energy supply in remote islands [6]
Italy	• In Italy this BM exists and is regulated but it doesn't find a wide application due to political and economic reasons, for example financing systems through third parties even if the PA should like them very much, they are not very familiar with the procedures and have many difficulties from a bureaucratic point of view.	
Spain	•	

4.2.8 Heating/cooling as a service

This strategy provides the integration of energy efficiency measures in heating and refrigeration systems. In this way, the objectives established in energy policies are promoted, preventing leakage energy efficiency of buildings, maximizing the efficiency and sustainability of heating and cooling systems.

Energy efficiency actions can be developed quickly thanks to technologies and without previous investments in new infrastructure.

Energy efficiency in heating and cooling provides benefits for both the economy and environmental sustainability, as well as for individual consumers in households, industry or buildings that can afford to invest or have access to the required financing.

This is developed through the automation and control of energy consumption in buildings through an electrical system that allows the reduction and changes in demand and thermal storage, depending on consumption.

Through energy efficiency changes, including, for example, the renovation of air conditioning, ventilation systems or heat recovery from cooling units, certain business models can be developed, included in the following table:

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Model	Value proposition	Revenue stream
Manufacturing enterprises	• New technical solutions. • Technical advice and energy efficiency. • New production possibilities through savings.	• Demand for fossil fuels will be reduced. • Economic and energy savings.
Residential buildings	• Potential consumers of heating and cooling. • Environment sustainability. • Responsible energy consumption.	• Significant savings through facility renovations. • Prevent heat or cold losses. • Economic and energy savings.
Service buildings (Offices)	• Technical advice and environmental awareness.	• Sustainable buildings, translated into rent increases.
Energy efficiency companies	• Encouraging investments in sustainable energy projects. • Customer awareness of economic and energy savings.	• Limited business competence. • Development of new projects in several markets and different sectors.
Financial institutions	• Ethical banking. • Interest on financing sustainable projects. • Promotion of environmental awareness.	• New financing portfolios. • Income and returns from monthly credit repayments, commissions and amortization costs.
Public institutions	• Sustainability commitments and environmental objectives. • Local, national and international policies, regulations and standards.	• Provide public grants and financial facilities.

The most efficient heating alternatives are:

- Aerothermal heat pumps.
- Solar thermal energy (solar water and air heaters).
- Biomass boilers.
- High-performance gas condensing boilers, low operating temperatures or floor heating installation.

Besides, the most optimal cooling alternatives from an energy efficiency perspective are:

- Gas heat pump in collective systems and electric heat pump in individual systems.

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- District heating, based on the use of a centralized location, like a cogeneration plant which burns fossil fuels, waste or biomass, or geothermal heating, heat pumps or central solar heating. Then, pipes are used to transport heat to residential and commercial users. The use of a big centralized boiler instead of a number of small boilers provide higher efficiencies and better pollution control, as long as the heat losses due to the longer distances to transport water are minimized with a good pipe insulation.

The adaptation of demand flows by controlling consumption according to the outside temperature, the orientation of the installation, the use and the energy tariffs, are keys to achieving better energy efficiency results.

Examples of energy saving are the following cases[7]:

- The replacement of the conventional boiler (energy performance around 70-80%), for more modern condensing (up to 105% of energy performance) or low operating temperature boilers (around 90-95% of energy performance), will achieve savings of up to 25-30%.
- Choosing to buy a class A+++ household appliance consumes 70% less than a conventional model.
- Thermostatic valve installation: 10% of energy savings.
- Air conditioning - Retrofit system: savings from end customers of 30-50% on the cost of electricity (depending on the system and how the maintenance was given at this time), in addition to the reduction in maintenance costs.
- Variable refrigerant flow (VRF) for HVAC systems. This system allows to vary the volume of refrigerant depending on the needs. They can be used to keep different temperatures depending on the zone of the building, even heating some zones and cooling others.
- Inverter technology in refrigeration compressors. Very related to variable refrigerant flow, inverters can be used to control the speed of the compressor motor of an air conditioning system, adapting it to the real needs for cooling. A conventional system uses a fixed-speed compressor, with only two options of capacities: 0% or 100%. This leads to inefficiencies, losses and breakdowns.

Currently, there are many aids and subsidies for the installation of Heating / cooling systems offered by the main state authorities whose subsidies come from their own funds or from specific programs promoted by the European institutions.

These grants are aimed at both individuals, neighborhood communities or companies from different sectors, particularly for the industrial sector due to their high consumption needs for production and factory activity.

Case studies:

[7] Source: "Eficiencia energética en edificios y climatización eficiente". El portal sectorial de las instalaciones.

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- District-heating in La Marina (Barcelona, Spain) [8]:

  The installation was carried out in 6 staircases and 68 homes. In this building, improvements were made to the insulation, air conditioning and hot water system of the "district heating" type.

- Integrated District Heating and Cooling in Greater Copenhagen (Denmark) [9]:
  The capital and 24 surrounding municipalities have developed a world-class DHC system that currently covers 98% of total demand through cogeneration and waste-to-energy.
- Integrated District Heating and Cooling in Greater Stockholm (Sweden):

  The District Heating (DH) system has a dominant market position throughout the country. It has an overall market share of the country of 57% and a market share of 93% for multi-family houses and apartments.

  The main current alternative to DH is individual heat pumps, because of low electricity prices.

  At the same time, District Cooling (DC) is growing in the country, at a growth rate of about 20 %, approximately.

  Many of the existing DH networks use free cooling from seawater and lakes, used mainly in office buildings, supermarkets and public centres.

Given the lack of information from the population about this type of technology, local and public authorities could inform citizens of the advantages of this type of system. In this way, greater awareness of its installation at a residential level would be created, the volume of estimated economic savings in invoices and the environmental importance of energy savings. Also, in relation to social responsibility would be transmitted in order to help mitigate the effects of climate change in the islands.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: General regulation should apply.	
France		
Germany		
Greece		• Subsidies (up to 70%) for upgrading energy

[8] Source: Fundación para la Eficiencia Energética y el Medioambiente de la Comunidad Valenciana.
[9] Source: “Efficient district heating and cooling systems in the EU”. European Commission.

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		efficiency in Greek houses is providing by the program "Eksikonomo kat Oikon" • Feasible interventions: ○ Replacement of heating system ○ Solar water heaters ○ HP installation ○ Shell insulation (outside and roof) ○ Window – Frame and glasses
Italy	• R: General regulation should apply.	
Spain	• C: Market barriers as the demand for energy efficiency technologies is still low.	

4.2.9 ESCO models

According to the Directive 2006/32/EC an Energy Service Company (ESCO) is *"a natural or legal person that delivers energy services and/or other efficiency improvement measures in a user's facility or premises and accepts some degree of financial risk in so doing. The payment for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and on the meeting of other agreed performance criteria"*

They can cover different activities such as energy audits, contracting, design, execution, monitoring and O&M and their participation on them depends on the coverage level of the contract. All these services can be independent of each other or be developed by the same ESCO. This is precisely one of the key advantages of this type of services, which allows the client to have a single interlocutor and outsource all required services in a single organization.

For islands, ESCO models are very convenient, clients from private or public sector that own plants, buildings or houses and that have low technical competences or economic resources are incentivized by the wide benefits that can be achieved. However, as it is still a relatively new model, there are some barriers that should be overcome, such as the lack of trust between customer and supplier and financial barriers.

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Model	Value proposition	Revenue streams
ESCO	• Encourage the development of energy efficiency projects. • Better image of the company. • Increase customer fidelity and its position on the market.	• Payments by the customer based on the service provided.
Customer	• Reduction of energy consumption. • Benefit from technical expertise. • Security of supply. • Lower financial risk (in some models the ESCO finance the project). • Contribution to sustainability	• Economic savings due to the reduction of energy consumption (reduction of energy bill).

For what concerns, the contracting methods, two main models exist, and they will be summarized in the following subparagraphs:

4.2.9.1 Energy Performance contracting models (EPC)

ESCO is remunerated on the basis of the energy savings that follow the implementation of the energy efficiency project. Indeed, for a pre-defined period of time, part of the saved money from the intervention is destined to the repayment of the ESCO, while the other part is the actual money saved by the customer. Once the shared savings period ends, the client retains the full amount of the savings.

Talking about financing, it must be said that the financial market usually does not support this type of companies due to the huge variety of possible interventions, which make the assessment of the risks related to projects difficult. The impossibility of drawing up project certification in a short space of time, i.e. the absence of standardised projects to facilitate risk assessment, means that bank financing of projects is one of the main obstacles to be overcome.

This is the reason why one of the most diffused financing models is constituted by the so-called Third-Party Financing (TPF), a contract where ESCOs or energy users obtain the financing from financial institutions on behalf of the final customers.
There are mainly two types of financial models:

- Shared savings: the ESCO fully finances the project and obtains a percentage of the savings for a certain time period, the value of the reward is linked to energy prices and the ESCO bears the risk of financing and performance. It can be used with clients who have no access to funding.

  In this business model, the ESCO requests for the financial agreement (i.e., a loan) to the financial institution, which funds the project due to the guaranteeing role of the player asking for it. The same would not be true if the client itself had requested for the loan.

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In this way, on the one hand, the customer is shielded from the financial risks coming from the uncertainty of the project in terms of energy saved. On the other hand, the cost of the financing is much lower than the one that it would have been agreed with the bank if the ESCO had not played the role of guarantee.

The clients have not to afford the total investment. Instead of this, they will repay it by partial or total transfer savings defined through the use of the average of pre-improvement expenses, aligned with the typical ESCOs' remuneration form.

The economic savings through the ESCO contract period are higher than the investment and allows that the ESCO recovers the investment with a profit. At the same time, the customer pays less for the energy than before the development of the project.

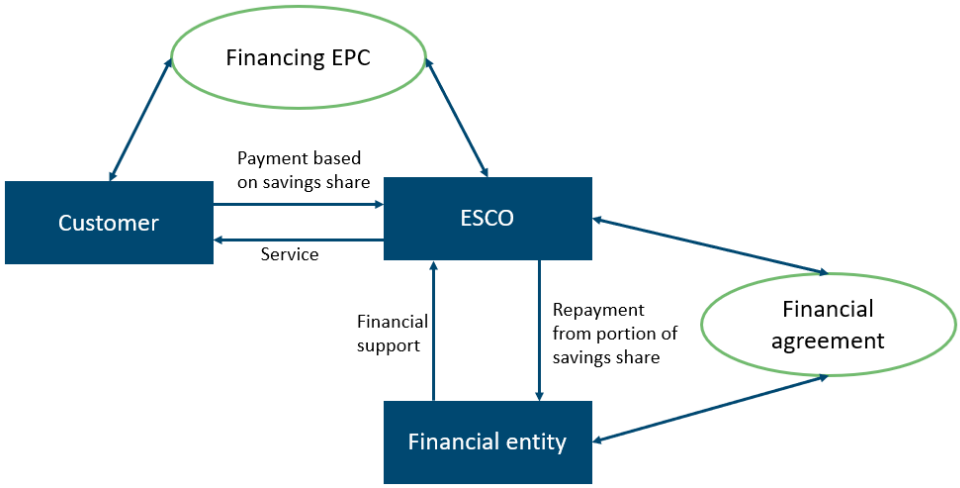

Figure 3 - Shared savings business model scheme

- Guaranteed savings: the customer finances the project. On the other hand, the customer and the ESCO sign a contract which includes some performance guarantees. Therefore, a minimum level of energy savings to meet the obligations towards debt service is guaranteed. The ESCO bears the risk of performance and the customer bears the credit risk. It requires a minimum level of customer's credit worthiness to ensure the repayment of the loan.

  In the second version of the TPF, request for funding comes from the user/client to a financial institution, supported by the guarantee of energy savings contract with the ESCO.

  As the picture below shows, it is possible that the customer, with the support of the ESCO's services and the warranty of energy savings assured by the signed contract with it, obtains a loan from the financial market (i.e., banks) especially if the project is promoted by highly qualified ESCOs. In this latter case the risk for the client is higher than in the previous one. However, it can be useful when customer can invest/borrow funds at lower cost.

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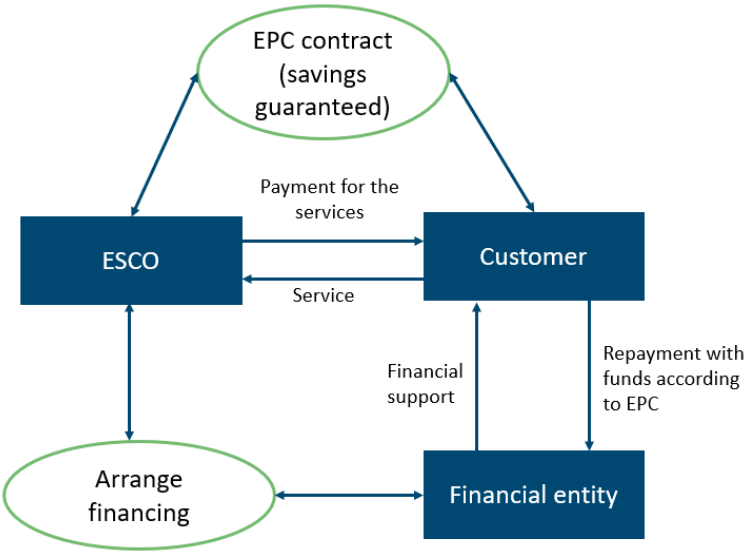

Figure 4 - Guaranteed savings business model scheme

Case studies:

- Impivaara swimming pool (Finland) [10]: the project, under an ESCO scheme, involves renovation of the building's automation system, renovation of the frequency converters for the fans and pumps and replace the recovery units of hot. The investment was of €21,000, done by SPARTRIM. It follows a shared service scheme, SPATRIM assumes the investment costs and receives a part of the annual savings for refinancing and it manages and control consumption. The duration of the contract is of 5 years and Impivaara benefits from the beginning of a part of annual savings. The annual energy savings amount to 1,400 MWh/year (19% of previous demand) and annual energy costs have been reduced by not less than 19%.
- Rosenbauer International AG in Austria[11]: the project is carried out in a factory of a multinational company and consists on the implementation of a heat recovery facility, renovation of hydraulic systems, installation of a cogeneration system and sealed of windows. The total investment costs amount to €365,000 assumed by the company with a contribution of €50,000 of the national government and €20,506 of the regional government in order to pay the loan of the project and it is signed a contract of 6.5 years with the ESCO, that must ensure a minimum amount of energy savings for this project. The annual energy savings amount to 1,463 MWh/year with annual savings of €53,500 per year.

[10] Source: "Guía sobre Empresas de Servicios Energéticos (ESE)" Fundación de la Energía de la Comunidad de Madrid
[11] Source: "Guía sobre Empresas de Servicios Energéticos (ESE)" Fundación de la Energía de la Comunidad de Madrid

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Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• C: Complexity of the tendering procedures. • C: Complexity of the concept. • C: Lack of support from the Government.	
France		
Germany		
Greece	• C: The willingness of the bidders (ESCOs) to assume even small risks in guaranteeing energy savings by signing the EPC • R: Complexity of the tendering procedure • C/T: The process of negotiation of how to perform the required monitoring and verification • T: The free access of the EPC provider in the premises of the public buildings at all times • T: The methodology of final evaluation of performance and the final payment date to the ESCO [3]. • C: Customer demand, • C: Subsidy/policy uncertainty, • C: Raising affordable financing, • C: High staff costs for EPC providers, • C: Lack of support from the government, • C: Complexity of the concept, • C: Lack of trust in the ESCO industry • C: Lack of standardized measurement and verification processes • C: Split incentives between landlords and tenants • C: Complex accounting and book-keeping rules • C: low energy prices • C: high costs of project development and procurement. • R: In the public sector there is currently great difficulty in implementing EPC projects mainly due to the complexity of the regulatory framework for Public Tenders, which is not particularly suited to consider both EPC and ESC contracting methods [7].	

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Italy	• In Italy it is very common and widespread in industry sector and quite applied also in the tertiary sector. • It depends on the investment capacity of the ESCO	• The residential sector may be the future sector where to launch and widespread this BM.
Spain	• C: This mechanism is very new and low spread among small projects. • T: Making the assessment of the risks related to innovative projects is difficult	

4.2.9.2 Energy Supply Contracting (ESC)

In this case, the ESCO supplies the customer with transformed energy (steam, hot water, cold, etc.) from a facility implemented by the ESCO. The aim is to reduce the final energy demand and the ESCO is remunerated for the useful energy output delivered in €/kWh. The ESCO, which finances the facility installation or refurbishment, usually maintains the ownership of the equipment and assumes the risk of the price of energy.

It is especially interesting for industrial, commercial and large residential buildings, in which the ESCO offers the opportunity to outsource technical and economic risks associated with energy supply and at the same time improving the environmental performance.

Suitable technologies for this type of contracts are efficient boilers, combined heat and power systems, district and small-scale heating networks and solar thermal and PV installations.

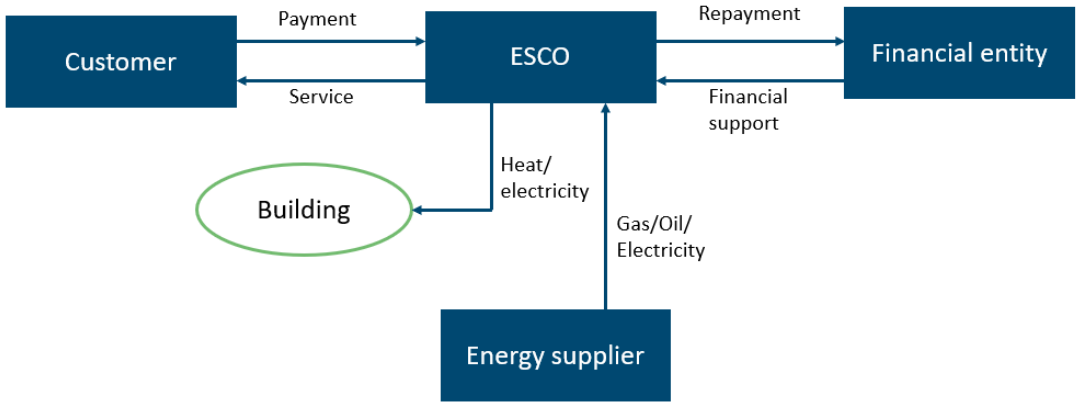

Figure 5 - ESC business model scheme

Some successful case studies in Europe are:

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- Enviroenergy (Nottingham City Council) 12, Enviroenergy is an ESCO owned by the city council responsible for distribution, metering and billing. ESCs are in place with several developers, in order to provide district heating coming from waste-to-energy. This ESCO provide energy services to 4,600 homes, 150 commercial customers and many public buildings thanks to 14.5 MW CHP systems. It generates around 180,000 MWh/a of high pressure steam and 20 GW of electricity and a total amount of carbon savings of 27,000 tCO_2/a
- In Madrid, the ESCO Calordom Enerpellet[13] provides district heating coming from biomass in 320 households of "Ciudad Pegaso" since 2009 with 2,000 kWt. The ESCO has designed the project, installed the system and financed it. Since the installation finished, Calordom will operate, maintain the facility and take care of supplying the biomass needed for at least 10 years. The results show that, with the administration grants, the cost of kWh produced by biomass is much lower than the one produced by other traditional fossil fuels.
- Housing Coperative "Bremer Höhe" [14] in Germany provides energy supply for 462 residential and 10 commercial units. The installation consists on a solar PV system of $47kW_p$ and 231 modules in a 341 m^2 area and a CHP system in the attic of $70kW_e$ and 160 kW_{th}. It has reached energy savings of 1,100 MWh/year and CO_2 savings of 450 t/year.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• C: Complexity of the tendering procedures. • C: Complexity of the concept. • C: Lack of support from the Government.	
France		
Germany		
Greece	• R/C: Raising affordable finance, Subsidy/policy uncertainty and lack of support from the government • R: In the public sector there is currently great difficulty in implementing EPC projects mainly due to the complexity of the regulatory framework for Public Tenders, which is not	• ESC Market in Greece remains extremely small [8]]

[12] Source: Enviroenergy
[13] Source: "Servicios Energéticos" Agencia Extremeña de la Energía
[14] Source:"Looking into different approaches for ESCO development. The example of Germany" Berliner Energieagentur GmbH

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	particularly suited to consider both EPC and ESC contracting methods [8]	
Italy	• Regulatory barriers related to the energy sales and provision	
Spain	• C: It is important to have a consistent technology and competitive ESCO. • T: Making the assessment of the risks related to innovative projects is difficult	

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4.3 Cluster 3: Technology-driven: innovative technologies

4.3.1 Energy Storage

Energy Storage is an effective tool to capture the energy produced at a certain time, to be released later when needed. It can be used to promote the penetration of renewable energy sources and to solve the intermittency problems on islands. Islands are isolated systems; this pose problems, such as power outages. Any incident can leave a big part of the population without electricity, especially on smaller islands. For this reason, having a reliable storage system can improve energy self-sufficiency.

The services of energy storage are mainly based on improving the stability of the grid (frequency and voltage control), guaranteeing electricity supply, providing generation support, adapting to demand forecasts, arbitrating prices and facilitating self-consumption.

There are four principal roles of an investor in this technology:

- Trading: the investor's role is to buy electricity and sell it to the consumers or to the market itself.
- Production: it takes into consideration generating and selling the electricity.
- T&D: it includes distribution and transport of the electricity
- Consumption: it involves the purchase and consumption of energy.

One investor can adopt one or several roles of the process.

The value proposition of energy storage satisfies mainly three needs on the global market:

- Ancillary services, such as frequency and voltage control, black start, guarantee the stability and flexibility of the system and the supply of energy
- Load shifting, providing supply or demand when needed, shaving consumption peaks and reducing the energy bill for end-consumers.
- Encourage the use of renewable energy sources.

Regarding the revenue streams, there are different ones:

- Incomes for the electricity sold, in which a player is rewarded depending on the price of the market.
- Cost avoidance, due to the savings generated thanks to lower infrastructure and operational costs, penalties avoided or reduction of electricity bills.
- Investment deferral, which is focused on the savings derived from the use of this technology instead of a more expensive production or grid capacity solution.

Several business models can be built combining the three components. In the case of islands, they are led principally by local residential consumers, organizations (small-medium enterprises, suppliers, local authorities) and network operators.

Some examples can be found on the following paragraphs:

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- Prosumers: they generate, consume and sell the excess of electricity to the market, principally by Feed-in-Tariffs or net metering schemes. They usually sign a contract with a company for the installation and operation and maintenance of the technology.
- Aggregators: they bring together local residential consumers and prosumers, taking care of increasing or reducing the electricity consumption according to the total energy demand. They usually aggregate the storage system through virtual power plants. PPAs and revenues are shared by the owners and the 3rd party.
- System operator owns the storage asset and captures network value only: the investment is made by the transmission or distribution network operator to provide network services only. The energy storage system is integrated in its regulated assets base, therefore, the costs can be recovered through regulated revenues. The transmission or distribution network operator usually keeps the whole control of the system, doing itself the dispatch in case of congestion or reliability events. However, in some cases, also a third party can operate the system.
- System operator owns the storage asset and captures both network and market values: the investment is made by the transmission or distribution network operator to provide network services first. In this case, the operator also captures unregulated revenues from market services. The distributor has then a partial control of the system, dispatch in case of congestion or reliability events. In unbundled markets, one or several third parties can take the market dispatch responsibilities.
- Municipal suppliers: different players purchase electricity in the wholesale market. They usually provide discounts to residents of the municipality.

Model	Value proposition	Consumers	Ownership
Prosumers	• Increasing self-consumption. • Providing backup power. • Exploiting the gap in buying and selling prices (reduction of energy bills).	• Domestic, private and public sector.	• Technology bought and owned by individual consumers.
Aggregators	• Frequency control. • Increase of self-consumption and reduction of energy bills. • Revenues shared between 3rd party and storage owner. • Meet forecast.	• Domestic, private and public sector. • National grid, network operators and generators.	• Consumer owns the technology. • 3rd party owns a contracted amount of the energy stored/sold. • PPA.

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	• Schedule of energy profile.		
System operator captures network value	• Stability of the system. • Network reliability. • Investment deferral. • Load shifting. • Generation capacity reserve. • Less subject to regulatory constraints. • Enhancing the use of RES.	• Domestic, private and public sector. • National grid, network operators.	• System operator.
System operator captures network and market values:	• Stability of the system. • Frequency and voltage control. • Load shifting. • Price arbitrage (higher revenues). • Generation capacity reserve. • Enhance the use of RES.	• Domestic, private and public sector. • network operators, national grid.	• System operator.
Municipal suppliers	• Frequency and voltage control. • Black-start energy. • Load shifting. • Demand side management. • Encourage the use of renewable energies. • Reduction of energy bills.	• Domestic, private and public sector. • National grid, network operators, generators.	• Local authority or council.

There are many types of storage systems, such as chemical, electrochemical, electrical mechanical and thermal storage. The focus will be put on two solutions that are considered to be the most suitable for islands: batteries, a more innovative technology that is expected to grow in the next few years and hydro-pumped storage, a more traditional and reliable technology widely use around the world.

4.3.1.1 Batteries

They are electrochemical systems which consist on one or more cells with external connections. The cells have three parts, an anode (the negative terminal), a cathode (the positive terminal) and electrolytes that allow ions to move between the electrodes and terminals, the current flows out of the battery to carry out its function. Nowadays, there

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are principally four batteries technologies used: lead, lithium, nickel and sodium batteries.

Batteries have a medium power capacity and discharge duration and short response time. Therefore, technologically, they fit almost all business models. They can be used to support consumption, to provide ancillary services or to reinforce power supply. However, they are still not very profitable due to their high costs.

Nevertheless, the continuous cost reduction in the past years (from about USD1,000 kWh in 2010 to less than USD200 kWh in 2018[15] and the aim of maximizing the diffusion of renewable energy sources have made batteries one of the technologies to be taken into account to manage the issues of intermittency of renewable energy sources. In addition, some countries have already invested in this type of technology:

- Western Power Distribution SoLa BRISTOL, in Bristol (England) [16], it was a 3 year project (2013-2016) led by a consortium of partners which received £2.8 million of funding from the Office for Gas and Electricity Market's (Ofgem) Low Carbon Network Fund for the development of the system. This was a relatively early and innovative project that involved 26 homes, 5 schools and an office block in Bristol and which aimed to explore the value of energy storage at the domestic, commercial and a Distribution Network Operator (DNO) level of the energy system. There were installed 4.8 kWh battery storage units in properties which were linked to the PV panels and customers benefit from "Smart Tariff" deal that allowed them to earn money by exporting the stored energy into the electricity grid reducing their peak energy demand.
- In Spain, the Project Endesa Store in the islands of La Gomera, La Palma and Gran Canaria[17] seek to demonstrate the technical and economic feasibility of large-scale storage systems in isolated networks. It is led by Endesa and with the participation of Telvent, Isotrol and Ingeteam (as industrial partners), and various research centers The "STORE" Project is the most important in Europe on energy storage in island environments, with a total investment of €11 million, with the support of the Center for Technological and Industrial Development (CDTI). In the case of the plant installed in Gran Canaria, in the municipality of La Aldea de San Nicolás, a electrochemical battery consisting on 1MW / 3 MWh Lithium-Ion batteries is used. Storage system is installed at the end of a line 20 kV. The main objectives pursued with this battery are: to carry out energy transfer between time periods (valley to ends) to improve generation efficiency; to allow for regulation of tension and response to gaps tensile; to collaborate in primary and secondary regulation before incidents occur; to reduce investments in distribution and generation in the face of specific growth of demand; and to favor the penetration of the sources of unmanageable generation. The results of the project development confirm that

[15] Source: "The emergence of cost effective battery storage" Nature Communications
[16] Source: "Non-traditional business models for city-scale energy storage: evidence from UK case studies" School of Business and Economics, University of Loughborough
[17] Source: Proyecto STORE, Endesa

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these technologies would allow to provide complementary generation services improving the quality, efficiency and safety of production.

- In Germany[18], the Government is subsidizing solar PV self-consumption together with battery storage so that the households can maximize the value of solar PV systems. They generate and consume their own electricity when needed and obtain the higher retail price instead of selling the energy produced at lower feed-in tariffs. Therefore, some companies, such as Sonnen and Lightblick are developing peer-to-peer networks where consumers can share their PV and storage capacity at lower prices than the feed-in tariff to provide ancillary services to the grid.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: Regulatory framework for Battery storage is not yet implemented.	
France		
Germany	• R: Regulatory framework for Battery ownership by system operators is not yet implemented. Even it will be implemented, the system operator will never be allowed to perform market actions with storage.	
Greece	• R: Battery will not be able to receive or send energy from the Grid. Will only receive energy from the local production and will only send energy to the local consumption. • T: Inverter has maximum power pf 30 kVA.	
Italy	• Bureaucratic barriers due to the fact that the batteries are allowed if they fulfil particular compliances (e.g. inverter on board), thus becoming less convenient to manage the storage as it is considered as a generation system and not a storage system (on the practical side it should be neutral instead of generation system which involves additional bureaucracy).	

[18] Source: "Business models in energy storage" Roland Berger Focus

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Spain	• From the technological point of view new batteries are ok, old batteries (pre lithium ones) shall be considered obsolete.	
	• R: Spain is still to transpose related Directives. No legal framework available. • T/C: forecasting of revenues from the commercialization of electricity (wholesale market) through storage is not enough to cover investments. Incentives should be evaluated.	• The National Strategy for Storage is under development. Currently, under public consultation phase.

4.3.1.2 Pumped hydro storage

Pumped-storage hydroelectricity is classified as mechanical storage. It is a system that usually consists in two reservoirs located at different heights, a unit for pumping water at high altitudes (to store electrical energy), and a turbine to generate electricity with the returning water at low elevation (conversion of potential energy during peak hours). All of this connected to the electric network. It is a technology with which a large volume of energy can be stored, during a long storage period, high efficiency and relatively low capital cost per unit of energy. A major trend in research of these systems has been focused on the energy storage in hybrid systems with wind power or other sources of intermittent renewable energy.

Pumped hydro storage offers a very large power capacity, very suitable in the case of isolated systems to guarantee the supply of electricity. However, it needs several minutes to come into operation and an appropriate landscape for the location of the technology.

Generally, the solution's value proposition is based on producing electricity when prices are low during baseload periods and sell it when the prices are high and its ability to inject energy on the grid at any time. In addition, as it is a mature technology, it is a very profitable solution, it is one of the technologies with lower cost/kW.

Nowadays, these large storage systems are playing a key role to ensure flexibility and stability, adapting to the intermittency of renewable energy sources. Some examples of pumped hydro storage business models can be found in:

- El Hierro Island (Canary Islands, Spain)[19], there is a hybrid hydro-wind power plant formed by a wind energy park of 11.5 MW and a hydro pumping plant of 10 MW. In this facility the excess of wind energy is used to pump water between the lower and higher deposit where it is storage and used when it is required. It has been developed to enhance the self-sufficiency of the island and achieve the goal of 100% of electricity coming from RES. It is a Public/Private Partnership, in which the budget for the design and construction of the plant amounted to €54.3 million, of which the largest part was provided by the Ministry of Industry, Tourism and Trade through the Institute for Diversification and Energy Saving (IDAE) and the rest of

[19] Source: "El Almacenamiento De Energía En La Distribución Eléctrica Del Futuro" Real Academia de Ingeniería, Endesa

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the financing by the promoter company Gorona del Viento El Hierro, S.A. As a result, the financing structure is composed by 10% of private finance, 35% of public finance and 55% grant

- In Madeira Island (Portugal)[20]: The Empresa de Elerctricidade da Madeira (the public electricity company of Madeira) along with two other regional bodies in charge of water management (IGA and DSH), both 100% owned by the region, carried out a project which involved the optimization of Socorridos hydro power station, transforming the plant into a reversible system to use its power capacity at any time of the year. The project investment was €34.7 million (€17.3 million EU contribution) and was finished 2007. It consisted on the construction of a Covão tunnel, a Socorridos storage reservoir, the renovation of the Encumeada and Canal do Norte tunnels and a pumping station at Socorridos. Thanks to this project energy production was ensured for the whole year, using water for irrigation and public supply and pumping it back in the reservoirs for electricity production.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• T: Lack of awareness of feasibility of such BM on islands.	
France	• Almost 100% of the hydroelectric potential in France is already exploited.	
Germany		
Greece	• R/C: Around 2GW of power are needed till 2025-2026 in storage. • R: Pump hydro systems are treated in the existing regulatory framework as generic hybrid energy systems. Additional this regulatory framework foreseen their installation in non-interconnected islands.	• Although installations in progress exists, the regulatory framework for pricing is lacking.
Italy	• No barriers (eventually there could be limits due to batteries)	
Spain	• Possible environmental barriers as these projects are mostly related to rivers/ponds.	• EC recognizes Spain as the MS with greater potential for such technology.

[20] Source: "Optimisation of the Socorridos Hydro power station Madeira" European Comission

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		14GW in projects at least announced.

4.3.2 Offshore wind energy systems

Offshore wind energy is considered to be one of the cleanest energies in the world. It comes from the force of the wind that is produced on the high seas, where it reaches higher speeds than on land, and where the wind resource is more abundant.

Its operation is based on a wind turbine that catches wind energy and transforms it to electricity using aerodynamic force coming from rotor blades. When the wind flows into the blade the air pressure decreases at one side of the blade and drag and lift forces are created. When the force of lift is higher than the drag, the rotor starts to move, it is connected to a generator that produces electricity using the aerodynamic force.

To make the most of offshore wind energy systems, mega-structures are installed. There are mainly two types of solutions depending on the type of foundation:

- Fixed structures: wind generation units whose platforms are seated on the seabed (maximum depth of 60m).
- Floating structures: wind energy generation units that are anchored (depths from 60 to 200 m)

This type of solution can be very appropriate for islands, due to its proximity to the sea and the greater potential and efficiency of the technology. Thanks to the absence of barriers, the wind can reach higher and more constant speeds.

Offshore wind energy systems are still a niche technology. There are several barriers that should be overcome to ensure the economic viability of the systems, such as the capital investment costs (around USD 4000 /kW[21]), O&M costs, the complexity of the installation, inadequate support mechanisms and the lack of a proper grid infrastructure off the coast. However, this technology has room for improvement, advances in technology, wind farm development, increasing developer experience, increasing industry maturity, etc. Therefore, some European countries have already bet for it, nowadays, there are 110 offshore wind farms in 12 European countries, accounting for a capacity of 22,072 MW in 2019[22].

For offshore wind energy plants, business models are mainly focused on the companies that produce electricity and owners of plants with great MW installed that are generated far from the consumption site. Usually, there are many actors involved in the development of these projects such as providers, shareholders, banks, government, etc.

Regarding the value proposition of offshore wind energy business models, it is based on the generation of a great amount of renewable energy that is supplied to the system and the development of opportunities for local value creation.

[21] Source: “Offshore innovation widens renewable energy options” IRENA
[22]Source: “Offshore wind in Europe key trends and statistics” Wind Europe

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In addition, in the idealization phase of the project when deciding on a specific location for the installation of offshore wind farms, it is necessary to consider the possible environmental challenges to be overcome or adapted in order to comply with the regulations and affect the marine environment and fauna (land and water) in the least possible way. Therefore, it is necessary to carry out a previous environmental study of the area to comply with the regulation framework.

The principal revenue stream comes from selling electricity to the grid (governed principally by PPAs or feed-in-tariffs). Also, revenues may come from the generation or sale of energy certificates for producing renewable energy or from tax benefits, depending on the country.

Build-own-operate-transfer (BOOT) Private-Public Partnership (PPP) business models are the most common for this type of technology. They usually include project companies or local owners who install and operate the technology for a determined period of time. The sale of electricity is usually done by PPAs or Feed-in-tariffs and the project company usually manages all the other contracts such as EPC (Engineering, Procurement and Construction) agreements, O&M agreements, etc. It can be owned by private investors that divide the net revenues and tax incentives or by local government or municipalities. Project companies should be able to recover the investment costs through the energy sold. However, if the required level of tariffs is not affordable, they may call for government support.

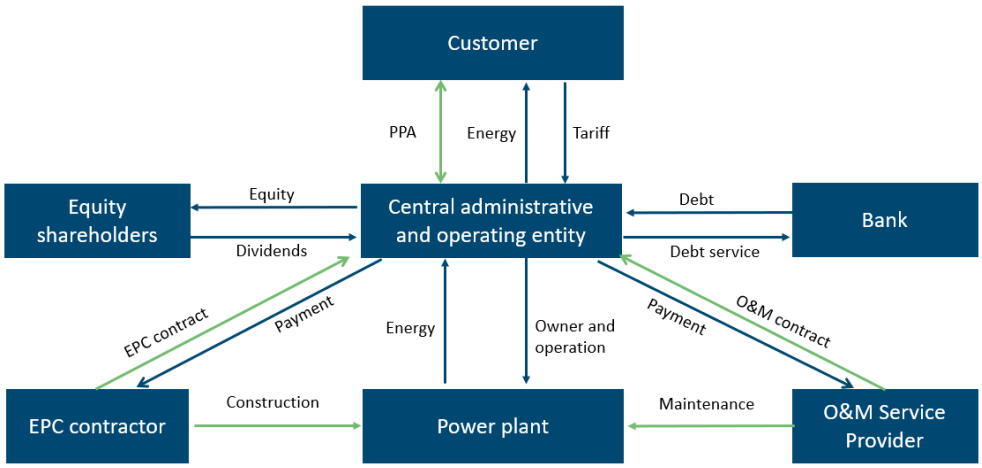

Figure 6 - BOOT/PPP business model scheme

Model	Value proposition	Consumers	Ownership
Private investors	• Penetration of renewable energy sources. • Tax incentives. • Sale of energy certificates.	• Domestic, private and public sector. • Network operators, national grid.	• Local or foreign investors own the project company.

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Municipal ownership	• Penetration of renewable energy sources. • Property tax exemption. • Energy self-sufficiency. • Local development.	• Utilities. • Municipal consumers. • National grid operators, network operators.	• Local government or municipality.

Case studies:

- BARD Offshore I[23], located in the German North Sea and developed by Bard Engineering GmbH. The project was finished in 2013 and consists of 80 turbines each one with a capacity of 5 MW, reaching in total 400 MW. It had a total cost of €2.9 billion, two banks, UniCredit and the European Investment Bank were the investors of this project and it is currently being operated by the company Ocean Breeze Energy GmbH & Co. In order to provide stable cash flows for the production of electricity, a PPA with the German government was sig, but the high investments and unplanned expenses generated lack of funds during the development of the project. However, from 2016 it has been running stably.
- Thanet Offshore Wind Farm[24], located in England, has a capacity 300 MW of power and it has been operating since 2010. It had a cost of £800 million and its financial structure follows a project financed scheme. The project company was owned by hedge fund Christofferson, Robb & Co and in 2008 Vattenfall, a Swedish energy company acquired TOW.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• T: BM not implemented in Croatia – lack of precedents makes it difficult to identify risks and promote with the local communities.	
France	• Very strong local opposition to such projects, leading to France lagging behind with regards to the implementation of offshore wind. Legal recourses can be done by individual citizens and can delay the projects by several years.	
Germany	• R/C: According to the renewable energy act, the remuneration for new offshore wind	

[23] "BARD Offshore I Wind Farm: A Case Study" Energy and the Environment- A Coastal Perspective
[24] Source: Thanet Offshore Wind Farm, Vattenfall

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	commissioned after 2020 will be only based on tendering procedures (no fixed incentives).	
Greece	• R: Regulatory framework does not exist. It's a governmental priority to develop a framework [9]	
Italy	• Barriers due the offshore wind plant impact	
Spain	• T/C: Only technical barriers caused by the Spanish geography, sea depth in Spain has diminished the deployment of this RES. But, technology advances, such as floating platforms, are overcoming this barrier. This technology may require further investment requirements if compared with fixed offshore systems.	• The National Roadmap for the Development of Marine Wind Energy is under elaboration. • Pioneering projects currently under deployment in Canary Islands.

4.3.3 Solar PV: Off-grid and distributed generation

Solar photovoltaics is a technology that uses solar radiation and converts it to electricity using semiconductors. When radiation hits one of the sides of a photoelectric cell a voltage difference is created between the faces of the solar panel and electrons move from one side to the other producing electricity. Solar PV systems have been developed from being a niche market technology to a mature technology and nowadays, they are one of the key technologies to promote the expansion of RES.

There are three categories of PV technology:

- First generation: it is the oldest and the most used technology nowadays. As it is a mature technology, it reaches high efficiencies and its performance is well known. Typically, the cells have one boron-doped p-type silicon substrate. Doping is meant to create extra holes in the silicon lattice. An anti-reflection coating of silicon nitride or titanium oxide is spread on the textured silicon surface to reduce reflection loss. A highly phosphorous doped n+ region is added on the front surface of boron-doped p-type substrates to form p-n junctions. Adding phosphorus enables to have more electrons available in the silicon lattice.
  There are two main categories:
  - Monocrystalline Silicon Cells: the cells are formed from single crystal of silicon with Czochralski process. During manufacture, Si crystals are sliced from large ingots. The main cost of the process is the purification and the efficiency of the solar cell ranges between 17-18%.
  - Polycrystalline Silicon Solar Cells: they are assembled with different crystals, coupled to one another in a single cell. They are created pouring silicon into

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a graphite mold. It is a less expensive method than the one explained before. However, the efficiency is lower, around 12-14%.

- Second generation: Thin-film solar modules are also known as second generation solar cells, because they are made of layers only a few micrometers thick. They are less expensive to manufacture as they require less semiconductor material. There are three types of thin-film solar cells on the market and all of them have a direct energy band gap, which are detailed below:
  - Amorphous Silicon Modules: This is manufactured at a low processing temperature and allows the use of various low-cost substrates, such as polymers or other flexible substrates. These modules present the disadvantage of suffering considerable degradation from solar exposure; achieving better stability if they are thinner layers; exposed to less absorption of light.
    Currently, the modules have a low efficiency level that ranges between 4 and 9%.
  - Cadmium Telluride (CdTe) Thin Film Solar Cell: This is a technology based on the use of cadmium telluride and presents the lowest costs compared to the rest of the conventional solar cells made of crystalline silicon.
    The efficiency of these modules is between 9 and 11%.
    But it can lead to serious environmental concerns, since cadmium is a heavy and highly toxic metal and its disposal on materials that can be extremely expensive and harmful to our environment and society.
  - Copper Indium Gallium Di-Selenide (CIGS) Solar Cells: This type of cell technology is manufactured by depositing a thin layer of copper, indium, gallium and selenide, along with the addition of glass or plastic, and with the installation of electrodes on the front and rear to collect the current.
    Their efficiency is relatively high (10-12%) and during their useful life they do not show excessive degradation.
- Third generation: these generation solar cells are still in a development stage. Some of them show great potential and have still a lot of room for improvement. In this category we can find technologies such as:
  - Nanocrystal solar cells (NCS): they are solar cells based on a flexible polymer substrate with a coating of nanocrystals, they show still little efficiency (7-9%) and some processes are costly, but they are relatively easy to construct.
  - Polymer solar cells (PSC): they are flexible solar cells with a polymer substrate. They have proven little efficiency (3-10%) and a short lifespan but they are relatively easy to install and cheap.
  - Dye-Sensitized Solar Cell (DSSC) based solar cells: they generally employ dye molecules between the different electrodes. Efficiency is around 10% and can be employed to generate electricity in several light conditions. However, they present some stability problems.
  - Concentrated Solar Cells: they use conventional silicon solar cells to produce direct current electricity and focus sunlight using lenses and curved mirrors.

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They can reach high efficiency (40%). Nevertheless, high-capacity heat sinks are required to evacuate the heat.

- Perovskite Based Solar Cell: it is a new technology based on ABX3 crystal structure of the absorber materials. X represents a halogen such as I−, Br−, Cl−; and A and B are cations of different size. They can reach efficiencies of 31%. However, they are not very stable and have a short time duration

There are several applications of this technology. In the case of islands, which have none or few network connections with the mainland and where big installations could be difficult or costly to install, innovative solutions such as off-grid and distributed generation systems should be considered.

- Off-grid systems are solutions that are not connected to the grid. In this case, the PV technology will be the generation system and they usually include also a system for energy storage.
- Distributed generation systems: they refer to small scale grid-connected PV technology in which produce electricity close to the end-user. They usually include the PV technology, a storage system and an energy management system.

Regarding the value that this technology could bring to the market, it should be highlighted:

- Lower electricity costs, interdependence from 3rd parties and government subsidies for the installation of the technology.
- Higher power reliability and security and increase correlation of production with load.
- Environmental protection.
- Development of the concept of prosumer.

The revenue streams are based on the electricity sold, the reduction of costs and investment deferral. The biggest barriers of PV generation are the high investment costs, the long payback periods and the lack of policies supporting the development of PV technology.

Some examples of business models that can be found in Europe are the following:

- Public/Private arrangements for distributed generation systems: a private company is in charge of installing PV systems close to consumption sites and the government pays subsidies to support its installation. A contract is signed for building and service the technology in public facilities with the obligation to rise a minimum number of sales to households.
- Aggregators: The key role of an aggregator for distributed PV generation system is to carry out several actions to reduce the prices that consumers pay. For instance, aggregators can be consumers not only consume electricity at the planned hours but also own and maintain the distributed generation system.
- Mini-grid community-based models for off-grid solutions: the community members own the system and manage production and consumption. They usually receive assistance due to the lack of technical and managerial expertise to operate the system.

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- Mini-grid private operator model for off-grid solutions: a private company owns, manages and operates the system. The funding comes from private equity and commercial loans, as well as, public subsidies.
- Mini-grid utility operator model for off-grid solutions: the government or the national utility operates and manages the system. It is easier to implement due to the less constraints in the regulatory field, because it is based on regulations applied to the national grid.

Model	Value proposition	Consumers	Ownership
Public/Private arrangements	• Power reliability and flexibility. • Correlation of production with load. • Lower risk. • Subsidies. • Local development.	• Domestic/public sector. • Grid operators and generators.	• Private/public company.
Aggregators	• Demand shifting. • Load shifting (reduction of energy bill). • Energy profile scheduling.	• Industrial and commercial sector. • Grid operators and generators.	• Consumers are the owners of the technology.
Mini-grid community models	• Increase self-sufficiency. • Load shifting (reduction of energy bill). • Subsidies.	• Residential, commercial and industrial sector.	• Community.
Mini-grid private operator model	• Increase self-sufficiency. • Load shifting (reduction of energy bill). • Subsidies. • Lower risks (technical and managerial expertise).	• Residential, commercial and industrial sector.	• Private company.
Mini-grid utility operator model	• Increase self-sufficiency. • Load shifting (reduction of energy bill). • Less regulatory constraints.	• Residential, commercial and industrial sector.	• Government/ utility grid.

In addition, some projects that are being developed in Europe are:

- Domus Energethica building (F.lli Bertani S.p.A)[25] in Italy: this building, located in the north of Italy and inaugurated in 2016 is formed by 40 apartments and several

[25] Source: "PV Financing Best Practice: Domus Energethica Multi Family Home (Italy)" PVFinancing

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commercial shops in the ground floor and it has installed 80 kWp of PV in the rooftop in order to supply electricity to the building. The PV system cost €100 000 and it was financed together with the financing of the construction of the building, without any public support or other form of incentive. The ownership remains to be the building company and uses an ESCO to sell electricity to the residents.

- Bali Paradise Hotel in Crete Island[26]: this hotel has from 2012 a total installed power of 80 kWp of solar PV in the rooftop of the facility with a cost of €203,500. For instance, the project's main aim was to improve the environmental characteristics of the hotel, providing electricity for its usage in the hotel and inject the excess to the public grid. It is paid by the Public Power Corporation a fixed amount per kWh for the injection of electricity
- In Europe, the EMPOWER project (within H2020 program)[27] introduces the figure of the technical and commercial aggregator, creating a local electricity market or micro-market in which prosumers can participate with their energy resources to obtain economic benefits. Each prosumer offers the capabilities and price of its resources to the micro-market. Once the offers of all participants are obtained, the aggregator, called SESP in the project (Smart Energy Service Provider), determines the best offers and sends control signals necessary to the participants. In addition, the SESP has an agreement with the DSO to support the operation of the network through micro-market participants in exchange for an economic remuneration. In this way, a prosumer with a battery can take part in the micro-market established by the aggregator obtaining economic benefits.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• R: Off-grid facilities are not recognized under Croatian law.	
France		
Germany	• R/C: According to the renewable energy act, the remuneration for new PV below 750 kWp will terminate after the cap of 52 GW total installed capacity in Germany will be reached (expected in 2020). The remuneration for new PV above 750 kWp will be only based on tendering procedures (no fixed incentives).	

[26] Source:"PVTRIN: Training Of Photovoltaic Installers" PVTRIN
[27] EMPOWER Project, European Comission

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Greece	• R: Large scale off-grid systems need energy production licenses. In any case they have to be complied with the security and safety standards	
Italy	• Regarding solar PV the Italian legislation is evolving and there is good possibility of business opportunities	
Spain	• R: Taxes and fees considered for installations over 100 KW of installed capacity. • T: it is a new technology without guaranteed profitability.	

4.3.4 Solar thermal energy: solar thermal collectors

Solar thermal collectors use energy coming from the sun and convert it into heat. They can be active systems, if they use external sources of energy to work (electrical pumps or valves) or passive if they use directly the sun radiation and the heat absorbed causes the hot water to rise.

The main parts of the solar water collector are:

- Solar collector, which gathers solar radiation to transform it into heat.
- Primary circuit: A closed circuit which conveys heat from the collector to the accumulator, using a liquid (water or other fluid). When the liquid is cooled, it is returned to the collector to be reheated.
- Heat exchanger: It is a serpentine which allows for exchanging heat from the hot liquid to the sanitary water, which is colder than the hot liquid in the serpentine.
- Accumulator: Deposit where the sanitary hot water is stored. Cold water enters the lower part of the accumulator and its temperature is risen when it contacts the heat exchanger. As water gets hot, its density is reduced and goes to the upper part of the accumulator.
- Secondary circuit: This circuit conveys the hot water to its final use, and the cold water from the supply to the accumulator.

Solar water heaters can be classified taking into account the solar collector, or the type of system used.

Based on the solar collector, there are 4 main different types of collectors:

- Flat plate collectors (FPC): These collectors have a dark flat absorber, which is heated when sunlight impacts it. The absorber has a transparent cover to reduce losses, and a liquid (water, glycol or a mixture) which can covey heat and runs through the box. There are metal tubes inside which transport the water, which is

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heated by the hot liquid which circulates through the box. FPCs are among the cheapest solar water heaters, being appropriate for warmer climates.

- Evacuated tube collectors (ETC): This system has parallel rows of glass tubes. Each glass tube contains a heat glass pipe or another type of absorber, surrounded by a vacuum. The hot water which will be used is circulated through the inner pipes. These solar water heaters are far more efficient, since the vacuum greatly reduces convection and conduction heat losses.
- Water unglazed collectors: These collectors are mainly used for swimming pools. They contain black tubes made of rubber or plastic, through which the water passes. Black tubes are heated by the sunlight, and the heat is passed to water. They are called “unglazed” since they have not a glass cover as flat plate or evacuated tube collectors. They are useful to heat large volumes of water, but the increase of temperature is reduced.
- Integral collector storage (ICS): These solar water heaters are quite recent and use both a collector and an accumulator to absorb solar water. The disadvantage of this system is that the accumulator is more likely to lose heat in non-sun hours. This system is cheaper and is a good choice when hot water is used in evening hours.

Other classification considers the pumping system for the water:

- Thermosyphon or passive systems do not have a pump in the primary circuit to transport heat from the collector to the accumulator. They use natural convection: cooler water from the bottom of the accumulator is naturally returned to the solar collector, due to its higher density.
- Pumped or active systems have a pump in the primary circuit, which is used to circulate hot water from the collector to the storage tank.

This technology can be very suitable for islands because it requires very low maintenance and can easily replace traditional fuels, increasing the self-sufficiency of the location. The main use of solar thermal applications is for (domestic) hot water, with the vast majority being installed in small homes. However, the share of solar thermal collectors to supply hot water to larger residential and non-residential buildings is increasing.

With regard to the value proposition offered by this technology, it is based on reduction of fossil fuels consumption, peak shaving (avoid capacity limits), easiness of integration into the existing systems and increase of self-sufficiency.

Revenue streams come mainly from the heat sold, cost savings compared to other technologies and government incentives. However, even if operation and maintenance costs are cheaper, the installation of the system is relatively expensive and in some countries there is a lack of expertise in this area.

Some business models that are used for this technology are summarized below:

- “Wholly public” business model, a local authority is the owner of the technology, having complete control of the facility, providing the investment support and determining the tariffs. The local authority can have a contract with a private company for the design and installation, and sometimes operation, of the system

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- Public-private partnership (PPP) for heat supply, a private sector company provides the needed investment, and has the responsibility of building and operating the facility and pays for the services for a certain period of time. The private operator undertakes the production of energy and its transfer to end users and, usually, the customer pays the same price for heat as before the investment. Therefore, the risk and responsibility of the public sector is decreased.
- Prosumers: the consumers generate and consume the heat produced. They usually sign a contract with a company for the installation of the system in the households and for maintenance.

Model	Value proposition	Consumers	Ownership
Wholly public	• Reduction of fuel consumption. • Energy efficiency. • Reduced energy costs. • Encourage use of RES.	• Residential or industrial sector. • Network operators, national grid.	• Municipality.
Public/Private Partnership	• Lower risk. • Energy efficiency. • Reduced energy costs. • Government subsidies. • Enhance the use of RES.	• Residential, commercial, industrial sector. • Network operators, national grid.	• Public/private company.
Prosumers	• Increase self-consumption. • Encourage the use of renewable energies. • Reduction of energy bills. • Energy efficiency.	• Domestic sector.	• Technology bought and owned by individual consumers.

Case studies:

- Vallda Heberg[28], in Sweden, it is a residential area built between 2011-2016 that includes 26 single family dwellings. It was constructed by a municipal housing company called EKSTA Bostads AB and had a total project cost of €38 million. The project was funded with 20% of investment cost for the installation of solar collectors, as well as some financial support from Swedish organizations. The installation consists of a small network in which the buildings were equipped with a heat recovery system and a heat generation and distribution system for

[28] Source: "Vallda Heberg: a Swedish certified passive house residential area", European Commission

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space heating and domestic heat water, with two sizes of solar collector systems, 38 and 142 m^2. The installation consists of a small network with the goal to achieve a 40% of the annual energy use coming from solar thermal collectors for domestic hot water and space heating, whilst the remaining 60% (mainly during the cold season) is expected to be supplied by a central wood pellet boiler.

- ESCO Solarcomplex AG[29] in the south of Germany: its aim is to transform the area of the Constance Lake into a renewable energy location. Therefore, in 2012, in the village of Büsingen, they have built district heating nets with a mix of biomass and solar heaters. The investment costs amounted for €3.5 million for the installation of 1000 m^2 of solar thermal collectors and they received support from the Federal Ministry for the Environment Nature Conservation and Nuclear Safety through supports for the renewable energy heat market. The consumers (mostly in the residential sector) did not pay the connection fee and many building owners connected their heating system to the DH system. Solar thermal energy will be used to cover heat demand during summer.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• T: BM not widely implemented in Croatia – risks yet to be identified.	
France		
Germany		
Greece	• R: The installation has to comply with the domestic rules of the urban planning authority of each area	
Italy	• Consolidate BM, no particular barriers	
Spain		

4.3.5 Plasma gasification

This technology uses a combination of electricity and high temperatures to turn waste into usable by-products without combustion. Although the technology is sometimes

[29] Source: "Guidelines on improved business models and financing schemes of small renewable heating and cooling grid" CoolHeating.eu

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confused with incinerating or burning trash, plasma gasification does not combust the waste as incinerators do. Instead, it converts the organic waste into a gas that still contains all its chemical and heat energy and transforms the inorganic waste into an inert vitrified glass called slag.

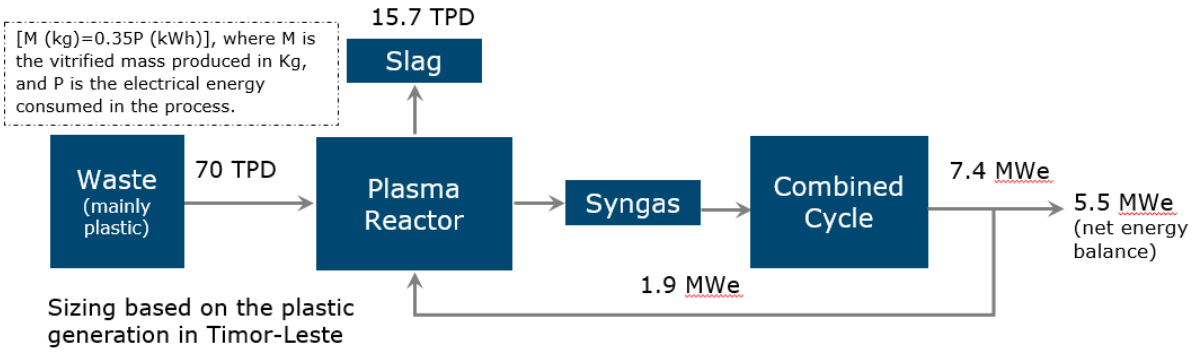

Figure 7 - Plasma gasification facility scheme

The products obtained can be very useful for further applications. In the case of syngas, it can be used by a combined cycle to produce electricity and the vitrified slag can be suitable for metal recovery, or to be included in concrete formulations and which can be used in construction

It is a very sustainable and a very efficient way to obtain electricity (816 kWh[30] of electricity production per ton of waste). Taking into consideration the great problem of plastic waste in oceans and waterways that damages the water quality, oceanic habitants and marine life. It can be highlighted that this technology does not emit GHG, furans, dioxins or other polluted gases.

This solution could be suitable for waste-to-energy companies working in government waste management programs or waste-to-energy companies partnering local manufacturers, R&D experts and NGOs through the development and implementation of their products. The activities related to this type of companies are mainly related to the collection and processing of waste and sale of products.

With regard to the value proposition, it is mainly focused on offering the communities a socially, economically and environmentally sustainable waste management services, promoting local and regional development, as well as the development of ancillary services such as equipment and services.

The revenue streams come from the waste management fees and electricity and vitrified material sold in the market. Profitability depends on the costs and availability of the raw material, in this case solid waste is highly available and this technology is much more efficient than other traditional Waste-to-Energy technologies. However, it requires a high

[30] "Municipal Solid Waste to Energy Conversion Processes", Gary C.Young

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initial investment, around US$80 million (for a 7.4 MW plant) and operation and maintenance costs.

Waste treatment through gasification is slowly taking over other traditional waste management systems. However, there are still very few expert companies in plasma, there is a lack of professionals with knowledge and experience in this technology. The Japanese company, Hitachi Metals, is the worldwide leader in the implementation of plasma gasification technology, being the owner of the commercial facilities of this technology operating in Japan. Nowadays, there are three facilities operative:

- Mihama-Mikata, Japan (Hitachi Metals Ltd.)[31]: It has been in operation since 2002, has a capacity of 24 tonnes per day and uses waste coming from municipal solid waste and water sludge. It is owned and operated by Hitachi Metals. The syngas output (around 1.9 MWth per day) is used to produce heat, and then, it is used to dry the sewage sludge so it can be gasified. No electricity is produced as the syngas is only applied for thermal use. The resulting heat is used to dry sewage prior to gasification.
- Utashinai, Hokkaido Island, Japan (Eco-Valley)[32]: It has been in operation since 2003, uses as feedstock Municipal Solid Waste (MSW) and Automobile Shredder Residue (ASR) and has a capacity of 220 tons per day of MSW or up to 165 tons per day of a 50/50 mixture of MSW and ASR. It is jointly owned by Hitachi Metals, Hitachi Limited, Hokkaido Prefecture, and the City of Utashinai. The plant produces electricity via steam (Rankine) cycle, employing a used steam turbine generator. When operating at capacity, the facility exported 1.5 MW of electricity to the grid. The technology used at Eco-Valley was a result of a successful collaboration between Westinghouse Plasma Corp. and Hitachi Metals. The lessons learned at Eco-Valley have been incorporated into Alter NRG's (the leader marketing company of plasma gasification technology) next generation gasifiers design.
- Pune, Maharashtra, India (Maharashtra Enviro Power Limited)[33]: it has been in operation since 2009, has a capacity of 72 ton per day and the feedstock is hazardous waste. It is owned by SMSIL, partner of Alter NGR and together the companies offer plasma gasification into the Indian market. It is the largest plasma gasification energy recovery from hazardous waste facility in the world. The facility uses Westinghouse Plasma Corporation's (WPC) technology and reactor vessel design and the produced gas is, directly, combusted in a steam boiler feeding a stream turbine that produces electricity (1.6 MW), which is exported to the grid.

The following potential barriers and additional specific issues have been identified based on national showcase assessments:

[31] Source: Mihama-Mikata Waste Gasification Plant, Global Syngas Technologies Council
[32] Source: "Plasma Gasification: Lessons Learned At Ecovalley Wte Facility", North American Waste to Energy Conferences
[33] Source: Pune, Maharashtra, hazardous waste plant, Maharashtra Enviro Power Limited

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Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• T: BM not widely implemented in Croatia – risks yet to be identified. • T: Lack of awareness of such BM and its feasibility on islands.	
France	• Research and demonstration projects are being conducted. The sector is not mature yet. http://www.alec-saint-brieuc.org/wp-content/uploads/2017/05/07-Presentation-Pyrogaz%C3%A9ification-Club-Pyro.pdf	
Germany		
Greece	• R: No combined regulatory framework exists for waste treatment and energy production. Installation and Operation has to be harmonized with the waste management framework and local regulations and CHP (production and distribution) frameworks.	• A license has been acquired for installation in Rhodes.
Italy	• The only potential barrier may be on the right identification, from a regulatory point of view, of the primary and secondary waste to reused	
Spain	• R/T: Separation of organic fraction is still insignificantly implemented in Spain. • T/C: Other RES are mor attractive given the climate conditions of Spain.	

4.3.6 Power-to-X

Power-to-X energy storage is an innovative system that allows to use the excess of energy of a production system and reconvert it into power, increasing the flexibility of the energy grid. It is very useful in the case of renewable energy systems, boasting a high volatility, thanks to this technology energy can be stored for long periods of time to be used when it is necessary. Additionally, it avoids curtailment of generation surplus, reducing the use of fossil fuel energies and contributing to decarbonization.

Power-to-X could enhance the installation of renewable energy plants in islands, which are areas with high wind and solar potential in which this energy excess can be used for

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multiple applications such as transport, hospitals, hotels, airports, heat generation, industrial feedstock, power generation, etc.

There are three main solutions that are used nowadays:

- Power-to-gas: in this process, renewable energy can be transformed to hydrogen or methane. An electrolyser splits water into oxygen and hydrogen using electricity, then through a methanation reaction the hydrogen can react with CO_2 and produce methane. Hydrogen can be used in transport and different buildings and methane can be used as an alternative to natural gas in transport or for power production. Also, it can be stored and transported using the existing natural gas infrastructure.
- Power-to-liquid fuels: in this case the hydrogen obtained from electrolysis can be reacted with CO_2 to replace traditional fossil fuels in transport and to produce chemicals for the industrial sector.
- Power-to-heat: the process involves using the electricity coming from RES to be used as heat, transforming electricity using pumps or large boilers. The heat generated can be transferred to buildings and it can be applied in centralized systems, where the heat is transmitted to several buildings through network pipes and decentralized systems, where the heat is used for individual buildings.

The principal actions of this technology involve energy capture (power conversion to X), energy storage, energy transport and energy valorization. Therefore, many stakeholders are usually involved.

Regarding the business models the value proposition of this technology satisfies several needs of the market:

- Balance of power markets converting hydrogen to electricity when renewable energy is not available.
- Stabilizing the grid, controlling the frequency and voltage.
- Enhancing the use of RES, avoiding grid congestion by converting the surplus of energy into heat or hydrogen to be stored and used later in transport or in buildings.
- Avoiding curtailment of renewable energy generation in order to provide flexibility and reliability to the system.
- Load shifting and peak shaving.

With respect to revenue streams they are mainly based on:

- Revenues coming from the sale of the products obtained.
- Costs reduction.
- Deferred investments, in back-up power plants, grid congestion, etc.

However, in the case of power-to-gas and power-to-fuel upfront capital costs (electrolysers, transport infrastructure and storage), and the high tariffs for electricity, make hydrogen expensive to be produced. Nowadays, it costs around €2.4-6.7 per kg[34], depending on the location and operational parameters. Therefore, a potential cost reduction would be desired in order to ensure the economic viability of this solution.

[34] Source: “Renewable Power to Hydrogen” IRENA

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Power-to-gas and to other liquids are still in an early stage, costs are still too high. Therefore, suitable business models are still being developed, in the case of power-to-heat, especially for residential end consumers, some business models have shown their viability: Aggregators, that use demand management systems to extract the information of the distribution network and create services that serve both customers and the grid providing more flexibility to the system; Energy-as-a-Service (EaaS) models, in which the service provider makes the capital investment and offers several services, such as frequency and voltage control, rather than only supplying electricity to consumers and Community Ownership models that enable the share of ownership and management of the technology.

Model	Value proposition	Consumers	Ownership
Aggregators	• Increasing grid flexibility. • Ancillary services (frequency/voltage control). • Replacing fossil-fuel based technologies. • Meeting buying and selling forecast. • Scheduling of energy profile. • Reduction of energy bills. • Reduction of installation and O&M costs.	• Residential, commercial and industrial sector. • National grid, network operators.	• 3rd party owns the system.
Energy-as-a-service	• Demand side management. • Load shifting. • Voltage control. • Reduction of renewable energy curtailment. • Reduction of energy bill. • Cost avoidance. • Peak shaving.	• Residential sector, commercial and industrial sector. • National grid, network operators.	• Service provider owns the system and charges the customer.
Community ownership models	• Shared costs. • Lower investment costs, lower risk. • Self-sufficiency. • Avoid curtailment.	• Residential sector.	• Shared ownership between the community.

Case studies:

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- In some Spanish islands [35], demonstration projects using power-to-hydrogen technology are being carried out to fuel public bus fleet. Due to the great availability of PV resources together with grant of buses this technology can be a viable solution.
- In Utsira, Norway[36], the first full-scale wind-hydrogen plant was built. In this pilot project with a cost frame of €3.7 million, 10 households are fully supplied of electricity by wind energy and when the wind production excess the electricity needs, it is used to produce hydrogen in an electrolyser and stored in a fuel cell. In this way, it ensures the electricity supply even when there is no wind production. It is owned by Statoil ASA and operated in collaboration with German wind turbine manufacturer Enercon. Two wind turbines were installed, with a capacity of 600 kW each, a flywheel with a 5kWh capacity to stabilize the intermittent renewable energy, a 100 kVA synchronous machine and a 10 Nm^3/h hydrogen electrolyser and a 2400 Nm^3 hydrogen pressure vessel. The success of the Utsira project was to demonstrate the feasibility of combining renewable energy and hydrogen in remote locations.
- Heat Smart Orkney project, in Scotland[37], a project to mitigate curtailment in commercial scale wind turbines to convert unused renewable energy into heat has been launched by Heat Smart Orkney Ltd. It is being implemented as part of the Heat Smart Orkney project, which secured funding of £1.3 million through the Scottish Government's Local Energy Challenge fund. The household heating devices will be connected to the Internet and will get switched on when the wind turbine receives a curtailment signal.
- Power-to-heat expansion in Denmark[38]: in 2015 the city of Aarhus, Denmark, expanded the capacity of an existing CHP plant by adding an 80 MW electric boiler and a 2 MW electric heat pump to provide district heating services to the neighborhood, the plan is to expand the heat pump's capacity to up to 14 MW after assessing the performance of the existing heat pump. The electric boiler and the heat pump are designed to use the excess wind generation in western Denmark, especially during winter when wind resource and heat demand are greater. The whole system required USD22 million of investment.

[35] Source: "Renewable Power-To-Hydrogen" IRENA
[36] Source: "Utsira Wind Power and Hydrogen Plant" International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE)
[37] Source: "Renewable Power-To-Hydrogen" IRENA
[38] Source: "Innovation Landscape For A Renewable-Powered Future" IRENA

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The following potential barriers and additional specific issues have been identified based on national showcase assessments:

Member State	Technical/Commercial/Regulatory Barriers	Further specific issues
Croatia	• T: BM not widely implemented in Croatia – risks yet to be identified.	
France	• Regarding hydrogen, in the short-term gas networks in France can accommodate a 6% share - except where sensitive facilities are located. In the longer-term, a share of 10% up to 20% can be considered. Several research and demonstration projects have been launched in France.	
Germany		
Greece	• R: No specific regulatory framework exists • C: Demand Side Management is not in commercial scale, preventing these implementations	
Italy	• The only problem from a technical point of view is related to the quantities: there must be the right quantities of input and output to have sufficient supply and at the same time satisfying the demand.	
Spain	• R: No current legal framework. Some technical specifications for alternatives fuels, as sustainable hydrogen, are included in RD 639/2016.	• The National Roadmap for Renewable Hydrogen is under development. Currently, under public consultation phase.

[1] Source: "Innovation Landscape For A Renewable-Powered Future" IRENA

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5 Conclusions and Lessons Learned

This report has provided a comprehensive overview of the regulatory situation on EU islands in NESOI countries. The status quo of the energy generation and distribution of the islands has been investigated on high level technical, commercial and regulatory side and aims to enable the implementation of detailed solutions in later stages of the project.

Many sustainable business models have been identified, where appropriate and feasible for the different technological solutions to be implemented, and mapped onto three appropriate clusters:

- New Business Models driven by regulations
- Commercially driven business models
- Technology-driven innovative technologies

Constraints and limitations are investigated for the islands in all of these clusters, taking into account the relevant barriers and considering enabling actors such as DSOs, ESCOs, generators, local authorities, etc.

However, it became obvious during the execution of this task that the Clean Energy Package regulation is still not defined in national Member State regulation. For this reason, the future feasibility of many innovative business models which are currently not legally possible will depend on the future evolution of the regulatory framework.

Furthermore, low utilization of smart meters in many Member States leads to technology-based constraints for several business models (such as demand response or P2P BM). On the other side, there appears to be an increasing complexity in managing new technologies in the grid, especially for legacy systems.

Procurement can have long lead time due to national processes, especially for public procurement. This should be considered during the execution phase of the projects to be supported by NESOI.

The continuous phase out of renewable incentive schemes may slow down the implementation and integration of RES in some national markets, posing local effect especially on the business models with renewable energies.

Permitting is a quite comprehensive and difficult topic, as it strongly depends on the specific implementation of real-life projects in Member States and also on regional/local legislation. Therefore, relevant clusters of permissions have been identified in this report that need to be specifically applied in following energy projects in NESOI.

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A1 Detailed National Showcase Assessments

This annex contains the detailed national showcase assessments as summarized in section 2.

A1.1 Croatia

Energy Generation

1. Who can produce energy?

Pursuant to the Energy Act, all legal entities and individuals are entitled to perform activities on energy market, including generation of electricity, provided they hold a permit issued by the Croatian Energy Regulatory Agency (HERA).
The permit is issued if an applicant fulfills the following conditions:

- registers for performing the activity of generating electricity;
- meets the technical qualifications for performing the activity of generating electricity;
- employs sufficient number of professionally trained employees (if applicable),
- holds sufficient finances for performing the activity of generating electricity;
- a permit allowing performance of activity of generating electricity has not been withdrawn from the applicant within five years prior to submission of a request;
- members of the management board and other corporate officers in the applicant's company have not been convicted with final effect of a commercial business-related crime (e.g. crimes against the payment system or business administration) within a period of 5 (five) years.

Source:

- *Energy Act*

2. Which innovative technologies are regulated (and not)?

Croatian legal system does not recognize innovative technologies, such as blockchain metering models, different models of electricity storage and load balancing. This is because the Electricity Market Directive (EU) 2019/944 has not yet been implemented into Croatian legal system. Adopting of the necessary regulation is expected until the end of 2020.

Only the basic regulatory framework which allows the introduction of smart metering models with the producers and prosumers of electricity (i.e. meters capable of remote reading) has been adopted by now.

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3. How are prosumer and/or blockchain metering models allowed?

In Croatia there is no regulatory setup which would prescribe specific metering models to be used by prosumers of electricity. The general requirements imposed to eligible producers apply instead. As per the Regulation on acquiring the status of an eligible producer of electricity, to obtain the status of an eligible producer an interested applicant must conduct a study of the installed metering devices (in Croatian: *Elaborat o ugrađenim mjernim uređajima*) in which the following is indicated: (i) the description of calculation meters and inspection meters installed within the facility; (ii) the description of used devices and installed metering points; (iii) the manner of reading the data and controlling and certifying meters and used devices.
Facilities shall connect to the transmission or distribution grid via the metering points, which record the amount of electricity that has been generated within the facility and transferred to the electricity grid. In addition, facilities must have meters which record the amount of electricity taken from the system.
In case multiple metering ports or metering points are installed within the facility, a producer shall provide for separate measurement of the following indicators: (i) the amount of electricity generated within the facility; (ii) the amount of electricity delivered to the grid; and (iii) the amount of electricity referring to the own consumption of electricity within the facility.
A blockchain metering model is yet not recognized under the Croatian law.

Source:

- *Regulation on acquiring the status of an eligible producer of electricity*
- *Rules of distribution grid system*
- *Rules of transmission grid system*

4. Which RE sources can link to the grid?

Generation facilities using the following renewable energy sources to generate electricity can link to electricity grid:

- aerothermal energy
- biogas
- biomass
- geothermal energy
- hydropower energy
- hydrothermal energy
- landfill gas and sewage gas
- sea waves
- solar energy
- wind energy

Source:

- *Renewable Energy Sources and High-Efficiency Cogeneration Act*

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5. Which metering models are allowed (front of, back of, etc.)?

Most final customers of electricity in Croatia still use standard metering devices. However, at the user's request the Croatian distribution system operator (HEP DSO) must install electricity meters with a possibility of distanced reading and other advanced features. The costs of such meters and necessary adaptations connected with its installation are borne by the users, as smart metering devices are still considered as a non-standard service of the DSO. Alternatively, prosumers are typically using smart metering devices.
With the National Energy Development Strategy for a period until 2030 with perspective to 2050, Croatia has undertaken to work on development of smart metering system. Until 2030, DSO should introduce a smart metering system, modernize and automatize the grid and develop information and communication systems in order to provide all users with possibility to participate in electricity market. The development of smart grids which would provide two-ways exchange of information would encourage the quality of retail in energy market, increase a level of energy trading and enable prosumers and generators to further grow.
Also, HEP DSO delivered a Ten-year (2019-2028) development plan of distribution grid, according to which further investments are intended via pilot projects co-financed from the EU funds.

Source:

- *General terms and conditions of the grid usage and supply of electricity*
- *National Energy Development Strategy for a period until 2030 with perspective to 2050*
- *Ten-year (2019-2028) development plan for HEP DSO distribution grid, with a detailed elaboration for initial three-year and one-year term*

6. How is energy price determined (free, regulated, etc.)?

In Croatia, the domestic consumption-based electricity prices are determined depending on the tariff model used by a final customer. Electricity Market Act and Methodology for determining tariff items of electricity supply within the universal service alter blue, white, red and black tariff models. The total (unique) price of electricity includes a fee for transmission grid usage, fee for distribution grid usage and a fee for electricity supply within the universal service. A customer of electricity receives one invoice with the indication of electricity consumption and additional grid connection fees. The detailed calculation of costs within the distribution system is indicated in the below table:

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Category		Tariff model	Tariff element					
			Operating energy			Power output	Excessive reactive energy	Metering point fee and electricity supply fee
			JT	VT	NT			
			[HRK/kWh]	[HRK/kWh]	[HRK/kWh]	[HRK/kWh]	[HRK/kVArh]	[HRK/month]
			Tariff items					
Household	Low voltage	Blue	0,77 (0,87)	-	-	-	-	17,40 (19,66)
		White	-	0,84 (0,95)	0,41 (0,46)	-	-	17,40 (19,66)
		Red	-	0,70 (0,79)	0,34 (0,38)	38,50 (43,51)	-	48,70 (55,03)
		Black	0,37 (0,42)	-	-	-	-	6,20 (7,01)

Table 2 - Detailed calculation of costs within the distribution system

Prices of electricity within the transmission system are calculated according to the following unit prices (paid by the final consumers at the low voltage level):

Consumer category		Tariff model	Output energy			Power output	Excessive reactive energy	Metering point fee
			JT	VT	NT			
			[HRK/kWh]	[HRK/kWh]	[HRK/kWh]	[HRK/kWh]	[HRK/kVArh]	[HRK/month]
			Tariff items					
			1	2	3	4	5	6
Household	Low voltage	Blue	0,22	-	-	-	-	10,00
		White	-	0,24	0,12	-	-	10,00
		Red	-	0,16	0,08	24,00	-	41,30
		Black	0,13	-	-	-	-	5,80

Table 3 - Prices of electricity within the transmission system

Additionally, all final consumers of electricity in Croatia participate in the renewable energy support system, by paying a unique fee in the amount of HRK 0,105 (approx. 0,014 ct.) per kWh (with an exception for greenhouse gas emission permit holders who participate with HRK 0.007 (approx. 0.00092 ct.) per kWh), determined by the Governmental Decision on Fee for Renewable Energy Sources and High-Efficiency Cogeneration.

Source:

- *Electricity Market Act*
- *Methodology for determining tariff items of electricity supply within the universal service*

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- *Decision on Fee for Renewable Energy Sources and High-Efficiency Cogeneration*
- *http://www.hep.hr/elektra/kucanstvo/tarifne-stavke-cijene/1547*
- *https://www.hops.hr/usluge-prijenosa*

7. Do small islands have a different status/regulatory set up?

In Croatia all islands enjoy specific protection. By virtue of the Act on Islands, Croatia in principle supports sustainable development on islands through the projects implementing one or more features recognized as characteristics of the "*smart island*" (i.e. island which, by using appropriate tools and innovative solutions is developing ecologically, socially, technologically and economically sustainable and is building circular economy, increasing self-sufficiency and resistance to climate changes). The following projects should be supported:

1. active participation in adjustments to or mitigation of the climate change at the local level;
2. introducing and using of advanced technologies to ensure optimal management and utilization of local resources and infrastructure through various business models;
3. reducing of the use of fossil fuels by increasing a sustainable utilization of renewable energy and energy efficiency resources;
4. promoting sustainable mobility on islands;
5. reducing until final elimination a shortage of water by implementing unconventional and smart methods of water resources management;
6. creating waste-free areas and circular economy promotion;
7. reservation of natural and cultural heritage of the island;
8. diversification of the island economy by exploiting the specifics of the islands in creating new and innovative local activities;
9. strengthening and promoting social involvement, education and citizen participation;
10. transition to alternative, long-term, sustainable and responsible forms of tourism on the islands.

Croatian Government is currently working on adopting the National plan for development of islands in a period between 2021 and 2027, which should identify specific guidelines aiming to increase the quality of life on islands, access to the public services, economic development, management of island resources and environment, as well as mobility and connectivity with the mainland. The local authorities on islands therefore participated with submitting answers to the questionnaire on the development challenges, opportunities and needed investments until 20 April 2020.

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Source:

- *Act on Islands*

8. Grid connection cost?

The new user who wants to connect to the electricity grid or the existing user of a grid who wants to increase the connection capacity, which may be either the final customer and / or the electricity generator, must pay the connection costs to TSO or DSO. The connection costs are used for financing of construction of the connection terminals, technical improvements of the grid and overall grid development.
A new entrant to the electricity grid that wishes to connect its generation facility to the transmission or distribution systems must enter into a connection agreement with TSO or DSO. Prior to entering the grid connection agreement, the investor must request an optimal technical solution study for grid connection (in Croatian: *Elaborat optimalnog tehničkog rješenja priključenja - EOTRP*) and obtain the electricity approval.
The Croatian Methodology for determining a fee for connection to the electricity grid of the new grid users and for increasing connection capacity of the existing grid users differs two connection types: (i) connection of the final customer's building and (ii) connection of the generator's building.

i. CONNECTION OF THE FINAL CUSTOMER'S BUILDING

The amount of fee is determined based on (a) unit price and connection power (for connection to low, medium or high voltage), or (b) actual costs of building connection of the final customer to the electricity grid.

1. Connection of final customer to the low voltage level (≤ 20 kW and > 20 kW)

The amount of connection fee borne by final customer to be connected to the low voltage level depends of the connection power. Different formulas apply to (a) connection power up to 20 kW at one metering point, and (b) connection power higher than 20 kW at one metering point.

a) ≤ 20 kW connection power:

Connection fee	=	Unit price for connection power up to 20 kW at the low voltage level	x	connection capacity of the new final customer / increased capacity requested by the existing final customer

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b) > 20 kW connection power:

Connection fee	=	Unit price for connection power up to 20 kW at the low voltage level	x	20	+	Unit price for a part of connection power higher than 20 kW at the low voltage level	x	connection capacity of the new final customer / increased capacity requested by the existing final customer x 20

2. Connection of final customer to the medium voltage level (35(30) kV or 10(20) kV)

Connection fee	=	Unit price at the medium voltage level	x	connection capacity of the new final customer / increased capacity requested by the existing final customer

3. Connection of final customer to the high voltage level (110 kV or 220 kV or 400 kV)

Connection fee	=	Unit price at the high voltage level	x	connection capacity of the new final customer / increased capacity requested by the existing final customer

ii. CONNECTION OF THE GENERATORS' BUILDING

Connection fee borne by the generator comprises of (i) actual costs of the connection terminals construction and (ii) actual costs of creating technical grid conditions for taking over the generated electricity. If the generator is connecting to the low or medium voltage level it shall bear in total the costs of technical conditions development for taking over electricity. In case of connecting to the high voltage level the generator pays 80% of costs.
Source:

- *Energy Act*
- *Methodology for determining a fee for connection to the electricity grid of the new users and for increasing a connection capacity of the existing grid users*
- *Regulation on issuing of energy approval and determination of conditions and deadlines for connection to the electricity grid*
- *Rules of connection to the distribution grid*
- *Rules of connection to the transmission grid*

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Energy distribution

9. Who owns the networks?

HEP group is the national energy company. It has been organized as a group of subsidiaries, with the parent company Hrvatska elektroprivreda d.d. (HEP d.d.) on top. HEP d.d. is in total owned by the state and is founder and the sole owner of subsidiary companies. Also, it owns all assets which are contractually transferred onto subsidiaries.

The Croatian Distribution System Operator (HEP DSO) is the only distribution system operator and one of the subsidiary companies within the HEP group. Therefore, all assets including the distribution grid, power transformers and connection terminals are owned by HEP d.d., the parent company of HEP DSO.

In other hand, the Croatian transmission system operator (HOPS) has been unbundled from HEP group according to the ITO (Independent Transmission Operator) model. HOPS is the sole electricity transmission system operator and an exclusive owner of the transmission grid (at the voltage level of 400 kV, 220 kV and 110kV).

Source:

- *Energy Act*
- *Act on Regulation of Energy Activities*

10. Who can intervene through tech investments on the network?

Grid investments are borne by the operator (both DSO and TSO). DSO is obliged to conduct continuous development plans in order to manage and maintain, build, modernize, improve and develop the distribution network. The aim is to provide for safe, reliable and efficient operation of distribution system. Also, DSO is responsible for grid developments which would ensure a long-term capability of the distribution grid, coordination with the transmission system and facilities and devices used by the final customers. Grid development plans are approved by the energy regulator (HERA).

Source:

- *Electricity Market Act*
- *Rules of distribution grid system*
- *Statute of the Croatian Energy Regulatory Agency*

11. How are grid investments remunerated?

DSO collects funds for the distribution grid developments from (i) connection fees paid by the new users of the distribution grid; (ii) fees for increased capacity paid by the users seeking to increase the connection power; and (iii) usage fees for distribution and transmission grid paid by the existing final customers which are incorporated in the unique price of electricity (as explained in answer under 6). Also, according to the Ten-year development plan, HEP DSO intends to invest HRK 20 million in the distribution grid developments distributed evenly at HRK 2 million per year.

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Another resource of financing the grid developments is the EU funding. Thus, the smart grid pilot projects conducted under the Feasibility Study of the Pilot project for introducing smart grids, with a cost-benefit analysis ("Study") by the DSO will be co-financed from the EU resources. The procedure of application of the project ended in July 2018 with signing of the agreement on co-financing. The Study elaborated pilot projects in three functional areas in which the grid investments are necessary: (a) smart metering infrastructure; (b) automatization of the grid at the medium voltage level; and (c) developments and optimization of the conventional network (investments in power transformers with reduced level of technical losses).

Source:

- *Methodology for determining a fee for connection to the electricity grid of the new users and for increasing a connection capacity of the existing grid users*
- *Regulation on the manner and criteria for determining the amount of the fee for the use of the transmission and distribution network*
- *Ten-year (2019-2028) development plan for HEP DSO distribution grid, with a detailed elaboration for initial three-year and one-year term*

12. Who can be DSO and what is the procedure to become one?

Pursuant to the Energy Act and its related regulations, DSO can be a legal person registered with the court registry for performing energy activities, which meets certain technical, professional and financial requirements specified for performing the activity of energy distribution. The applicant must obtain a license for performing the activity of electricity distribution, issued by HERA.
Distribution of electricity is organized as a public service. This means that the license holder should respect the following principles: (i) security of electricity supply; (ii) prescribed or contracted quality of electricity supply; (iii) proposal of the amount of tariff items, determined in accordance with certain regulated conditions; (iv) use of primary energy sources; (v) environmental protection; (vi) protection of health, life and assets of citizens; and (vii) measures of protection of final customers.
However, there is another possibility to perform the activities of an electricity distributor in which the distribution shall not be considered as public service. This is the distribution within a closed distribution system that distributes electricity within a geographically closed industrial and / or commercial location or a location of common services. Operation of such closed distribution system is possible only with a prior acquiring of the status of a closed distribution system, if the following conditions are met:

- the calculation metering point of the system owner is connected to the transmission grid,
- the system does not distribute electricity to the households, except to those located within the area under the system,
- the business or production processes of customers in the grid are integrated for some specific technical or security reason,
- the system primarily distributes electricity to the owner or operator of the closed distribution system and / or its affiliates (i.e. that at least 80% of electricity

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consumption falls on the owner or operator of the closed distribution system and / or its affiliates).

HERA will grant the status of a closed distribution system if the system owner proves above conditions and appoints the system operator. Prior opinion of the national DSO and TSO is mandatory. Another limitation is that the eligible producers of electricity are not entitled to connect to the closed distribution systems. However, as Croatia did not fully implement the Directive 2009/72/EC concerning common rules for the internal market in electricity, the institute of closed distribution systems is not effective in practice.

Source:

- *Energy Act*
- *Regulation on licenses for performing energy activities and keeping the registry of issued and revoked licenses for performing energy activities*
- *Electricity Market Act*

13. Can there be more DSOs on the same network?

Distribution system can only be operated by one DSO. The applicant for license for performing the activity of electricity distribution must prove ownership or usage rights (with lease contract or other similar contract) over the grid and equipment it intends to use in performing activities.

Source:

- *Energy Act*
- *Electricity Market Act*

14. Which metering and storage and load balancing technologies are admitted by the regulator?

Metering technologies

As previously explained, smart metering infrastructure is not yet fully implemented in Croatia. HEP TSO is continuously working on gradual implementation of the smart grid and replacement of standard metering devices used by the final customers with those models capable of remote reading. TSO is currently conducting analysis of the key documents and pilot projects within the EU, testing new technologies and working on intense investments in revitalization and replacement of SCADA systems and accelerated implementation of AMR systems.

Storage technologies

Storage technologies are still not recognized in Croatian legal framework. The necessary regulation which would determine this matter is expected to be adopted by the end of this year with the implementation of the Electricity Market Directive (EU) 2019/944.

Load balancing technologies

There is no regulatory limitation on load balancing technologies. DSO, as the leader and the sole member of the distribution system operator balance group should adopt

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regulation on the balancing methods. At the moment, balancing is conducted by concluding the agreements on provision of balancing services with different participants on electricity market.

Source:

- *Ten-year (2019-2028) development plan for HEP DSO distribution grid, with a detailed elaboration for initial three-year and one-year term*
- *Rules of transmission grid system*
- *Rules of electricity market organization*

15. Who is the regulator?

The regulator is the Croatian Energy Regulatory Agency (HERA).

16. Do small islands have a different status/regulatory set up?

There is no specific regulatory setup for energy distribution on islands. Only the Act on Islands, as the general framework for further implementation of specific incentives and programs has been adopted (for more details please see answer under 7 above).

Source:

- *Act on Islands*

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Tendering

Public clients

Public clients may only award contracts for deliveries and services by means of an award procedure. According to the Public Procurement Act, these public clients include

- Republic of Croatia, i.e. the state bodies
- local and regional self-government units
- public law authorities
- associations established by one or more subjects indicated above.

Sectoral clients include

- public clients performing one of the sectoral activities (i.e. activities in the field of gas, thermal energy, electricity sector, water sector, transportation, operation of airports, seaports and inland ports, mail services and exploitation of oil, gas, coal and other solid fuels)
- companies in which a public client has or may have, directly or indirectly, a predominant influence based on ownership, financial shares or rules governing the company and which are performing one of the sectoral activities
- other subjects performing one of the sectoral activities based on special or exclusive rights granted by the competent authority.

Public clients can choose between different types of procedures for the award of public contracts according to the Public Procurement Act for public supplies and services. However, they generally have to choose the public tender procedure which is called open procedure above the EU threshold. According to (EU) 2019/1827 – 1930, the EU thresholds from 2020 are as follows:

- 5.350.000 EUR for construction works
- 5.350.000 EUR for concessions
- 139.000 EUR for deliveries and services ordered by governmental authorities
- 214.000 EUR for deliveries and services ordered by other public clients
- 428.000 EUR for deliveries and services in the energy sector

The procurement intent shall be made public in appropriate sources such as newspapers, public accessible procurement portals and www.eojn.nn.hr. Once the EU thresholds have been reached, the publication of the tender must also be sent to the Official Journal of the EU, which will translate the publication of the tender into all official languages of the EU and publish on the portal "Tenders Electronic Daily" (TED). Also orders below the threshold values can be published on the TED portal on request.

The contracting authority can only choose other special types of procedure if there are special reasons such as

- the performance by its nature can only be carried out in a suitable manner by a limited group of contractors, especially if exceptional expertise or performance or reliability is required

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- the public tender would cause an effort for the client or the applicants which would be disproportionate to the achievable advantage or the value of the service,
- a public tender has had no economic result, or
- a public tender is inappropriate for other reasons (e.g. urgency, confidentiality).

Other special types of procedure are

- The restricted tender procedure above the EU threshold, which stipulates that only a limited group of contractors will be invited to submit tenders
- The procedure for direct award, referred to as negotiation procedure for awards above the EU threshold, which allows, among other things, negotiations on the terms of the contract with the contractors and the procedure for competitive dialogue, which is only provided for Europe-wide tenders, and even more for the contracting authority allows scope for negotiations with the bidders.

These special types of procedure are preceded by a public participation competition in which suitable contractors are selected, who are then asked to submit an offer. In very special and limited exceptional cases, a restricted invitation to tender, a direct award or an EU-wide negotiation process can also be carried out without a competition.

Private clients

Private clients which are not public clients or sectoral clients according to the Public Procurement Act are not restricted according to the formal tendering rules. Typical tendering procedures that apply in Croatia are:

- RFI (Request for Information): Inquiry to potential contractors as to whether they could basically meet a sketched requirement. The answers given usually contain list prices. This variant of the tender is suitable for the first exploration of the market.
- RFQ (Request for Quotation): For a detailed requirement (specification), a description of the service is requested with a price that is as precise as possible, but usually non-binding. These inquiries are sent to contractors whose basic capability the client is already convinced of.
- RFP (Request for Proposal): Tender in the usual sense, the submitted offers are binding within the specified period of validity. The requests for tenders contain a detailed specification of services or a specification as well as all additional agreements belonging to the contract. Tendering procedures are also used within (larger) companies. In principle, there is no obligation to accept one of the offers.

Source:

- *Public Procurement Act*

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List of Regulatory Sources

Title (EN)	Title (CRO)	Abbreviation (CRO)	Version
Act on Islands	Zakon o otocima		116/18
Act on Regulation of Energy Activities	Zakon o regulaciji energetskih djelatnosti		120/12, 68/18
Decision on the amounts of tariff items for electricity distribution	Odluka o iznosu tarifnih stavki za distribuciju električne energije		112/18
Electricity Market Act	Zakon o tržištu električne energije		22/13, 95/15, 102/15, 68/18, 52/19
Energy Act	Zakon o energiji		120/12, 14/14, 95/15, 102/15, 68/18
General terms and conditions of the grid usage and supply of electricity	Opći uvjeti za korištenje mreže i opskrbu električnom energijom		85/15, 49/20
Governmental Decision on Fee for Renewable Energy Sources and High-Efficiency Cogeneration	Odluka o naknadi za obnovljive izvore energije i visokoučinkovitu kogeneraciju		87/17
Methodology for determining a fee for connection to the electricity grid of the new users and for increasing a connection capacity of the existing grid users	Metodologija utvrđivanja naknade za priključenje na elektroenergetsku mrežu novih korisnika mreže i za povećanje priključne snage postojećih korisnika mreže		51/17, 31/18
Methodology for determining tariff items of electricity supply within the universal service	Metodologija za određivanje iznosa tarifnih stavki za opskrbu električnom energijom u okviru univerzalne usluge		116/13, 38/14
National Energy Development Strategy for a period until 2030 with perspective to 2050	Strategija energetskog razvoja Republike Hrvatske do 2030. s pogledom na 2050. godinu		
Public Procurement Act	Zakon o javnoj nabavi		120/16

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Title (EN)	Title (CRO)	Abbreviation (CRO)	Version
Regulation on acquiring the status of an eligible producer of electricity	Pravilnik o stjecanju statusa povlaštenog proizvođača električne energije		132/13, 81/14, 93/14, 24/15, 99/15, 110/15, 60/20
Regulation on issuing of energy approval and determination of conditions and deadlines for connection to the electricity grid	Uredba o izdavanju energetskih suglasnosti i utvrđivanju uvjeta i rokova priključenja na elektroenergetsku mrežu		7/18
Regulation on licenses for performing energy activities and keeping the registry of issued and revoked licenses for performing energy activities	Pravilnik o dozvolama za obavljanje energetskih djelatnosti i vođenju registra izdanih i oduzetih dozvola za obavljanje energetskih djelatnosti		88/15, 114/15, 66/18
Regulation on the manner and criteria for determining the amount of the fee for the use of the transmission and distribution network	Pravilnik o načinu i kriterijima za utvrđivanje iznosa naknade za korištenje prijenosne i distribucijske mreže		
Renewable Energy Sources and High-Efficiency Cogeneration Ac	Zakon o obnovljivim izvorima energije i visokoučinkovitoj kogeneraciji		100/15, 123/16, 131/17, 96/18, 111/18
Rules of connection to the distribution grid	Pravila o priključenju na distribucijsku mrežu		
Rules of connection to the transmission grid	Pravila o priključenju na prijenosnu mrežu		
Rules of distribution grid system	Mrežna pravila distribucijskog sustava		74/18, 52/20
Rules of electricity market organization	Pravila organiziranja tržišta električne energije		107/19, 36/20
Rules of transmission grid system	Mrežna pravila prijenosnog sustava		67/17
Statute of the Croatian Energy Regulatory Agency	Statut Hrvatske energetske regulatorne agencije		99/07, 134/08, 137/08, 39/19

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Title (EN)	Title (CRO)	Abbreviation (CRO)	Version
Ten-year (2019-2028) development plan for HEP DSO distribution grid, with a detailed elaboration for initial three-year and one-year term	Desetogodišnji (2019.-2028.) plan razvoja distribucijske mreže HEP ODS-a s detaljnom razradom za početno trogodišnje i jednogodišnje razdoblje		

Table 4 - List of Regulatory Sources for Croatia

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A1.2 France

Energy Generation

1. Who can produce energy?

According to the Energy Code, everybody (both domestic as industrial actors) can generate electrical energy, as long as the following conditions are fulfilled by the generator:

- Large units (in general with capacity higher than 50 MW, or 10 MW for fossil fuel-based units) have to comply with the multi-annual energy planning (Programmation Pluriannuelle de l'Energie – PPE). The PPE is elaborated by the French government for the mainland, and together with local authorities for non-interconnected areas (ZNIs – see below). Furthermore, project developers have to obtain an administrative authorization delivered by the national administration. In addition, on the mainland, there is a strict upper boundary of 2.2 kg CO_2 per MW of installed capacity per year, which limits the number of hours during which fossil fuel units can work.
- For small units, for instance rooftop PV panels at households, there is no need for such administrative authorization, but a declaration must be done at the municipal authority and specific urban constraints must be checked. Within historical areas, the national authority in charge of maintaining the French cultural patrimony (Architecte des Bâtiments de France - ABF) is consulted, and may not approve the project (for instance, in city centres, in picturesque villages, or close to churches or any other historical building, it's impossible to install PV panels). Furthermore, even for self-consumption installations, connection to the distribution network is required.

Renewable energy is supported by feed-in tariffs and feed-in premiums, allocated through tendering procedures or administrative procedures, as depicted in the below table:

CEER member	Type of support	Process determining the level of support or the quota	PV	On-shore wind	Off-shore wind	Bio-energy	Hydro-power	Duration of support (years)
France	Feed-in Tariff	Tendering procedures	✓					10 to 20
	Feed-in Premium	Tendering procedures	✓	✓	✓	✓	✓	
	Feed-in Tariff	Administrative procedures	✓			✓	✓	
	Feed-in Premium	Administrative procedures		✓		✓	✓	

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Table 5 - Renewable energy feed-in tariffs and feed-in premiums in France (Source: CEER)

Amounts of feed-in tariffs and feed-in premiums are updated each quarter and published by the Energy Regulatory Authority (CRE). As an illustration, amounts corresponding to the first 2020 quarter for photovoltaic installations are the following:

In case of sale of 100% of the electricity generated:

Type installation	Puissance (kWc)	Tarifs (c€/kWh) du 1/01 au 31/03/2020
Integration au bâti (avec fin de la prime **IAB** depuis le 30/09/18)	≤ 3 kwc	18,53 + 0,00 = 18,53 €
	≤ 9 kwc	15,35 + 0,00 = 15,35€ fin de la prime IAB (0,00 €) depuis le 31/09/18
Intégration simplifiée au bâti (ISB)	≤ 3 kwc	18,53 €
	≤ 9 kwc	15,35 €
Non intégré au bâti ou IAB/ISB < 100kWc	≤ 36 kwc	12,07 €
	≤ 100 kwc	10,51 €

In case of self-consumption with sale of surplus:

Type installation	Puissance (kWc)	primes et tarifs (c€/kWh) du 1/01 au 31/03/2020
Sur bâtiment et respectant les critères généraux d'implantation	≤ 3 kwc	prime de 390 € /kwc (soit 1170 € pour 3 kwc) + vente à 10 c€/kWh)
	≤ 9 kwc	prime de 290 € /kwc (soit 2610 € pour 9 kwc) + vente à 10 c€/kWh)
Sur bâtiment et respectant les critères généraux d'implantation	≤ 36 kwc	prime de 180 € /kwc (soit 6480 € pour 36 kwc) + vente à 6 c€/kWh)
	≤ 100 kwc	prime de 90 € /kwc (soit 9000 € pour 100 kwc) + vente à 6 c€/kWh)
Sur bâtiment et respectant les critères généraux d'implantation	> 100 kwc	0

Table 6 - Amounts of feed-in tariffs and feed-in premiums

Sources:

- *Energy Code, articles L. 311-1, D314-15, D314-23*
- *Urban Planning Code, art. R. 421-17*

2. Which innovative technologies are regulated (and not)?

Smart metering is fully regulated (see below).
The recently adopted Energy-Climate Law intends to facilitate the deployment of innovative technologies:

- Experimentation contracts: calls for projects can be organised to make use of innovative renewable technologies.
- Hydrogen from renewable sources: The legal framework for the production, transport, storage and use of hydrogen is made more flexible.
- Renewable Energy Communities: The legal framework is defined, transposing the EU Clean Energy Package directive.
- Regulatory sandbox: an experimental system (also known as a "regulatory sandbox") is introduced in the energy sector. The scheme provides that the regulator (CRE) and other competent authorities *"may, by reasoned decision, grant derogations from the conditions of access to and use of networks and facilities to deploy (as experimentations) innovative technologies or services in support of energy transition and smart systems"*. This system provides a legal framework adapted to projects that test innovations that would ultimately require changes to the applicable regulatory and legislative framework.

Regarding electricity storage (i.e. installations which both generate and consume electricity), grid connection requirements are currently being revised to facilitate the

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development of storage. Storage is treated specifically in non-interconnected areas (see below).
In France, demand response is well developed. According to the multi-annual energy planning (PPE), 6 GW of actionable demand response capacity should be developed by 2023. Demand response can be valued as energy or as capacity. Furthermore, has a clear framework on the status of independent aggregators and their role and responsibilities in the market.

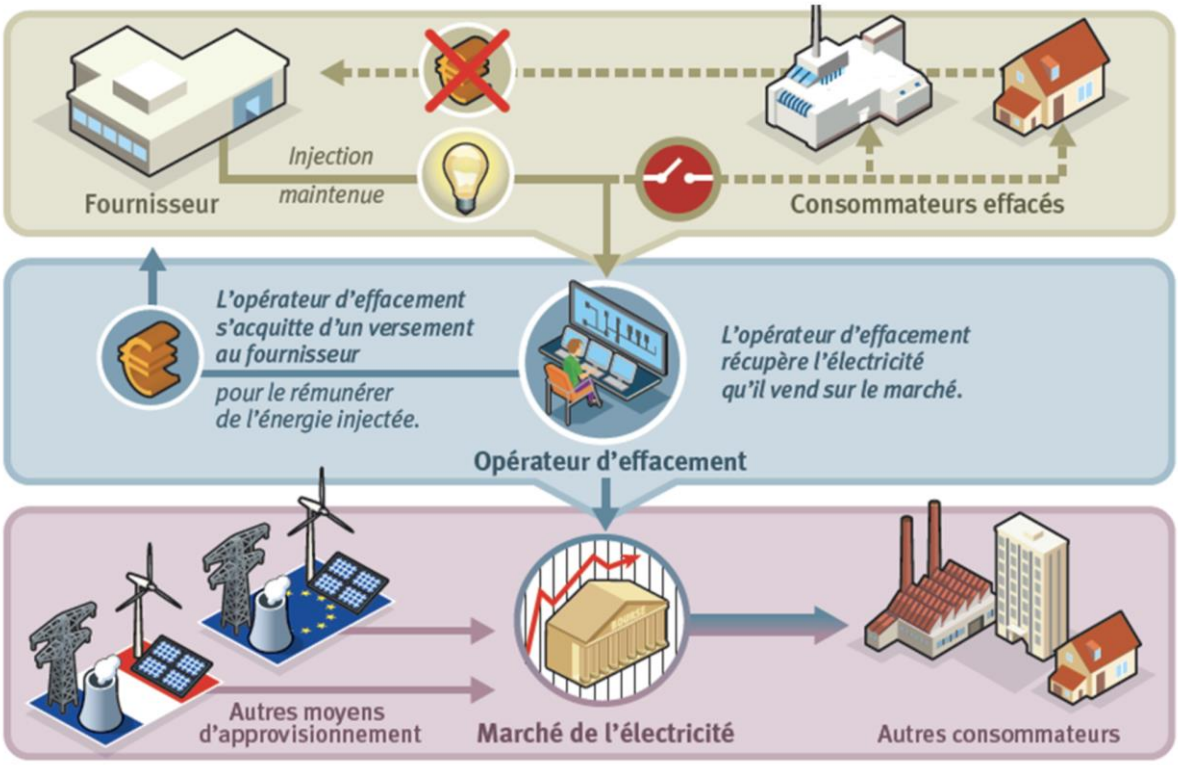

Figure 8 - Demand response electricity and money flows (Source: CRE)

Source:

- *Energy-Climate Law*

3. How are prosumer and/or blockchain metering models allowed?

Prosumer model, i.e. individual consumption of self-generated energy, is facilitated thanks to the deployment of the LINKY smart meters (see below section). LINKY smart meters allow for bidirectional communication (metering of consumption and generation). Collective self-consumption (energy communities) is facilitated since the publication of the self-consumption decree in 2017.
Several experiments of collective self-consumption based on blockchain are ongoing. Major French energy players are currently experimenting blockchain:[39]

[39] Source : Think Smart Grids association, https://www.thinksmartgrids.fr/actualites/blockchain-domaine-energie

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- As part of the Confuences eco-district in Lyon, Bouygues Immobilier is exploring the Blockchain to trace the distribution of energy produced by photovoltaic panels on the roofs of buildings in the district and consumed locally by its residents. The group draws on the expertise of startups Energisme and Stratumn. If the pilot proves successful, the system could be extended to other eco-neighbourhoods in France.
- In South-West of France, the Digisol project, winner of an ADEME call for projects, started in 2017. Led by SUNCHAIN, a spin-off of the engineering company TECSOL, this project is experimenting with the use of blockchain as part of a collective self-consumption project. It is based on the Blockchain Hyperledger, a private platform for the development of the Blockchain supported by the Linux foundation. ENEDIS, the France DSO, has joined this experiment. Its information system can connect directly to the blockchain and collect for each consumer the share of electricity coming from local production and its electricity supplier (for billing and balancing), as well as any surplus of local production. This information is then transmitted to the suppliers and the legal entity. Eventually, up to 1,000 sites could be equipped within the DIGISOL project.
- GREENFLEX, a subsidiary of TOTAL, has announced a blockchain demonstrator for local energy communities. Blockchain would be mobilized to trace the source of energy to facilitate the market between individuals. Greenflex is relying on the startup Blockchain Partner to model and simulate these exchanges and build a digital demonstrator. A first virtual demonstrator, bringing together supermarkets, industries and private homes, was launched on a neighbourhood scale at the end of 2017.
- The DAISEE start-up based in Villeurbanne is working on an Open Source program aimed at making energy a common good based on Blockchain technology. The structure aims to create the Energy Internet based on a resilient, distributed, secure and trusted infrastructure for all stakeholders in the energy system.

Source:

- *Self-consumption decree amending Energy Code*

4. Which RE sources can link to the grid?

RES that can link to the grid are:

- Hydropower
- Wind energy
- Photovoltaic
- Biogas (methanisation of non-hazardous waste, raw vegetable matter, urban or industrial wastewater)
- Geothermal energy

Source:

- *Energy Code*

5. Which metering models are allowed (front of, back of, etc.)?

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In France, all electricity consumers shall be equipped with a smart meter by 2024.
The same smart meter, called LINKY, is being installed at every consumption site. Some citizens oppose to LINKY; but the Energy Transition Law has made clear that the installation of LINKY was mandatory.
The smart meters belong to the DSO, who is in charge of maintaining them.
LINKY meters are compliant with French standard NF C14-100.

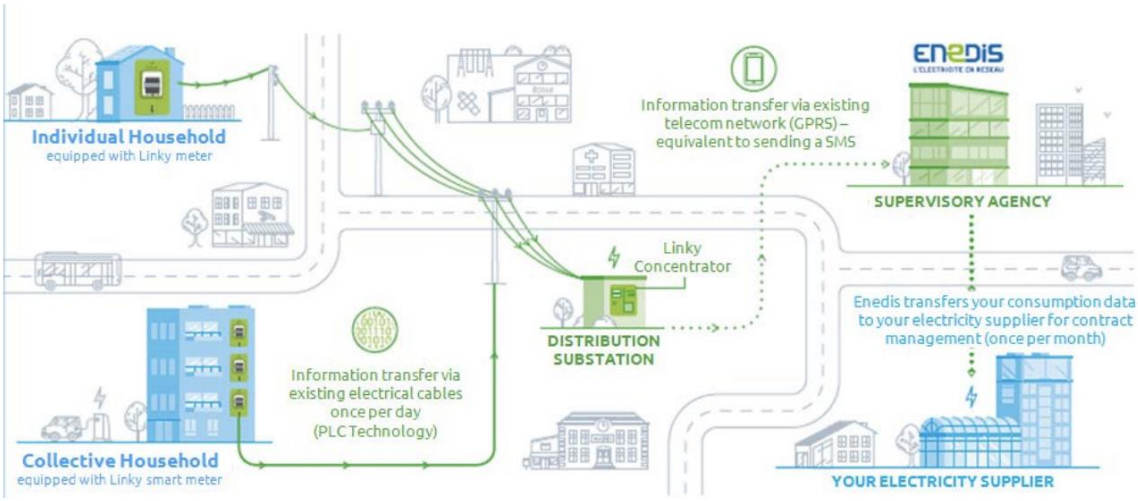

Figure 9 - LINKY data flows (Source: ENEDIS)

Source:

- *Energy Code, article R341-8*
- *Energy Transition Law, article 29*

6. How is energy price determined (free, regulated, etc.)?

Two systems co-exist in France:

1. Regulated price
2. Free market offers.

Historically in France, electricity price was regulated (price determined by the French government). Electricity was sold by EDF on 95% of the national territory, and by local energy companies in certain specific territories. Today, only small consumers with a peak consumption lower than 36 kVA have the right to subscribe such regulated electricity price. The price has two components: capacity component (annual amount depending on subscribed capacity) and energy component (€/kWh). Today, around 75% of households are still under such regulated price.
On average, regulated price is structured as follows: 35% are taxes, 28% are grid costs, 27% are energy costs. Taxes include, among other, the contribution for renewable sources and for solidarity tariff.

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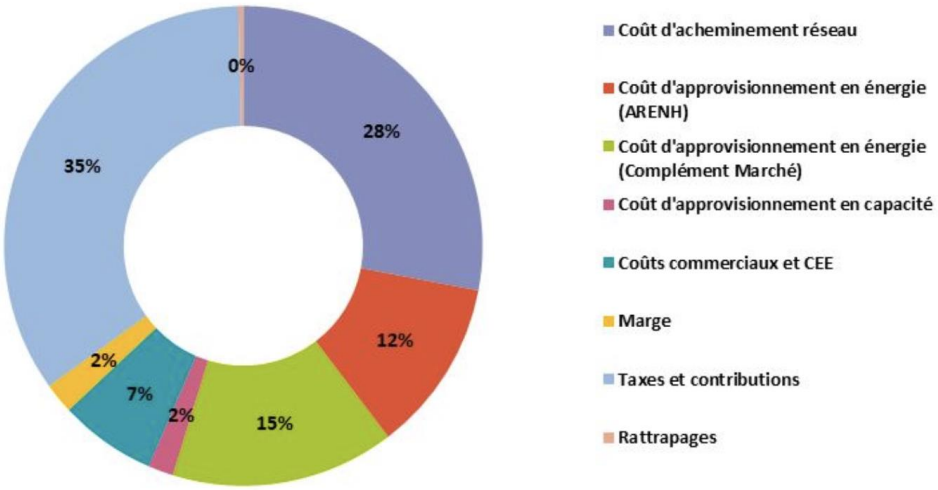

Figure 10 - Regulated price structure (Source: CRE)

Regulated electricity prices have evolved over time as follows (difference colours correspond to the different capacity ranges):

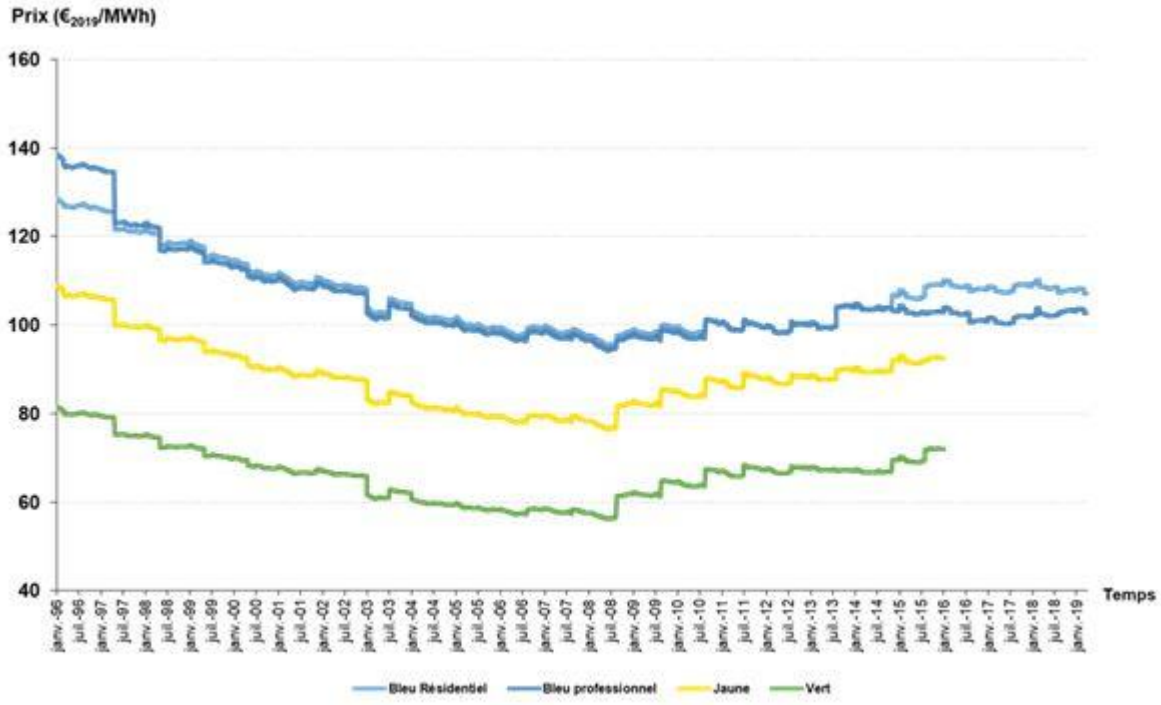

Figure 11 - Regulated price evolution over time (Source: CRE)

Since the start of the liberalization of the energy sector, market offers have emerged. Market offers are proposed both by incumbents (EDF and local energy companies) and by new market players. Even though new market players' market share is continuously

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growing, especially for the large consumers market segment, the market is still very concentrated in France due to the existence of regulated price for small consumers.

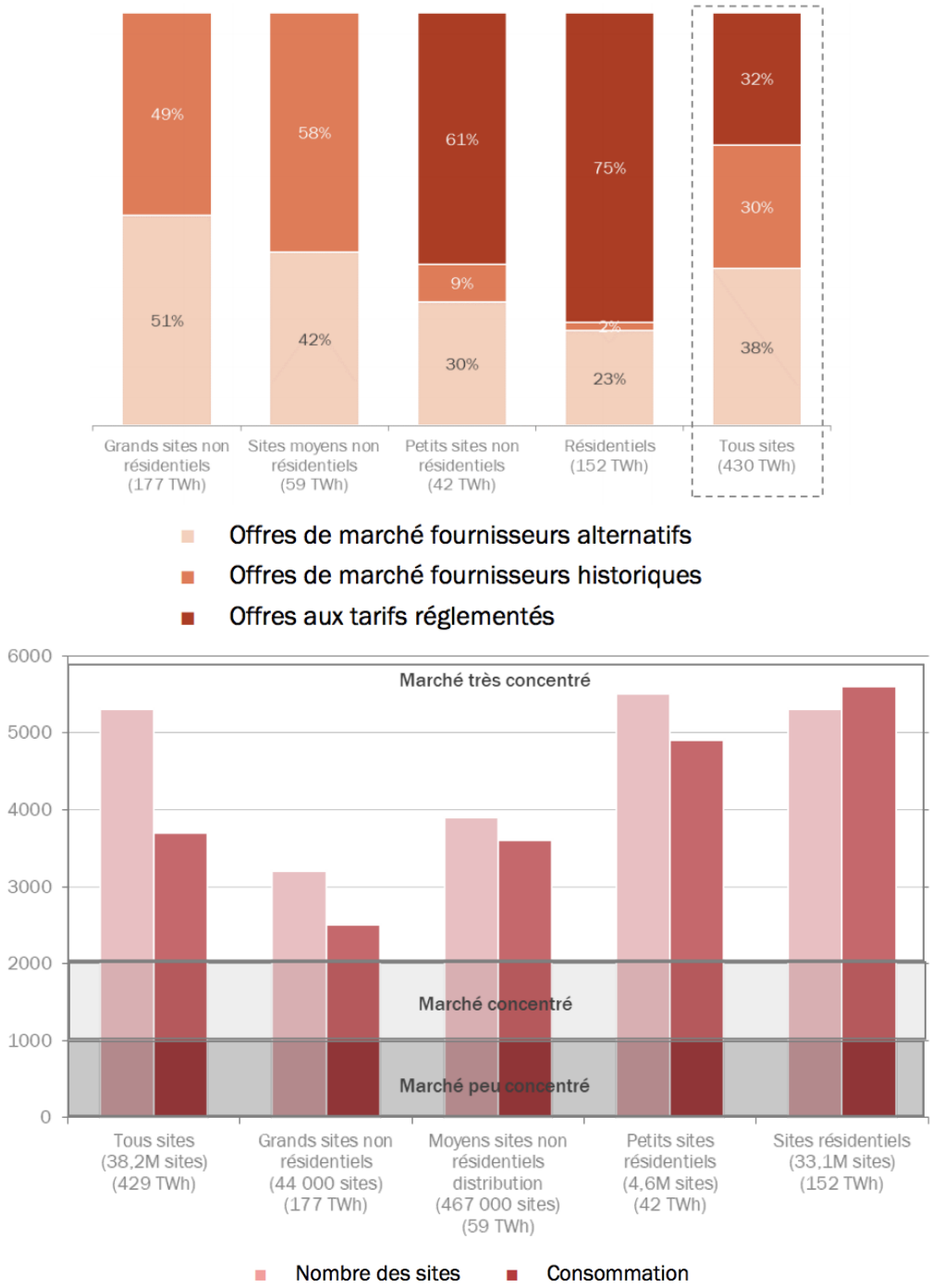

Figure 12 - French electricity market structure (Source: CRE, retail energy market observatory, Dec. 2019)

Sources:

- *Energy Code, articles L.337-4 to L.337-9, and R. 337-18 et seq.*

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7. Do small islands have a different status/regulatory set up?

There is a specific status for non-interconnected areas (ZNI - “zones non interconnectées”).
Main ZNIs are: Corsica, Guadeloupe, La Réunion, Mayotte, Martinique, French Guyana, Saint-Pierre-et-Miquelon, Wallis et Futuna notamment, Chausey. New Caledonia and French Polynesia have specific statutes and are not considered as ZNIs.
NB. Within the names mentioned in the above paragraph, only Corsica, Guadeloupe, La Réunion, Mayotte and Martinique are eligible to NESOI. French Guyana is not an island. Other territories are Overseas Countries and Territories (OCTs) which, albeit being part of the French territory, are not part of the European Union.

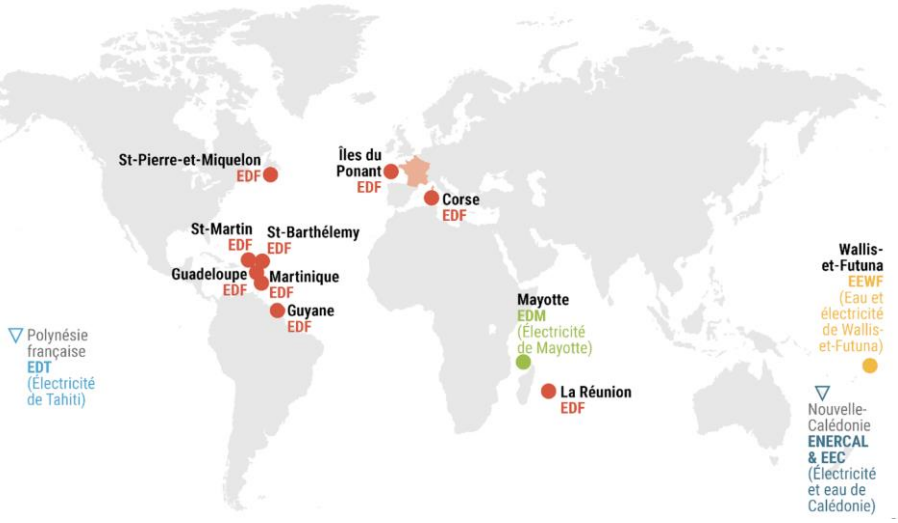

Figure 13 - Main French ZNIs (Source: CRE)

The climatic and geographical characteristics of non-interconnected areas as well as the small size of their power systems create strong constraints for the energy mix, power grid management and supply. They justify the use of adapted technological solutions and lead to higher production costs than in metropolitan France: they reach 290 €/MWh on average in 2016.These costs vary greatly from one region to another depending on the characteristics of the generating fleet and the network.

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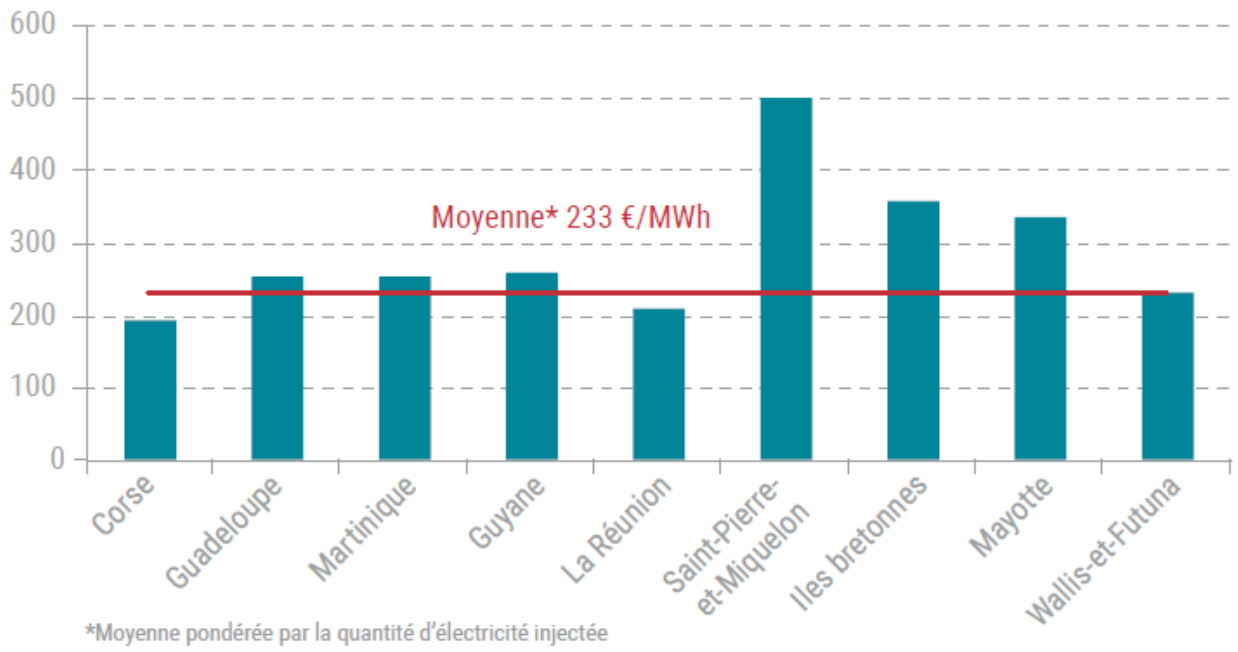

Figure 14 - ZNIs' very high electricity production costs (Source: CRE)

Isolated from the mainland French electricity grid, ZNIs provide the bulk of their electricity supply from imported fossil fuels (gas, fuel oil, coal), supplemented where necessary by local renewable energy.
They are facing the challenge of their energy transition and have set their sights on the development of renewable energies and energy autonomy.
The law "Energy Transition for Green Growth" has set them ambitious objectives:

- to cover 50% of their energy mix with renewable energies by 2020;
- to achieve energy autonomy by 2030.

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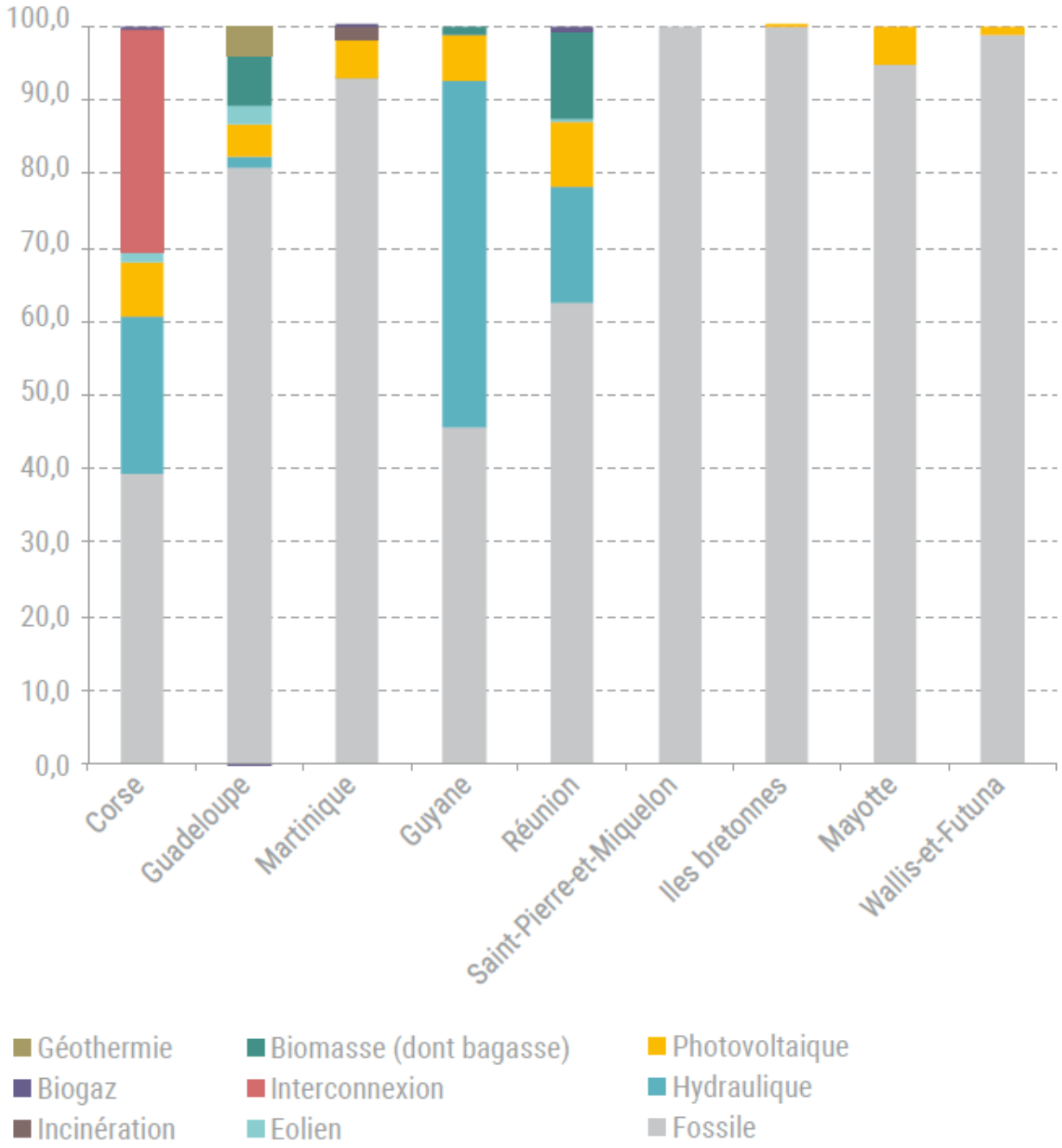

Figure 15 - An electricity mix mainly based on fossil fuels (2016) (Source: CRE)

Furthermore, the "Energy Transition Law for Green Growth" (LTECV) has set up specific multiannual energy programmes (Programmation Pluriannuelle de l'Energie – PPE) for each non-interconnected area. Co-developed by the government and local authorities, they are the tool for steering energy policy and involve local authorities in the energy policy of their territories.

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Local authorities may ask the Minister of Energy to issue a call for tenders or the Energy Regulatory Authority (CRE) to analyse a tariff provision if the rate of development of the sector concerned is not in line with the objectives of the area.
Regarding islands, the following energy generation units are eligible to feed-in tariffs i.e. fixed regulated prices per MWh generated, whatever the electricity market price, with priority dispatch:

- Installations using hydraulic power from lakes, rivers and gravity-fed water with an installed capacity of strictly less than 500 kilowatts;
- Installations using photovoltaic solar energy installed on buildings with a peak power less than or equal to 100 kilowatts;
- Installations using the mechanical energy of the wind located in areas particularly exposed to the risk of cyclones and having a device for forecasting and smoothing production;
- Installations using biogas produced by methanisation of non-hazardous waste and raw vegetable matter with an installed capacity of less than or equal to 12 megawatts located in areas not interconnected to the continental metropolitan network;
- Installations primarily using biogas produced by the methanisation of materials resulting from the treatment of urban or industrial wastewater with an installed capacity of less than or equal to 12 megawatts located in areas not interconnected to the continental metropolitan network;
- Installations using biogas from non-hazardous waste storage facilities with an installed capacity of less than or equal to 12 megawatts located in areas not interconnected to the continental metropolitan network as their main use.

Furthermore, energy generation units are eligible to feed-in premium, i.e. fixed regulated premium over the spot electricity price, only if they are located on or connected to the continental French territory. Therefore, the following applies **only to islands which are interconnected to the mainland**:

- Installations using hydraulic power from lakes, rivers and gravity-fed water with an installed capacity of less than 1 megawatt;
- Installations using mainly the energy released by thermal treatment of household or similar waste;
- Installations primarily using biogas produced by methanisation of substances resulting from the treatment of urban or industrial wastewater with an installed capacity of between 500 kilowatts and 12 megawatts;
- Installations using biogas from non-hazardous waste storage facilities with an installed capacity of between 500 kilowatts and 12 megawatts as their main use;
- Installations using as their main energy source energy extracted from geothermal deposits;
- Installations for the cogeneration of electricity and heat recovered from natural gas with an installed capacity of strictly less than 1 megawatt;
- Installations using the mechanical energy of the wind, located on land, which do not have any wind turbine with a rated power greater than 3 MW and within the limit of six wind turbines.

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Sources:

- *Energy Code, articles D314-15, D314-23*

8. Grid connection costs

According to the Energy Code, the connection of a user to the public electricity networks includes

- extension works,
- connection works,
- where applicable, the reinforcement of existing networks.

Who pays for what regarding the connection to public electricity distribution networks:

Type d'installation concernée		Raccordement aux réseaux publics de distribution (RPD)				Raccordement au réseau public de transport (RPT)
		Branchement	Extension	Ouvrage propre	Quote-part	
Installations de consommation		40 %	40 %	NA	NA	30 %
Installations de production EnR	P ≤ 100 kVA	40 %	40 %	NA	NA	NA
	100 kVA < P ≤ 500 kW	NA	NA	40 %	40 %	NA
	500 kW < P <1 MW				Interpolation linéaire	NA
	P = 1 MW				20 %	NA
	1 MW < P ≤ 3 MW			Interprétation linéaire	Interpolation linéaire	NA
	3 MW < P < 5 MW				Pas de réfaction	NA
	P ≥ 5 MW	Pas de réfaction				
Installations de production non EnR		Pas de réfaction				
Réseaux publics de distribution		NA	40 %	NA	NA	30 %

Table 7 - Coverage of connection costs by network tariffs according to connection categories (Source: CRE)

- Consumption installations
  - 60 % of the connection costs to be borne by the applicant
  - 60 % of the extension costs to be borne by the local authority in charge of city planning if the facility requires a planning permit OR 60% of the extension costs to be paid by the applicant if the installation does not require planning permit
  - the rest is supported by network tariffs (40 % connection, 40 % extension, 100 % reinforcement)

- Non-RES generation facilities:
  - 100% of connection costs to be borne by the applicant
  - 100% of the extension costs to be borne by the connection applicant
  - the rest is supported by network tariffs (100% reinforcement)

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- RES generation facilities with a power less than or equal to 100 kVA:
  - 60% of connection costs to be borne by the applicant,
  - 60% of the extension costs to be borne by the applicant,
  - the rest is supported by network tariffs (40 % connection, 40 % extension, 100 % reinforcement)

- RES generation facilities with a power greater than 100 kVA (see above table for what is supported by network tariffs, hereafter referred to as x and y):
  - (100-x) % of the costs of the structures to be borne by the applicant
  - (100-y) % of the proportionate share shall be borne by the applicant
  - the rest is supported by network tariffs (x % own works, y % share, 100 % reinforcement).

Source:

- *Energy Code, articles L.341, L.342*

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Energy distribution

9. Who owns the networks?

In France, the public distribution networks are the property of municipalities, which may delegate all or part of their competence as the granting authority to regional syndicates. If they do not manage their distribution networks themselves, through specific public companies, the granting authorities entrust it to a distribution network operator (DSO). Thus, ENEDIS and some 160 local distribution companies share the management of the public electricity distribution networks.
Delegation contracts are negotiated independently by each granting authority. However, in 2018 a common template for such contracts has been published by the federation of granting authorities (FNCCR - Fédération nationale des collectivités concédantes et régies).

Source:

- *Energy Code, article L.322*
- *Local Authorities Code, article L.2224-31*

10. Who can intervene through tech investments on the network?

Only DSOs and TSOs can intervene on the network.

11. How are grid investments remunerated?

For public electricity distribution networks, unlike for investments relating to the electricity transmission network, the regulator (CRE) has no approval powers conferred by law for the investment programmes of DSOs.
The forecast programmes for planned investments on the distribution networks are drawn up at regional conferences organised under the aegis of prefects.
The distribution network tariff is determined in particular by the investment trajectory as forecasted by DSOs and covers all the capital costs of the investments for the entire investment programme.

Source:

- *Local Authorities Code, article L.2224-31*
- *Energy Code, article L.111-56-1*

12. Who can be DSO and what is the procedure to become one?

As previously explained, delegation contracts are negotiated independently by each granting authority. The organisation which is granted the role of DSO then has the monopoly for this activity during the contract duration (often 30 years).
If they do not manage their distribution networks themselves, through specific public companies, municipalities (owner of the network) are obliged to delegate it to ENEDIS or to a local distribution company.
The selection of DSOs is therefore not open to competition.
Source:

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- *Energy Code*
- *Local Authorities Code*

13. Can there be more DSOs on the same network?

A distribution system can only be operated by one DSO.
Source:

- *Energy Code*

14. Which metering and storage and load balancing technologies are admitted by the regulator?

Metering technologies
See above section on metering.
Load balancing technologies
See above section on demand response.
Storage technologies
The following figure depicts the different services that storage can provide.

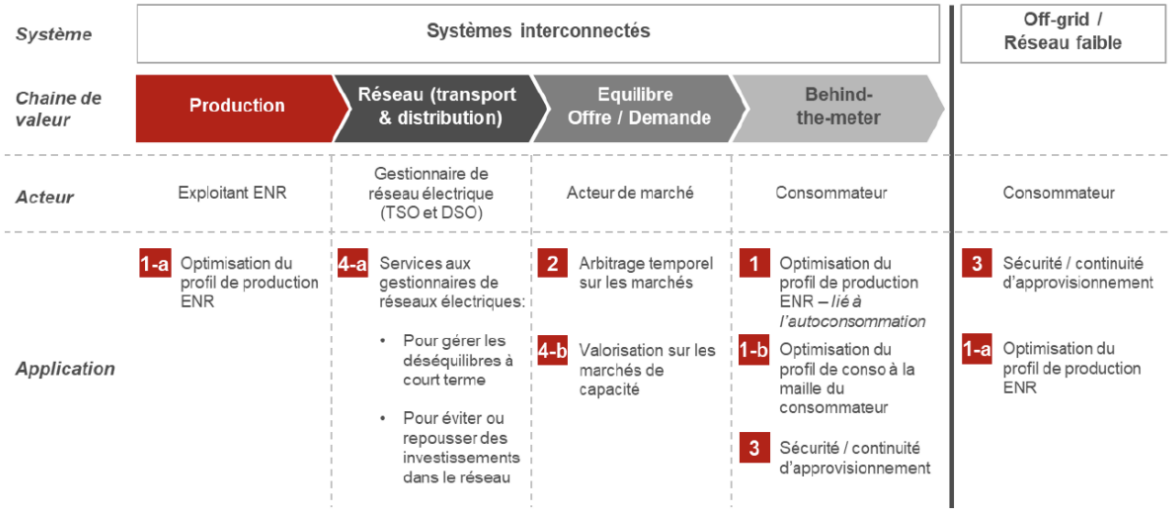

Figure 16 - Services provided by storage (Source: CRE)

Services provided by storage at generation and consumption level are not regulated. Services provided to transmission and distribution operators must be done in a competitive environment. Network operators do not have the vocation to develop, manage or operate storage assets in accordance with Articles 36 (concerning the operators of distribution networks) and 54 (concerning transmission system operators) of the (EU) Directive 2019/944. Indeed, the exercise by a monopoly network operator of a such activity could delay or even prevent the development of this segment, ultimately leading to higher costs borne by the community, in addition to generating potential subsidies between electricity storage and regulated activities.

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However, by way of derogation, in accordance with the Directive, system operators can own, manage, operate or develop storage facilities, subject to the approval of CRE, and if the following conditions are met:

- a market failure has been identified following an open tender procedure in an area concerned;
- such facilities are necessary for network operators to fulfil the obligations for the efficient, reliable and secure operation of their networks, and These are not used to buy or sell electricity on the markets of electricity.

It should be noted that this derogation, if implemented, can only be temporary. In this sense, consultations will have to be held at regular intervals to reassess the potential interest of other market players to engage in this sector. If this consultation is positive, network operators will have to gradually phase out their activities in this area.
The situation is different in non-interconnected areas (ZNIs) – see below.
Furthermore, in accordance with the derogation provided for in the Directive, in "micro isolated grids", system operators can own and manage storage assets.

Source:

- *(EU) Directive 2019/944*

15. Who is the regulator?

The regulator is Commission de Régulation de l'Energie (CRE) located in Paris. CRE is made of 2 independent bodies:

- The collegial board: Five commissioners, appointed for their legal, economic and technical qualifications, determine the main orientations and adopt decisions and opinions based on expert assessments from the various departments, under the authority of the president and chief executive.
- CoRDiS: The Dispute Settlement and Sanctions Committee, known by its French acroynm "CoRDiS" (Comité de règlement des différends et des sanctions), comprises four members, including two members of the Conseil d'Etat (French Council of State), and two judges from the Cour de cassation (France's Supreme Court). They are tasked with settling disputes concerning access to and use of the public electricity and gas networks between operators and users, and also with penalising infringements of the Energy Code.

16. Do small islands have a different status/regulatory set up?

See above section 7. Islands which are not connected to the mainland (zones non interconnectées - ZNIs) have a specific set up.
For instance, in ZNIs the electricity system is still vertically integrated. The incumbent operator (EDF) is in charge of electricity generation, distribution and commercialisation. Therefore, EDF's Insular Electricity Systems Division (EDF SEI) is the DSO in Corsica and most of the French overseas territories.
To offset the additional costs of electricity in ZNIs and avoid inequalities within the French population, public authorities have introduced the "contribution to the public electricity service" (CSPE). This tax, which is paid by all French citizens, helps to finance the

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additional cost of producing the electricity consumed in Corsica, the overseas territories, Mayotte, Saint-Pierre and Miquelon and the islands of Ponant and Chausey.
However, generation is open to competition, in general through public tenders. The electricity generated is then sold to EDF which is the single buyer and has long-term contracts with all generators. EDF perceives the CSPE as a compensation.

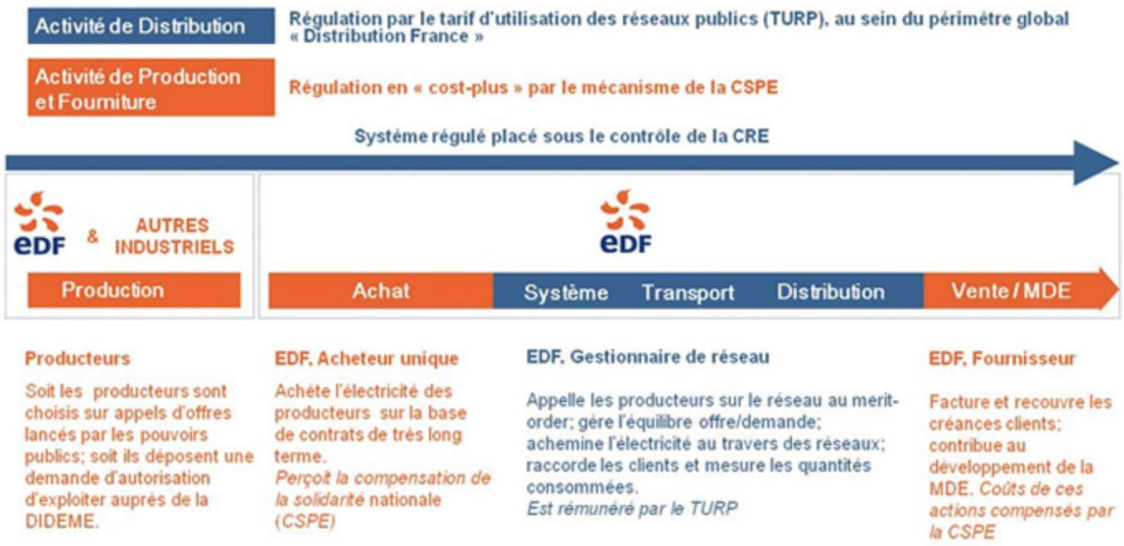

Figure 17 - Specific regulatory set-up in ZNIs

Regarding storage, there is a specific regulatory set-up as well. According to article L. 121-7 of Energy Code, DSOs are allowed to manage storage facilities if they allow avoiding additional production costs. The regulator (CRE) has established a specific support mechanism for the development of centralised storage in ZNIs to make sure that storage costs would be covered only to the level of avoided production costs.
A first call for storage projects has been held in 2017 in Corsica, Guadeloupe, Martinique and La Réunion islands. 46 applications were received and 11 were selected, for a total capacity of 50 MW (27 MW for arbitrage services and 23 MW for fast reserve). A new call for projects should be launched by CRE soon, depending on the proven economic efficiency of storage.
Source :

- *Energy Code*

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Tendering

To meet its needs for works, supplies and services, a public purchaser (State, local authority, hospital, etc.) must conclude a public contract with an economic operator. The rules that apply to these contracts are defined by the public procurement legislation.
Definition. A public contract is a contract concluded for pecuniary interest between a public purchaser and a public or private economic operator to meet the purchaser's needs for works, supplies or services.

Contracts with a value of €40,000 or more must be awarded by electronic means.

Persons eligible to apply for a public contract are defined as follows:

- When the competition procedure is at its beginning, the term “economic operator” is used to include the diversity of persons who may respond to a call for tenders.
- The “candidate” is an economic operator who applies to participate or is invited to participate in the procedure.
- The “tenderer” is an economic operator who submits a tender in the context of a public procurement procedure.

The legislation provides for 3 types of needs for the public purchaser:

- Works
- Supplies (e.g., purchase, rental)
- Services

The differentiation between these 3 types is important because some rules vary according to the qualification of the requirement (also called "subject matter of the contract") – see below thresholds.

Principles.

To ensure the efficiency of public procurement and the proper use of public funds, all public procurement must respect 3 principles:

- **Freedom of access to public procurement.** Everyone must be freely aware of a buyer's purchasing needs. This principle is guaranteed by the advertising disseminated by the buyer to make his needs known.
- **Equal treatment of candidates.** Respect for the principle of equal treatment prohibits any discrimination and extends to the entire procedure. The drafting of the specifications must be objective and not guide the choice. All tenders arriving within the time limit requested must be examined, regardless of the nationality or location of the applicant. All candidates must have equivalent information and, if one of them asks a supplementary question, the buyer must send his answer to all candidates.
- **Transparency of procedures.** Transparency allows all candidates or any interested person to check with the buyer that the first 2 principles are

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respected. The selection criteria are made known to the candidates as soon as they are advertised. They will enable the buyer to choose the most economically advantageous offer. Similarly, any tenderer whose tender is rejected must be informed of this and of the reasons for the rejection.

Companies in the energy sector. According to the Directive 2014/25/EU, transposed into the national public procurement code, public companies like EDF and its subsidiaries are bound to apply the same rules than public bodies.
Thresholds. The following thresholds apply:

Type	Buyer	Advertising non mandatory	Advertising mandatory with free procedure	Advertising mandatory in national public tendering journal	Advertising mandatory in national public tender journal and in EU official journal
Supplies and services	State & national bodies	Below 40,000€	From 40,000€ to 89,999€	From 90,000€ to 138,999€	From 139,000€
	Local authorities and other buyers	Below 40,000€	From 40,000€ to 89,999€	From 90,000€ to 213,999€	From 214,000€
Works	All public bodies	Below 40,000€	From 40,000€ to 89,999€	From 90,000€ to 5,349,999€	From 5,350,000€
Social and specific services	State & national bodies	Below 40,000€	From 40,000€ to 749,999€	No	From 750,000€ (only in EU official journal)
	Local authorities and other buyers	Below 40,000€	From 40,000€ to 749,999€	No	From 750,000€ (only in EU official journal)

Table 8 - Public procurement thresholds in France

Source:

- *Public procurement code*

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List of Regulatory Sources

Title (EN)	Title (FR)	Abbreviation (FR)	Version
Energy Transition Law for Green Growth	Loi de transition énergétique pour la croissance verte	LTECV	LOI n° 2015-992 du 17 août 2015
Energy Code	Code de l'énergie		Version consolidée au 24 avril 2020
Urban planning Code	Code de l'urbanisme		Version consolidée au 1 mars 2020
Energy-Climate Law	Loi Energie Climat		LOI n° 2019-1147 du 8 novembre 2019
Local Authorities Code	Code général des collectivités territoriales		Version en vigueur le 10 novembre 2019
Self-consumption decree	Décret n° 2017-676 relatif à l'autoconsommation d'électricité		28 avril 2017
Public procurement code	Code des marchés publics		

Table 9 - List of Regulatory Sources in France

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A1.3 Germany

Energy Generation

1. Who can produce energy?

According to the Energy Act, everybody (both domestic as industrial actors) can generate electrical energy, as long as the following conditions are fulfilled by the generator:

- The generation units fully align with national network codes, its functional requirements and processes, depending on voltage level and power cluster.
- The generation units are designed, erected and operated according to the state of the art as described in applicable technical standards, in order to ensure a high level of operational safety.

Source:

- *Energy Act (EnWG) §§ 19, 49*

2. Which innovative technologies are regulated (and not)?

The following innovative technologies are regulated in Germany:

- Smart metering via the Metering Act and related technical guidelines from the Federal Institute of Information Security (BSI)
- Feed-in management for RES generation during times of network congestions

The following innovative technologies are currently not regulated in Germany (subject to change with the implementation of (EU) 2019/944 until Jan 2021):

- Energy Management systems unless the interfaces and functionalities to smart metering systems are affected
- Market-based DR
- Aggregation of generation

Source:

- *Energy Act (EnWG) §13*
- *Renewable Energy Act (EEG) §14*
- *Metering Act (MsbG)*
- *BSI-TR 03109*

3. How are prosumer and/or blockchain metering models allowed?

The prosumer metering model is realized by the mandatory functionalities outlined in the FNN basic meter and smart meter gateway requirement specifications. The meter shall support the bidirectional metering of active power and communicate these metering values though the smart meter gateway to the meter operator, where the meter is connected to a smart metering system. Furthermore, a local display on the meter shall indicate the direction of the active power flow in any case.
A blockchain metering model is whether supported by the technical and functional specifications nor by the implemented market communication procedures.

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Source:

- *FNN basic meter functional requirement specification (FNN Lastenheft BZ-Fkt)*
- *FNN smart meter gateway functional requirement specification (FNN Lastenheft SMGw-Fkt)*

4. Which RE sources can link to the grid?

RES that can link to the grid are:

- Hydropower
- Landfill gas, sewage gas, mine gas
- Biomass
- Geothermal energy
- Wind energy
- Photovoltaic

Source:

- *Renewable Energy Act (EEG)*

5. Which metering models are allowed (front of, back of etc)?

In Germany, the metering model is determined by the Metering Act which generally distinguishes between a smart (intelligent) metering system, and a modern meter:

- A modern meter is defined logically as an electronic meter, that reflects the actual consumption and time of use, and could be connected to a smart metering system via a smart meter gateway (SMGW).
- A smart metering system includes a modern meter connected to a SMWG and to advanced metering infrastructure, that fulfils the use cases of the relevant technical rules, e.g. BSI protection profiles and BSI-TR 03109 framework regarding data privacy, cybersecurity and interoperability.

All customers shall be at least equipped with modern meters until 2032. As the Cost-Benefit Analysis in Germany has been assessed negatively in general, a smart metering system rollout is mandatory in the following cases:

- Final customers with an annual consumption above 6000 kWh;
- Final customers participating in DR schemes via controllable loads and interruptible supply contracts;
- DER operators (both prosumers/producers) with installations above 7 kW capacity.

All other customers can demand a smart metering system on specific request, where different price caps apply for different groups of customers.
Source:

- *Metering Act (MsbG)*

6. How is energy price determined (free, regulated etc)?

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In Germany, the average domestic consumption-based electricity price beginning of 2020 is 31,37 ct per kWh, thereof:

- 16,48 ct taxes and fees (regulated)
- 7,71 ct grid costs incl. metering and billing (regulated)
- 7,18 ct energy procurement (unregulated)

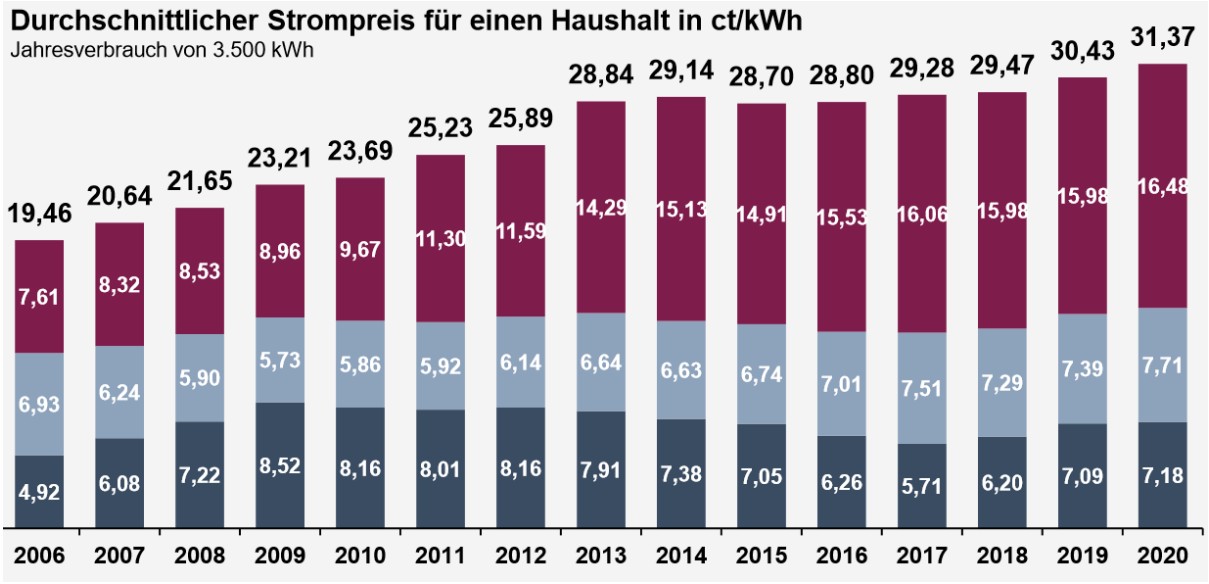

Figure 18 - Structure of German electricity proce (Source: BDEW)

So the procurement costs equals 23% of the electricity price is mainly determined by the costs of generation and belongs to the unregulated part.
Roughly 7 ct/kWh included in the regulated part of taxes and fees is assigned to the renewable energy incentive scheme in order to subsidize the national generation of renewable energies

7. Do small islands have a different status/regulatory set up?

There is no specific regulatory setup for generation on islands.

8. Grid connection cost?

Based on the Energy Act, system operators are obliged to provide grid connections to their under appropriate, non-discriminatory and transparent conditions. The costs of grid connection depend on the voltage level to which the generator is connected.
Low voltage (<1 kV) connected generators
DSOs are entitled to demand appropriate building cost subsidies from final customers to be connected, incl. prosumers/producers. According to the Low Voltage Connection Regulation, building cost subsidies might only be demanded for the part of the requested connection capacity exceeding 30 kW, meaning that standard household connections are not affected in general. Building cost subsidies shall not exceed 50% of the total connection costs.

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Medium to high voltage (>1 kV) connected generators
For final customers to be connected to medium voltage level, the Federal Network Agency has decided that the following formula applies:
Building cost subsidies = Capacity price (>2.500 h/a) of the voltage level × ordered capacity
High voltage (>110 kV) connected bulk generators >100 MW
For bulk generation units >100MW connected to >110 kV, the generator shall pay for the full connection costs to the nearest connection point incl. reinforcement for this connection point according to the Power Plant Connection Regulation.

Source:

- *Energy Act (EnWG) §17*
- *Low Voltage Connection Regulation (NAV) §11*
- *Federal Network Agency position paper on building costs subsidies above LV level*
- *Power Plant Connection Regulation (KraftNAV) §8*

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Energy distribution

9. Who owns the networks?

Distribution networks incl. all assets are owned by the relevant DSOs based on concessions. According to the Energy Act, municipalities shall generally make their public routes available for the installation and operation of electrical lines in a non-discriminatory manner.

Concessions shall be based on contracts, where the system operator shall publish relevant technical and economic parameters of the grid equipment concerned and pays the municipality appropriate concession fees based on kWh. The contract period is hereby limited to 20 years. Where a new concession holder physically takes over grid equipment from a previous concession holder, he shall pay a reasonable compensation based on fair value and capitalized value. The take-over of a grid part also increases the new concession holder's revenue cap

Source:

- *Energy Act (EnWG) §§46-48*

10. Who can intervene through tech investments on the network?

The intervention on networks depends on the smart grid asset type under consideration, more specifically:

- **Network reinforcements** - only the system operator (both DSO and TSO) under approval of the regulator
- **Innovative grid controls (e.g. dynamic line rating)** - only the system operator (both DSO and TSO) under approval of the regulator
- **Smart meters** – only the system operator (both DSO and TSO) or the responsible metering operator contracted by the relevant system operator.
- **Generation (incl. RES and DER)** – only the owner/operator under consideration of the relevant network codes.
- **Storage** – currently only the owner/operator under consideration of the relevant network codes. With future implementation of the new Electricity Market Directive (EU) 2019/944, the system operator (both DSO and TSO) might be allowed to operate storage as fully integrated network component (FINC) under specific conditions.
- **EV charging** - currently only the owner/operator under consideration of the relevant network codes. With future implementation of the new Electricity Market Directive (EU) 2019/944, the DSO might be allowed to operate storage under specific conditions.

Source:

- *Energy Act (EnWG)*
- *Metering Act (MsbG)*

11. How are grid investments remunerated?

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The remuneration of grid investments is driven by the mechanisms of the Incentives Regulation. The basic principle is the definition of revenue caps for system operators, based on a comprehensive cost examination and benchmarking, which sets the target for grid fees within a regulatory period of 5 years. More efficient system operators are allowed to keep additional revenue which should provide more motivation for further cost reduction. System operators with <30,000 electricity customers fall under the de-minimis rule and are allowed to apply a simplified process for efficiency grade determination

Costs are generally distinguished between controllable and non-controllable costs, where grid investments fall under non-controllable costs. However, grid investments always shall have the purpose of being appropriate investments and shall be approved by the national regulator Bundesnetzagentur especially for

- Grid connection of generators
- Integration of RES
- Replacements of HV overhead lines by cables
- Restructuring measures to guarantee technical state of the art and safety
- Installation of high-temperature conductors and lines
- HVDC systems

Grid investments cover both CAPEX and OPEX (TOTEX) and are remunerated via the regulation formula in Annex 1 of the Incentives Regulation.

Source:

- *Incentives Regulation (ARegV) §23, Annex 1*

12. Who can be DSO and what is the procedure to become one?

DSO can be any legal person that fulfils the technical and procedural requirements of the Energy Act and its related regulations. This applies to both public and closed distribution systems.
The DSO applicant shall prove its capability of fulfilling the technical and procedural requirements and need to obtain a DSO license from the regulator, the Federal Network Agency (Bundesnetzagentur).
Furthermore, the DSO applicant shall also obtain concessions from the affected municipalities/legal authorities for its operation area based on the procedures outlined in the Energy Act. There are basically two options:

- Take over concessions and existing (part of a) network and from another DSO
- Obtain concessions for a new network area and erect a new-build distribution system.

Source:

- *Energy Act (EnWG)*

13. Can there be more DSOs on the same network?

A distribution system can only be owned and operated by one DSO based on the concessions obtained.

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Source:

- *Energy Act (EnWG) §§46-48*

14. Which metering and storage and load balancing technologies are admitted by the regulator?

Metering technologies

BSI-TR 03109 defines the functional, interoperability and cybersecurity provisions for smart metering systems, while component specific requirements are outlined in the FNN basic meter and smart meter gateway requirement specifications.
BSI-TR 03109-1 lays down interoperability and security requirements for the SMGW, referring to functionalities stated in 2012/148/EU. It therefore defines the functionalities via use cases and provides specific per-layer descriptions (protocol stack) of required communication interfaces based on standards:

- LMN: the local metrological network interface exchanges metering information with modern meters, including electricity, gas, water and heat;
- WAN: the wide area network interface exchanges information with external market parties (e.g. for DR) and the SMGW admin;
- HAN: the home area network exchanges information with controllable loads and generators.

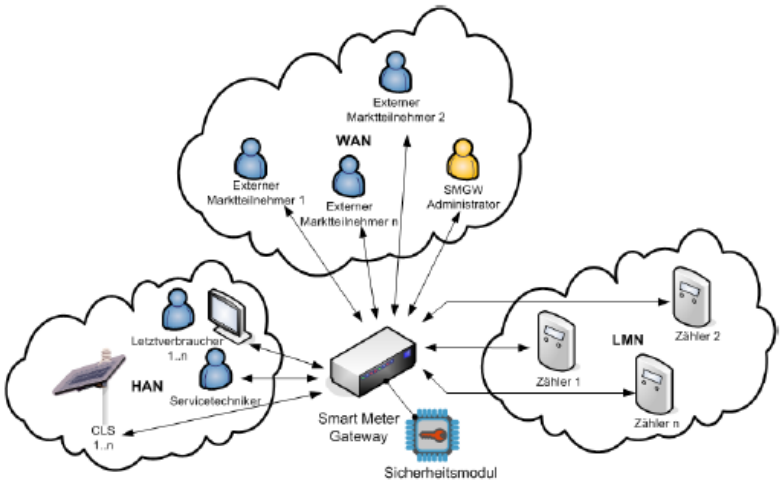

Figure 19 - Smart Meter architecture with key interfaces according to BSI-TR 03109-1

The following use cases shall be supported by smart metering systems as minimum requirements:

- For WAN communication
  - Administration and configuration
  - Service access for SMGW admin
  - Provision of alarms and notifications
  - Data communication to SMGW admin and external, eligible parties

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  - Communication between external parties and controllable loads
  - Wake-up service

- For tariffing and balancing
  - Data saving tariffs
  - Time variable tariffs
  - Load variable tariffs
  - Consumption variable tariffs
  - Prepaid tariffs
  - Event variable tariffs
  - Meter readings on specific request
  - Counter readings
  - Reading of minimum and maximum power peaks
- For controllable loads
  - Provision of current feed-in data of generation/DER
  - Remote switching of controllable loads and generation/DER
- For grid status information
  - Provision of grid status information

Storage Technologies

There is no regulatory limitation of storage technologies, as long as the specific type of storage fulfills the requirements of the applicable network codes at the connection point (mainly by the inverter).

Load balancing technologies

There is no regulatory limitation of load balancing technologies.

Source:

- *BSI-TR 03109*
- *FNN basic meter functional requirement specification (FNN Lastenheft BZ-Fkt)*
- *FNN smart meter gateway functional requirement specification (FNN Lastenheft SMGw-Fkt)*

15. Who is the regulator?

The regulator is the Federal Network Agency (Bundesnetzagentur) located in Bonn. The Ruling Chamber 6 of the Federal Network Agency is responsible for all enquiries regarding electricity networks.

16. Do small islands have a different status/regulatory set up?

There is no specific regulatory setup for islands in general. According to the Electricity Tax Act the energy tax of 2,05 ct/kWh does not apply for the islands Helgoland and Büsingen.

Source:

- *Electricity Tax Act (StromStG) §1*

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Tendering

Public clients

Public clients may only award contracts for deliveries and services by means of an award procedure. According to the Restriction of Competition Act, these public clients include

- Federals
- States
- Local authorities and municipalities
- Utilities with monopoly status effectively controlled by authorities (especially TSOs, DSOs and Stadtwerke for electricity, gas and heat) and that fall under the Sectoral Regulation

The reasons for this are the sparing use of funds and the fight against corruption and nepotism. All contractors should be given fair and non-discriminatory access to public procurement markets. Within the EU, this means that contractors shall be given access to contracts from other Member States.
Public clients can choose between different types of procedures for the award of public contracts according to the Regulation on the Award of Public Contracts and the Procedures for the Award of Contracts for public supplies and services. However, they generally have to choose the public tender procedure which is called open procedure above the EU threshold. According to (EU) 2019/1827 – 1930, the EU thresholds from 2020 are as follows:

- 5.350.000 EUR for construction works
- 5.350.000 EUR for concessions
- 139.000 EUR for deliveries and services ordered by governmental authorities
- 214.000 EUR for deliveries and services ordered by other public clients
- 428.000 EUR for deliveries and services in the energy sector

The procurement intent shall made public in appropriate sources such as newspapers, public accessible procurement portals or www.bund.de. Some federal states also operate federal procurement portals. Once the EU thresholds have been reached, the publication of the tender must also be sent to the Official Journal of the EU, which will translate the publication of the tender into all official languages of the EU and publish on the portal "Tenders Electronic Daily" (TED). Also orders below the threshold values can be published on the TED portal on request.
The contracting authority can only choose other special types of procedure if there are special reasons such as

- the performance by its nature can only be carried out in a suitable manner by a limited group of contractors, especially if exceptional expertise or performance or reliability is required
- the public tender would cause an effort for the client or the applicants which would be disproportionate to the achievable advantage or the value of the service,
- a public tender has had no economic result, or
- a public tender is inappropriate for other reasons (e.g. urgency, confidentiality).

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Other special types of procedure are

- The restricted tender procedure above the EU threshold, which stipulates that only a limited group of contractors will be invited to submit tenders

- The procedure for direct award, referred to as negotiation procedure for awards above the EU threshold, which allows, among other things, negotiations on the terms of the contract with the contractors and the procedure for competitive dialogue, which is only provided for Europe-wide tenders, and even more for the contracting authority Allows scope for negotiations with the bidders.

These special types of procedure are preceded by a public participation competition in which suitable contractors are selected, who are then asked to submit an offer. In very special and limited exceptional cases, a restricted invitation to tender, a direct award or an EU-wide negotiation process can also be carried out without a competition.
For awards in the upper threshold range, the public client must inform all bidders whose offers should not be taken into account of this decision before placing the order. They then have the opportunity to submit an application for review of the award procedure to the responsible public procurement chamber.
Only for construction works, specific regulations apply in Germany according to the Procedures for the Award of Contracts for Construction Services (VOB).
For the energy sector, the specific tendering procedural requirements of the Sectoral Regulation apply.

Private clients

Private clients which are not public clients according to the Restriction of Competition Act and Regulation on the Award of Public Contracts are not restricted according to the formal tendering rules. Typical tendering procedures that apply in Germany are:

- RFI (Request for Information): Inquiry to potential contractors as to whether they could basically meet a sketched requirement. The answers given usually contain list prices. This variant of the tender is suitable for the first exploration of the market.
- RFQ (Request for Quotation): For a detailed requirement (specification), a description of the service is requested with a price that is as precise as possible, but usually non-binding. These inquiries are sent to contractors whose basic capability the client is already convinced of.
- RFP (Request for Proposal): Tender in the usual sense, the submitted offers are binding within the specified period of validity. The requests for tenders contain a detailed specification of services or a specification as well as all additional agreements belonging to the contract. Tendering procedures are also used within (larger) companies. In principle, there is no obligation to accept one of the offers.
- RFF (Request for Feature): Request to expand a system or offer.

Source:

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- *Restriction of Competition Act (GWB)*
- *Sectoral Regulation (SektVO)*
- *Regulation on the Award of Public Contracts (VgV)*
- *Procedures for the Award of Contracts for Construction Services (VOB)*
- *Procedures for the Award of Contracts for public supplies and services (VOL)*

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List of Regulatory Sources

Title (EN)	Title (DE)	Abbreviation (DE)	Version
Federal Network Agency position paper on building costs subsidies above LV level	Positionspapier der BNetzA zur Erhebung von Baukostenzuschüssen (BKZ) für Netzanschlüsse im Bereich von Netzebenen oberhalb der Niederspannung	-	2009-03-27
Incentives Regulation	Anreizregulierungsverordnung	ARegV	2007-10-29 Amd 2019-12-23
Technical rules for smart metering systems and the secure operation	Technische Vorgaben für intelligente Messsysteme und deren sicherer Betrieb	BSI-TR 03109	https://www.bsi.bund.de/DE/Publikationen/TechnischeRichtlinien/tr03109/index_htm.html
Renewable Energy Act	Erneuerbare-Energien-Gesetz	EEG	2014-07-21 Amd 2019-11-20
Energy Act	Energiewirtschaftsgesetz	EnWG	2005-07-07 Amd 2020-04-21
Restriction of Competition Act	Gesetz gegen Wettbewerbsbeschränkungen	GWB	1998-08-26 Amd 2020-03-25
Power Plant Connection Regulation	Kraftwerks-Netzanschlussverordnung	KraftNAV	2007-06-26
Metering Act	Messstellenbetriebsgesetz	MsbG	2016-08-29 Amd 2019-11-20
Low Voltage Connection Regulation	Niederspannungsanschlussverordnung	NAV	2006-11-01 Amd 2019-03-14
Sectoral Regulation	Sektorenverordnung	SektVO	2016-04-12 Amd 2018-07-10
Electricity Tax Act	Stromsteuergesetz	StromStG	1999-03-24 Amd 2019-06-22
Regulation on the Award of Public Contracts	Vergabeverordnung	VgV	2016-04-12 Amd 2019-07-12
Procedures for the Award of Contracts for Construction Services	Vergabe- und Vertragsordnung für Bauleistungen	VOB	https://www.beuth.de/de/themenseiten/vob allgemein
Procedures for the Award of Contracts for public supplies and services	Vergabe- und Vertragsordnung für Leistungen	VOL	
FNN basic meter functional requirement specification	FNN Lastenheft Basiszähler - Funktionale Merkmale	FNN Lastenheft BZ-Fkt	v1.4.1

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Title (EN)	Title (DE)	Abbreviation (DE)	Version
FNN smart meter gateway functional requirement specification	FNN Smart-Meter-Gateway - Funktionale Merkmale - Lastenheft	FNN Lastenheft SMGw-Fkt	v1.2

Table 10 - List of Regulatory Sources in Germany

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A1.4 Greece

Energy Generation

1. Who can produce energy?

For the mainland

Individuals with citizenship of a Member State of the EU or Legal Entities or Joint Ventures with headquarters in a Member State of the EU. They can submit application for license of energy production, or they can produce, even without license, depending on the energy production technology and the maximum power, they envision to produce.
The licensing procedure is complex but its simpler for lower installed power. In general, the required licenses are:

1. License for Electrical Energy Production

They don't need license for Electrical Energy Production the following categories

- Geothermal Power Units with electrical power lower than 0.5 MW
- Biomass, Biogas and Biofuel with electrical power lower than 1 MW
- PV or Solar Thermal with electrical power lower than 1 MWp
- Wind Systems with electrical power lower than 100 kW
- Hydro systems with electrical power production lower than 50 kW
- CHP with electrical power lower than 1 MWh
- RES or CHP units for Research or Educational Purposes lower than 5 MW
- RES or CHP units for Autonomous Systems lower than 5 MW

2. License for Environmental Protection

They don't need license for Environmental Protection (But they need to accept Environmental Compliance Regulations) the following:

- Wind with install power up to 5 MW o
- PV with installed power from 20 kWp to 2 MWp or for smaller systems if in Natura Zone

3. Connection Terms

Till 8 MW the Terms are given by HEDNO and for higher power from IPTO

4. Installation License

In general, it's not needed for small works (e.g. lower than 1000 kW)

5. Contracts for Selling Energy and Contracts Connection to the Grid

6. Civil Works Licenses

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7. Operation License

In general, it's not needed for small works (e.g. lower than 1000 kW)
For Small PV systems installed in Houses (<10kWp) the procedure is simpler.

For the Non-Interconnected Islands

People or entities or ventures, who:

- Have been succeeded in a public tender / procedure according to law 2773/1999
  - If the public tender fails to declare a concessionaire, then the PPC is entitled to produce energy
- They want to produce with RES or they are self-producers

Sources:

- *Y.A.17951/00 ΦΕΚ Β' 1498/8-12-00*

2. Which innovative technologies are regulated (and not)?

Smart Metering is foreseen (law 4001/2011) and promoted as technology (minister decision Δ5/ΗΛ/Α/Φ33/2067 - ΦΕΚ Β 297 - 13.02.2013) but there is not a strict regulatory framework regarding their operation, data management and usage (as stated in various recent press articles). Nevertheless, the Greek Regulatory Authority for Energy, expects that their usage will be broader (Decision Number RAE: 409/2020 ΦΕΚ 1364). There is a new regulatory framework for metering devices, which includes Telemetering Meters and not explicitly smart meters (RAE Decision Number 30/2020)

3. How are prosumer and/or blockchain metering models allowed?

Prosumers are allowed through the Energy Communities, which have been established under the law 4513/2018.
There as is no legislation for Blockchain metering models.

4. Which RE sources can link to the grid?

RES that can link to the grid are:

- Hydropower
- Landfill gas, sewage gas, mine gas
- Biomass
- Biofuels with/without gasification
- Geothermal energy
- Wind energy
- Photovoltaic
- Electrical Solar Thermal Systems (with/without storage)
- All other RE compatible with EU laws

Source: Laws: 3851/2010, 4414/2016, 4685/2020

5. Which metering models are allowed (front of, back of, etc.)?

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In Greece the meters are catagorized accordingly to:

- Type
  - Eletromechanical Meters (only installed in LV)
  - Electronic Meters without remote control
  - Electronic Meters with remote control
- Voltage Level
  - Load Meters (LV, MV, HV)
  - Production Meters (LV, MV, HV)
- Data collection
  - Remote Data Collection., where data collected remotely
  - Non- Remote Data Collection, where data are collected locally
- Energy Data Logging
  - Hourly loggers. They log the energy consumption at least every hour
  - Non-Hourly loggers. They continuously add the energy consumption, without hourly logging.
- Position
  - Meters in the Network-User border
  - Internal Meters, in the user local grid.

The next 2 categories are valid only for the non-interconnected islands

- If the production is higher than 2 MVA, a second alternative meter (validation meter) is required
- In Power Production Plants, other meters might be required to measure for example enthalpy of steam, fuel etc. according to Minister Decision (Υ.Α. Δ6/Φ1/Οικ 8765/6.5/2010 ΦΕΚ Β' /179/2012) for clearance purposes.

Source: RAE Decision Number 30/2020

6. How is energy price determined (free, regulated, etc.)?

In Greece the domestic tariffs from the PPC can be estimated from the next tables (without COVID19 tariff change which will be valid for a short period of time).

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Non-Regulated - Procurement		
Range	Variable Cost (€/kWh)	Fixed Cost (€) per 4 month
0-2000 kWh (Total Consumption)	0.11058	1.69 – 1 Phase / 5.32 (3 Phase)
>2000 kWh (Total Consumption)	0.11936	

Regulated							
	Transmission		Distribution		Other	RES	Social
Range	Power	Energy					
Units	€/(kVA*PF)/year	(€/kWh)	€/(kVA*PF)/year	(€/kWh)	(€/kWh)	(€/kWh)	(€/kWh)
0-1600	0.13	0.00542	0.52	0.0213	0.00007	0.017	0.0069
1601-2000							0.05
>2001							0.0850

Taxes	
Special Consumption Tax	0.0022 €/kWh
Special Tax	0.5% on costs of procurement + regulated + Special Tax Cost – RES
VAT	6% on Procurement+ Regulated + Special Tax

Table 11 - Domestic tariffs in Greece

Example

Data: 4 Month Consumption - 1100 kWh - PF=1 - 8 kVA of max power.

Unregulated costs
1.69 + 0.11058*1100 = 123.33 €

Regulated costs
Transmission
0.13*8*(120/365)+1100*0.00527 = 6.14 €

Distribution
0.52*8*(120/365)+1100*0.0213 = 24.8 €

Other
0.00007*1100=0.08 €

Social
0.0069*1100=7.59 €

RES
0.017*1100=18.70 €

Total Regulated
57.31 €

Taxes

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Special Consumption Tax:
0.0022*1100 = 2.42 €

Special Tax
(123.33+57.31-18.7+2.42)*0.5%=0.82 €

VAT
(123.33+57.31+2.42)*6%=10.98 €

Total Tax:
14.22
Total Cost for 1100 kWh = 194.86
Average cost:
194.86/1100 = **0.177 €/kWh**

Source:

- *https://www.dei.gr/Documents2/TIMOLOGIA/NEA-TIMOLOGIA-SEPT2019/PARADEIGMATA-XREOS/PARADEIG-OIKIAKO-G1-04092019.pdf*

7. Do small islands have a different status/regulatory set up?

There is a distinction between interconnected and non – interconnected islands with the mainland. The non-interconnected islands have in most cases different status in, for energy production licensing and tariff. For consumption, energy cost is the same as the interconnected network (for each energy provider)

8. Grid connection cost?

If Consumer:
The final customer pays a portion of the grid connection. There is a Minister Decision (Δ5ΗΛ/Β/Φ1.10/6636) that regulates the costs and the days required for each type of connection. The final prices are provided by the DSO considering for a) the voltage level, b) Phases, c) type of use d) area in Greece, e) distance from connection point etc. It's a complex procedure. For more details, please check these documents: MV & LV

If Producer:
For PV: If no new grid works are required, then the following table describes the costs.

Voltage Level	Phases	PV Power (kWp)	Cost without new meter (€)	Cost with new meter (€
LV	1	=< 5	300	370
	3	=<55	300	390
	3	55-110	450	
MV	3	=<500	650	

Table 12 - Connection costs without new grid works

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Energy distribution

9. Who owns the networks?

In Greece there are 2 DSOs and 1 TSO

The whole of the Greek distribution network assets is owned by the PPC but the network is operated by the Greek DSO (HEDNO). HEDNO pays rent to PPC.
The Athens International Airport (AIA) distribution network is owned by AIA and is responsible for the distribution on electrical power in the airport and supporting areas.

Transmission Network assets are owned by the Greek TSO (IPTO). In the non-interconnected islands HEDNO is responsible for Transmission Networks

10. Who can intervene through tech investments on the network?

Only the system operator (both DSO and TSO) under approval of the regulator

11. How are grid investments remunerated?

For the national Systems

For the Greek TSO (IPTO) according to their annual financial statements the new investments are covered by the consumers and grands.

For the Greek DSO (HEDNO) the grid investments are approved by the Regulatory authority and then they paid with a regulated price for recovering the required capital (according to article by the HEDNO CEO).

12. Who can be DSO and what is the procedure to become one?

The Greek Law (4001/2011) with all the relevant updates, regulates this issue. In general, any Physical or Legal Person can become a DSO and the license is provided by the Regulatory Energy Authority. The Greek laws are in accordance with the EU Directive 2009/72 and 2016/1388.

In Greece there is the National Greek Distribution Grid, which is operated by HEDNO. HEDNO operation is regulated by Regulatory Energy Authority.
The DSO for the Athens International Airport is granted a special license with the law 4001/2011
Other DSOs may exist in closed/private networks interconnected with the Transmission Grid which is a monopoly.

13. Can there be more DSOs on the same network?

There is not a clear answer, but the network operator and the owner can be different. For the case of the National Greek Distribution Grid, when the operator (HEDNO) fails to correspond to the duties, another operator can take over.

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Source:

- *Law 4001/2011 article 111*

14. Which metering and storage and load balancing technologies are admitted by the regulator?

Metering technologies

The meters have to be compatible with the DLMS/COSEM protocol in the application layer using OBIS codes

Source:

- *RAE Code*

Storage technologies

After an extensive survey, no special limitation has been found. Special care (e.g. licensing procedure, tariffs) is provided to hybrid systems in non-interconnected islands and specially in pumped storage hydropower technologies

Source:

- *Law 3468/2006 with updates.*

Load balancing technologies

15. Who is the regulator?

The regulator for Greek Energy Systems is the Regulatory Energy Authority located in Athens.
www.rae.gr

Source:

- *Law 2773/1999 as updated*

16. Do small islands have a different status/regulatory set up?

In the non-interconnected islands. The electrical energy transmission is managed by the distribution as well. Specific rules apply and a different management code.

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Tendering

Public clients

In general, there are two main categories for public tenders. Those governed by the Greek Law 4281/2014 (with the relevant updates) and those that follows the European Directives European Directive 2014/24/ and 2014/25 (Equivalent Greek Law 4412/2016 with the relevant updates).

Public clients may only award contracts for deliveries and services by means of an award procedure. These clients can be:

- Central Government
- Local authorities and municipalities
- Utilities and government controlled public transport companies
- Public Hospitals

These tenders are held in respect to the following principles.
The principle of publicity. All the public sector spending and investments have to be known to the public and known to the market representatives.
The principle of transparency. The whole process of announcing, selecting the supplier/contractor and awarding a public contract must be based on rules, which are known in advance and apply in full throughout the competition. They also need to be understood and distinguished for their clarity. It is expressly forbidden to change the terms of the tender after its announcement.
The principle of equal treatment. The terms of the competition cannot exclude companies from another country or a category of companies from the same country by introducing a policy of discrimination.
There are two kinds of tenders. Open call which everyone is permitted to submit an offer, and closed call which those who are interested submit a capability application. These applications are evaluated and then invitations are sent in order to submit an offer.
For lower contracts (In general, from 2500 €), then the Greek Law is applied.
Most public tenders for supplies, services and projects are carried out by the Contracting Authorities electronically through the online platform of the National Electronic Public Procurement System (E.S.I.DIS).
If the contract is higher than 139,000 € for services and supplies, higher than 5,350,000 € for construction works for other services in the energy sectors 428,000 then each country is subject to European Laws and the have to be published in Tenders Electronic Daily (TED) Web site as well.

Private clients

There is not a standard procedure

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List of Regulatory Sources

Title (EN) -as being translated by CERTH/CPERI	Title (GR)	Version (Original Laws)
Regulation for Energy Production and Procurement	Κανονισμός Αδειών Παραγωγής και Προμήθειας Ηλεκτρικής Ενέργειας	MD 17951/2000
Deregulation of the Greek Energy Market	Απελευθέρωση της Αγοράς ηλεκτρικής ενέργειας	Law 2773/1999
Replacement of metering system of final electrical energy consumption	Αντικατάσταση συστημάτων μέτρησης τελικής κατανάλωσης ηλεκτρικής ενέργειας	MD 2067/2013
For the operation of Energy Markets (Electrical and Natural gas). For research, production and networks of Hydrocarbon	Για τη λειτουργία Ενεργειακών Αγορών Ηλεκτρισμού και Φυσικού Αερίου, για Έρευνα, Παραγωγή και δίκτυα μεταφοράς Υδρογονανθράκων	Law 4001/2011
Approval of Meter Manual and Methods of the Management Code of the EDDIE	Έγκριση Εγχειριδίου Μετρητών και Μετρήσεων του Κώδικα Διαχείρισης του ΕΔΔΗΕ	RAE 30/2020
Energy Communities	Ενεργειακές Κοινότητες και άλλες διατάξεις.	Law 4513/2018
To speed up the growth of the RES for climate change mitigation	Επιτάχυνση της ανάπτυξης των Ανανεώσιμων Πηγών Ενέργειας για την αντιμετώπιση της κλιματικής αλλαγής	Law 3851/2011
New law for the Funding of RES, CHP Units, and high efficiency Heat systems.	Νέο καθεστώς στήριξης των σταθμών παραγωγής ηλεκτρικής ενέργειας από Ανανεώσιμες Πηγές Ενέργειας και Συμπαραγωγή Ηλεκτρισμού και Θερμότητας Υψηλής Απόδοσης -	Law 4414/2016
Updating of the Environmental Laws. Integration into their Greek legislation Directives 2018/844 and 2019/692 of the European Parliament	Εκσυγχρονισμός περιβαλλοντικής νομοθεσίας, ενσωμάτωση στην ελληνική νομοθεσία των Οδηγιών 2018/844 και 2019/692 του Ευρωπαϊκού Κοινοβουλίου και του Συμβουλίου	Law 4685/2020
Estimation of cost participation for LV users	ΣΥΣΤΗΜΑ ΥΠΟΛΟΓΙΣΜΟΥ ΣΥΜΜΕΤΟΧΩΝ ΚΑΤΑΝΑΛΩΤΩΝ ΧΑΜΗΛΗΣ ΤΑΣΗΣ	

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Title (EN) -as being translated by CERTH/CPERI	Title (GR)	Version (Original Laws)
Estimation of cost participation for MV users	ΣΥΣΤΗΜΑ ΥΠΟΛΟΓΙΣΜΟΥ ΣΥΜΜΕΤΟΧΩΝ ΚΑΤΑΝΑΛΩΤΩΝ ΜΕΣΗΣ ΤΑΣΗΣ	
Procedure of user Connections to the Greek Transmission System	Διαδικασία Σύνδεσης Χρηστών στο Ελληνικό Σύστημα Μεταφοράς Ηλεκτρικής Ενέργειας	2012
Update of costs and factors for the estimation of user cost in the distribution grid	Αναπροσαρμογή των τιμών και των συντελεστών των συστημάτων υπολογισμού Συμμετοχών για την σύνδεση πελατών στο Δίκτυο Διανομής	MD 6636/2007
Electrical Energy Production from RES, CHP and high efficiency Heat systems.	Παραγωγή Ηλεκτρικής Ενέργειας από Ανανεώσιμες Πηγές Ενέργειας και Συμπαραγωγή Ηλεκτρισμού και Θερμότητας Υψηλής Απόδοσης	Law 3468/2006
Measures to support and develop the Greek economy	Μέτρα στήριξης και ανάπτυξης της ελληνικής οικονομίας	Law 4281/2014
Public Procurement, Supply and Services (Adaptation to EU Directives 2014/24 and 2014/25 / EU)	Δημόσιες Συμβάσεις Έργων, Προμηθειών και Υπηρεσιών (προσαρμογή στις Οδηγίες 2014/24 ΕΕ και 2014/25/ΕΕ)	Law 4412/2016

Table 13 - List of Regulatory Sources in Greece

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A1.5 Italy

Energy Generation

1. Who can produce energy?

In a context of free electricity market, the various activities that characterize the sector are distinct from each other and are carried out, under a concession or free market regime, by different subjects. Electricity production is a liberalized activity that in recent years has been characterized by a remarkable development also as a result of the regulations recently issued at European and national level aimed at promoting the use of renewable sources and energy saving. In this context, numerous new operators are born which start operating on the free market, in the field of electricity production in Italy.
It is necessary that a producer, before going on to undertake the production and sale activity electricity, know the numerous regulatory and non-regulatory aspects that relate directly or indirectly to this activity. Table below summarizes, in a nutshell, the regulatory and non-regulatory aspects that an electricity producer must know, specifying the subjects that regulate and that provide each service.

	Who is regulating the service	Who provides the service
Authorization	Region/State (if P<300 MWt and off shore wind plant)	Region, local entity or State (if P<300 MWt and off shore wind plant)
Connections	Authority	DSO or Terna
Transport and distribution	Authority	DSO or Terna
Measurement	Authority	DSO or Terna
Energy transfer	Authority	Free market or GSE (Gestore dei servizi energetici)
Exchange on the spot	Authority	GSE (Gestore dei servizi energetici)
Incentives	MSE, MATTM and Authority	GSE (Gestore dei servizi energetici)

Table 14 - The regulatory and regulatory aspects that an electricity producer must know

Electricity production in Italy still largely takes place using non-renewable sources (natural gas, coal and oil), although the development of renewable sources is constantly increasing: geothermal, hydroelectric, solar and wind energy.
In order to meet Italian energy requirements, electricity also needs to be purchased from other countries. Most of the electricity Italy imports through the 25 interconnections with foreign countries comes from France and Switzerland.

Source:

- *TERNA Grid Code (§§ 4.3.2 Unità di produzione e Unità Virtuali)* https://download.terna.it/terna/Capitolo%204_8d7d19fd2b6b1c4.pdf
- *ARERA: testo unico ricognitivo della produzione elettrica – Settembre 2019 ((§§ 1.1 Produzione di energia elettrica)*

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https://www.autorita.energia.it/allegati/elettricita/TUP.pdf

2. Which innovative technologies are regulated (and not)?

The following innovative technologies are regulated in Italy:

- Smart metering as explained at point 4
- Feed-in management for RES generation during times of network congestions
- Aggregation of generation – UVAM (Unità Virtuali Abilitative Miste – decree 422/2018 of ARERA)
- Self-Supply of energy (SDC – Sistemi di Distribuzione Chiusi, SSPC – Sistemi Semplici di Produzione e Consumo)
- Energy Communities and collective self-consumption (D.Lgs. 162/19 art. 42bis)
  In Italy, we are in the planning and implementation phase of an innovative energy policy, which sees the following European legislation being implemented:
    - Regulation (EU) 2018/1999 - governance of the Energy Union and climate action
    - Directive 2018/2001 (RED II) - new update of the Renewable Energy Directive RED II), with the total transposition deadline set for June 2021 for the "official" launch of the Energy Communities;
- In the meantime, on 14/02/2020 the amendment to the DL Milleproroghe 2020 was approved which allows, through the creation of Energy Communities, the production and exchange of energy from RES (max 200 kW in LV, with incentives that cannot be combined and tax deductions)
- Non-connected minor islands (D.M. 14/02/2017)

Source:

- *ARERA: Testo unico ricognitivo della produzione elettrica*
- *Decree 422/2018 of ARERA*
- *D.Lgs. 162/19 art. 42bis*
- DL Milleproroghe 2020 (14/02/2020)
- *D.M. 14/02/2017*

3. Which RE sources can link to the grid?

Renewable energy sources were initially defined in the legislative decree n. 387/03, of transposition of the European directive 2001/77 / CE, and subsequently in the legislative decree n. 28/11, of transposition of the European directive 2009/28 / CE. In particular, pursuant to the legislative decree n. 28/11, electricity produced from renewable sources is electricity from sources non-fossil renewables:

- Wind,
- Solar,
- Aerothermal, the energy stored in the ambient air in the form of heat,

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- Geothermal, the energy stored in the form of heat in the earth's crust
- Hydrothermal and ocean, the energy stored in surface waters in the form of heat,
- Hydraulics,
- Biomass, the biodegradable fraction of products, wastes and residues of biological origin from agriculture (including vegetable and animal substances), from forestry and industries related, including fishing and aquaculture, mowing and pruning from public green areas and private, as well as the biodegradable part of industrial and urban waste.
- Landfill gas,
- Residual gases from purification processes and biogas.

The same decree defines as electricity produced from renewable energy sources both the electricity produced by plants powered exclusively by energy sources renewables and the production attributable to renewable sources (in the case of hybrid power plants), while excluding from this definition the electricity produced by storage systems. Therefore, ad example, in the case of pumping hydroelectric plants, only the electricity attributable to the natural contributions (where present) is to be considered electricity produced from renewable sources.

Source:

- *ARERA: testo unico ricognitivo della produzione elettrica – Settembre 2019 ((§§ 1.2.1 Impianti alimentati da fonti rinnovabili - definizione di fonti rinnovabili) https://www.autorita.energia.it/allegati/elettricita/TUP.pdf*
- *Legislative decree n. 387/03*
- *Legislative decree n. 28/11*

4. Which metering models are allowed (front of, back of, etc.)?

Italy was the first European country to introduce electric smart meters on a large scale for low voltage end customers and is still the first country in the world for the number of smart meters of electricity in service (over 35 million). According to a recent report from the European Commission, the Italian smart metering system, with the replacement of traditional meters since 2001, has been the most efficient in Europe[40].

According to ARERA[41] the smart metering development Italy foresaw two generation of smart metering:

- a first generation of smart metering (2001-2011)
- a second generation of smart metering (2G) with several benefits with respect to the first generation that is therefore to be replaced at the end of its life cycle

In general, the measuring equipment installed at connection, generation and measurement points consumption related to low voltage connection points must meet the minimum requirements of referred to in resolution no. 292/06[42] or resolution 87/2016 / R

[40] https://eur-lex.europa.eu/legal-content/IT/TXT/?uri=CELEX:52014DC0356
[41] https://www.arera.it/allegati/elettricita/170111smartmet.pdf
[42] Decree n. 292/06 provides " Directives for the installation of electronic electricity meters prepared for remote management for low voltage sampling points "

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/ eel[43] in accordance with the provisions of same resolutions. The functional requirements that must be ensured by smart systems second generation metering (2G) according to the provisions of Annex A to the resolution 87/2016 / R / eel also apply in the case of generation measuring points and measuring points connection measurement coinciding with pure input points, starting from the start the introduction of second generation (2G) measurement systems by each distribution company.
In the case of production plants connected to low voltage networks for which the network operator is responsible for the installation and maintenance of the measuring equipment, the technical conditions for the installation and maintenance of measurement equipment of the electricity produced are defined by the same grid operator, in accordance with what indicated in the Standards and Guides of the Italian Electrotechnical Committee and in compliance with the provisions provided.
For private clients, Public Administration or small enterprises, GSE (Manager of electric services) offer the possibility to access to the Self-consumption Portal that is a platform that allows those that intend to install for example a photovoltaic system, to obtain detailed information on the advantages of self-consumption through Guides, FAQs, Examples and Maps, to carry out technical-economic simulations on the system to be built and have support when starting to build the system. This service allows several advantages, such as savings in utility bills, enhancement of the energy produced (the Exchange on the spot, the Dedicated Withdrawal and the DM Minor Islands), ax concessions (deductions or super depreciation), Reduction of environmental impacts[44].

Source:

- *ARERA - Testo unico ricognitivo della produzione elettrica – September 2019 (§§ 3.1.5 Disposizioni relative alle apparecchiature di misura dell'energia elettrica)*
- *Decree n. 292/06*
- *Decree 4 July 2014, n. 102*

5. How is energy price determined (free, regulated, etc.)?

In Italy, the average domestic consumption-based electricity price beginning of 2020 (April) is 16,08 ct. per kWh, thereof:

- 5,71 ct. energy procurement
- 3,909 ct. transport and counter management
- 4,182 ct. grid costs
- 2,28 ct. taxes

[43] " Functional specifications enabling low voltage smart meters and performance of the related second generation (2G) smart metering systems in the electrical sector, according to Decree 4 July 2014, n. 102".
[44] https://www.gse.it/servizi-per-te/fotovoltaico/autoconsumo

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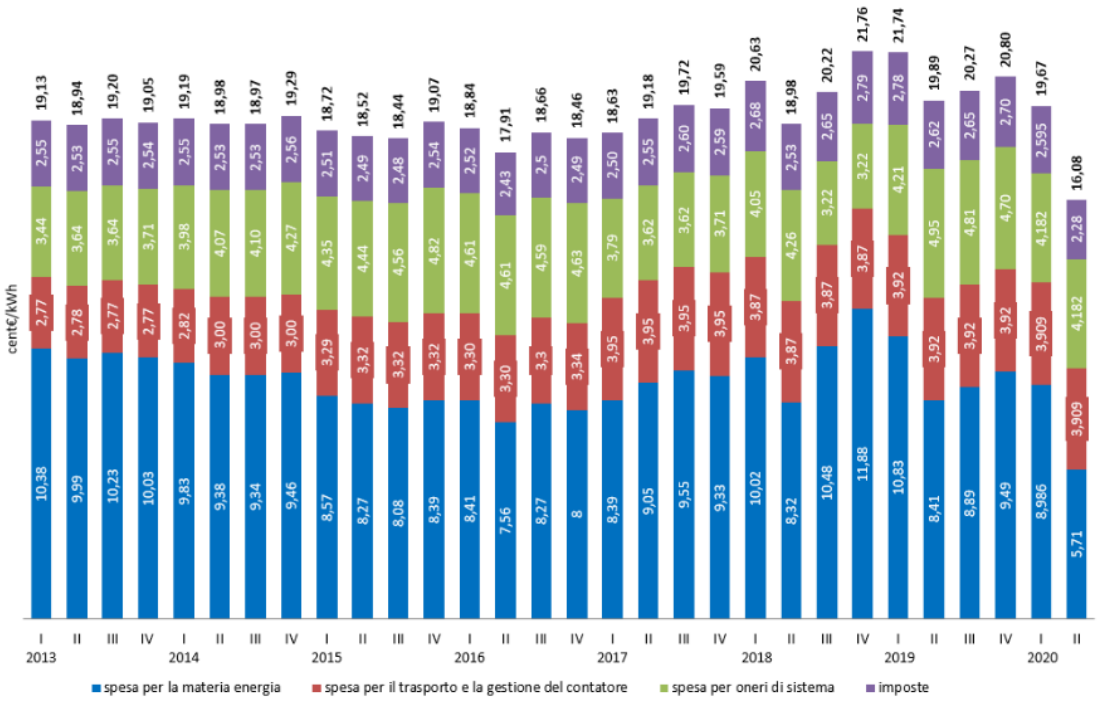

Figure 20 - Economic supply conditions for a family with 3kW of committed power and 2700 kWh of annual consumption in eurocent / kWh

Source:

- *ARERA: Autorità Di Regolazione Per Energia Reti E Ambiente https://www.arera.it/it/dati/eep35.htm*

6. Do small islands have a different status/regulatory set up?

There is no specific regulatory setup for generation on islands. Minor islands are not connected to the national grids (as in the case of Sardinia and Sicily) and have autonomous electricity production, most of the time from non-renewable sources, despite the big amount of RES (wind and solar). Even if the cost of energy production is higher for the minor islands, in order to avoid islands inhabitants discrimination, an incentive mechanism was created allowing islands inhabitants to pay the same tariffs for electricity as the one of the continent inhabitants, by paying an adjustment to the island's electricity companies, equal to the difference between how much the kWh actually costs and how much the inhabitants pay for it. This adjustment is paid in the electricity bill by all Italian users with a special additional, the UC4.[45] To guarantee the continuity of the service according to ARERA, the average cost of electricity production in the minor islands not interconnected is indeed about 6 times higher than the national one. Every year almost

45 https://www.qualenergia.it/articoli/20130405-lo-spreco-delle-isole-minori-non-connesse-alla-rete-elettrica/

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80 million euros are taken from the bills, within the UC4 component of the charges of system4, and paid to local companies.[46]
Concerning the regulatory framework, it is worth to be mentioned the "Decree of minor islands" which defines objectives and incentive methods for renewable energy in the smaller Italian islands not interconnected with the electricity grid of the continent. Specifically, it establishes the minimum development objectives for the production of electricity and thermal energy from renewable sources to be reached by 31 December 2020 and the methods for supporting the investments necessary for the realization. Resolution no. 558/2018 / R / EFR defines the tariffs for the remuneration system for electricity and thermal energy produced from renewable sources in the non-interconnected islands and the related access methods, in implementation of the provisions of the Ministerial Decree 02/14/2017. To GSE is assigned the task of carrying out the technical and administrative evaluation for the provision of the incentive.

Source:

- *Ministerial Decree 14 February 2017 - Coverage of the needs of the smaller islands not interconnected through energy from renewable sources.*

7. Grid connection cost?

As per the German showcase, the costs of grid connection in Italy depend on the voltage level to which the generator is connected (minor differences may be detected concerning the ranges of voltage level) as provided below:

- Low voltage (<1 kV) connected generators
- Medium to high voltage (>1 e <30 kV) connected generators
- High voltage (>30 <150 kV) connected bulk generators >100 MW

[46] https://www.legambiente.it/wp-content/uploads/Isole-Sostenibili-Rapporto-2019.pdf

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Energy distribution

8. Who owns the networks?

The electricity transmission service is the service divided into transport activities and transformation of electricity on the national transmission grid. Instead the distribution service is the service divided into transport and transformation activities of electricity on distribution networks.
The transmission service manager is Terna Rete Italia S.p.A. of the Terna Group S.p.A.
The head of the distribution service is the competent distribution company (DSO) in the area of interest to which the plant is connected.
Distribution networks incl. all assets are owned by the relevant DSOs based on concessions.
The provisions related to the services of electricity transmission and distribution are defined in Annex A to deliberation 654/2015 / R / eel containing "Integrated text of the provisions for the provision of electricity transmission and distribution services - Provisions for the period 2016-2019 (TIT) "; these provisions are effective from January 1, 2016.

Source:

- *ARERA - Testo unico ricognitivo della produzione elettrica §§4 Trasmissione e distribuzione dell'energia elettrica*
- *Deliberation 654/2015 / R / eel containing "Integrated text of the provisions for the provision of electricity transmission and distribution services - Provisions for the period 2016-2019 (TIT)*

9. How are grid investments remunerated (monitoring, consumption energy management, storage, flexibility)?

The remuneration of grid investments is driven by the mechanisms of the Incentives Regulation. The basic principle is the definition of revenue caps for system operators, based on a comprehensive cost examination and benchmarking, which sets the target for grid fees within a regulatory period of 4 years. More efficient system operators are allowed to keep additional revenue which should provide more motivation for further cost reduction. System operators with <25,000 electricity customers fall under the de-minimis rule and are allowed to apply a simplified process for efficiency grade determination

Costs are generally distinguished between controllable and non-controllable costs (CAPEX/OPEX, where grid investments fall under non-controllable costs. However, grid investments always shall have the purpose of being appropriate investments and shall be approved by the national regulator ARERA especially for

- Grid connection of generators
- Integration of RES
- Replacements of HV overhead lines by cables
- Restructuring measures to guarantee technical state of the art and safety
- Installation of high-temperature conductors and lines
- HV/DC systems

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Grid investments cover both CAPEX and OPEX (TOTEX) and are remunerated via the regulation formula in Annex 1 of the Incentives Regulation.

Source:

- *ARERA*

10. Who is the regulator?

The Italian Regulatory Authority for Energy, Networks and Environment (ARERA) carries out regulatory and supervisory activities in the sectors of electricity, natural gas, water services, waste cycle and district heating. It is an independent body established under Italian Law No. 481 of 14 November 1995 for the purposes of protecting consumer interests and promoting the competition, efficiency and distribution of services with adequate levels of quality, through regulatory and control activities.

Source:

- *https://www.arera.it/it/inglese/about/presentazione.htm*

11. Do small islands have a different status/regulatory set up?

There is no specific regulatory setup for small islands in general. Nevertheless, it is worth to be mentioned the last decree for the smaller islands: Ministerial Decree 14 February 2017 - Coverage of the needs of the smaller islands not interconnected through energy from renewable sources.

Source:

- *Ministerial Decree 14 February 2017 - Coverage of the needs of the smaller islands not interconnected through energy from renewable sources.*

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Tendering

Public clients

Public clients may only award contracts for deliveries and services by means of an award procedure. These public clients include

- Federals
- States
- Local authorities and municipalities
- Utilities with monopoly status effectively controlled by authorities (especially TSOs, DSOs and Public Utilities for electricity, gas and heat) and that fall under the Sectoral Regulation

The reasons for this are the sparing use of funds and the fight against corruption and nepotism. All contractors should be given fair and non-discriminatory access to public procurement markets. Within the EU, this means that contractors shall be given access to contracts from other Member States.
Public clients can choose between different types of procedures for the award of public contracts but they generally have to choose the public tender procedure which is called open procedure above the EU threshold. According to (EU) 2019/1827 – 1930, the EU thresholds from 2020 are as follows:

- 5.350.000 EUR for construction works
- 5.350.000 EUR for concessions
- 139.000 EUR for deliveries and services ordered by governmental authorities
- **214.000** EUR for deliveries and services ordered by other public clients
- 428.000 EUR for deliveries and services in the energy sector

Once the EU thresholds have been reached, the publication of the tender must also be sent to the Official Journal of the EU, which will translate the publication of the tender into all official languages of the EU and publish on the portal "Tenders Electronic Daily" (TED). Also orders below the threshold values can be published on the TED portal on request.
The contracting authority can only choose other special types of procedure if there are special reasons such as

- the performance by its nature can only be carried out in a suitable manner by a limited group of contractors, especially if exceptional expertise or performance or reliability is required
- the public tender would cause an effort for the client or the applicants which would be disproportionate to the achievable advantage or the value of the service,
- a public tender has had no economic result, or
- a public tender is inappropriate for other reasons (e.g. urgency, confidentiality).

Other special types of procedure are

- The restricted tender procedure above the EU threshold, which stipulates that only a limited group of contractors will be invited to submit tenders

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- The procedure for direct award, referred to as negotiation procedure for awards above the EU threshold, which allows, among other things, negotiations on the terms of the contract with the contractors and the procedure for competitive dialogue, which is only provided for Europe-wide tenders, and even more for the contracting authority Allows scope for negotiations with the bidders.

These special types of procedure are preceded by a public participation competition in which suitable contractors are selected, who are then asked to submit an offer. In very special and limited exceptional cases, a restricted invitation to tender, a direct award or an EU-wide negotiation process can also be carried out without a competition.
For awards in the upper threshold range, the public client must inform all bidders whose offers should not be taken into account of this decision before placing the order. They then have the opportunity to submit an application for review of the award procedure to the responsible public procurement chamber.

Private clients

Private clients are not restricted according to the formal tendering rules. Typical tendering procedures that apply in Italy are very similar to the German ones, therefore including mainly the following steps:

- RFI (Request for Information): Inquiry to potential contractors as to whether they could basically meet a sketched requirement. The answers given usually contain list prices. This variant of the tender is suitable for the first exploration of the market.
- RFQ (Request for Quotation): For a detailed requirement (specification), a description of the service is requested with a price that is as precise as possible, but usually non-binding. These inquiries are sent to contractors whose basic capability the client is already convinced of.
- RFP (Request for Proposal): Tender in the usual sense, the submitted offers are binding within the specified period of validity. The requests for tenders contain a detailed specification of services or a specification as well as all additional agreements belonging to the contract. Tendering procedures are also used within (larger) companies. In principle, there is no obligation to accept one of the offers.
- RFF (Request for Feature): Request to expand a system or offer.

Additional questions:

1. **How are prosumer and/or blockchain metering models allowed (energy communities)?**

In Italy prosumers and/or blockchain metering models are allowed but not regulated so far. Italy has time till 2021 to incorporate the related European legislation into the National codes.

2. **Who can intervene through tech investments on the network (owner? DSO? User?)**

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Mainly the owner of the network (that is the DSO) can intervene through tech investments.

3. Who can be DSO and what is the procedure to become one?

In Italy, the distribution and delivery of electricity in the 1960s was carried out under a public monopoly by Enel. With the Bersani Decree of 1999, the sale activity was liberalized while the distribution activity is reserved to the State which assigns it in concession to various companies (DSO). The first part of the electricity grid, that is the long-distance transmission that takes place at high voltage, is now managed by a single operator: Terna. Currently each area of the Italian territory is given under concession to a single operator under a natural monopoly.
The service is carried out by several companies, including both private and municipal companies, which deal with the maintenance of networks and meters, the connection of a new user and the activation of the meter (or deactivation). In any case, if one of these operations is required to open an electricity supply contract, you must always contact the supplier, who then transmits the request to the distributor. Only in the event of a breakdown on the road or on the electrical system before the meter, it is necessary to contact the distributor operating in the specific area directly.

4. Can there be more DSO on the same network?

Yes, at Regional and Province level there can be more DSO on the same network while at the level of Municipality there is only one DSO managing the network.

5. Which metering and storage and load balancing technologies are admitted by the regulator?

In Italy mainly the Smart Metering is regulated while other load balancing technologies (e.g. energy management systems) or other Demand Response services (e.g. vehicles to grid or P2P) are not regulated.

Source:

- *ARERA*

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List of Regulatory Sources

Title (EN)	Title (IT)	Abbreviation (IT)	Version
Recognitive single text of electricity production	Testo unico ricognitivo della produzione elettrica	TUP	September 2019
TERNA Grid Code	TERNA Codice di rete		
Decree 422/2018 of ARERA	Decreto 422/2018 di ARERA	D.Lgs. 422/2018	2/08/2018
D.Lgs. 162/19 art. 42bis	DL Milleproroghe 2020 (14/02/2020)	D.Lgs. 162/19 art. 42bis	30/12/2019
D.M. 14/02/2017	D.M. 14/02/2017	D.M. 14/02/2017	14/02/2017
Legislative decree n. 387/03	Decreto Legislativo n. 387/03	D.Lgs. n. 387/03	9/12/2003
Legislative decree n. 28/11	Decreto Legislativo n. 8/11	D.Lgs. n. 8/11	
Decree n. 292/06	Decreto Legislativo n. 292/06	D.Lgs. n. 292/06	11/04/2007
Deliberation 654/2015 / R / eel containing "Integrated text of the provisions for the provision of electricity transmission and distribution services - Provisions for the period 2016-2019 (TIT)	Deliberazione 654/2015 / R / eel contenente "Testo integrato delle disposizioni per la fornitura di servizi di trasmissione e distribuzione di energia elettrica - Disposizioni per il periodo 2016-2019 (TIT)	Delibera 654/2015 / R / eel	23/12/2015
Ministerial Decree 14 February 2017 - Coverage of the needs of the smaller islands not interconnected through energy from renewable sources.	Decreto ministeriale 14 febbraio 2017 - Copertura delle esigenze delle isole minori non interconnesse attraverso l'energia da fonti rinnovabili.	D.Lgs. 14/02/2017	14/02/2017

Table 15 - List of Regulatory Sources in Italy

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A1.6 Spain

Energy Generation

1. Who can produce energy?

Energy production is regulated over a free competition basis since 1997. Electricity energy producers are defined as those natural or legal persons who have the function of generating electricity, as well as building, operating, and maintaining production facilities. Producers shall comply with the rights and duties included in the Electric Sector Law.
In the case of energy production for self-consumption:

- For supply modalities with self-consumption without surplus, this is, without any physical option to feed the grid, the subject will be considered as a consumer.
- For supply modalities with self-consumption with surpluses. In these cases, there will be two types of subjects: the consumer and the producer. Production facilities not exceeding 100 kW of power shall be exempt from the obligation to register in the administrative register of electrical energy production facilities.

Source:

- *Ley 24/2013, de 26 de diciembre, del Sector Eléctrico*
- *Real Decreto 244/2019, condiciones administrativas, técnicas y económicas del autoconsumo*

2. Which innovative technologies are regulated (and not)?

The following innovative technologies are regulated in Spain:

- **Self-consumption:** individual or collective, with or without surplus fed to the grid. **Net balancing** is not allowed in Spain, but compensation schemes for the electricity fed to the grid are conceived in the legislation.
- **Energy communities** are defined by Ley 24/2013 as "non-profit organizations, natural persons, or small and medium-sized enterprises whose shareholders or majority members are natural persons, local entities, or also other small and medium-sized enterprises" that could be owners of generation facilities and may access to special remuneration treatment.
- **Smart Metering** (almost) fully deployed in Spain.
- **(Explicit) demand response** is only possible in the Interruptible Load programme for large energy-intensive companies.
- Time of Use pricing (*discriminación horaria*) is regulated. Changes on tariff and the period distribution will be simplified and applied for users with contracted power less than 15 kW in the short time (Orden IET/2013/2013).
- Grid balancing is not carried out by DSOs/BRPs. In Spain, there are not Balancing Responsible Parties (BRP) and the responsibility for the full grid balancing relies on the TSO (Red Eléctrica Española).
  Energy storage

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The following innovative technologies are currently not regulated in Spain:

- Neither aggregation, nor aggregator are concepts conceived in the current regulation. Related regulation is foreseen in the short time to correspond with EU Directive 944/2019 and EU Regulation 943/2019.
- There is not a specific regulation for **District Heating**, neither are barriers for such developments.
- (Implicit) demand response. Implicit demand response is not directly regulated but it is based on hourly price signals provided by the default regulated supply tariff for domestic consumers (Time of Use Pricing)
- Heating/cooling as a service. Heating/cooling equipment, technical characteristic and maintenance are regulated (RITE).
- P2P (Energy trading). Bilateral contracts for energy purchase and dispatch. TSO must be informed about any bilateral contract but is not regulated.
- Power-to-X: some technical specifications for alternatives fuels, as sustainable hydrogen, are included in RD 639/2016.
- PPA contracts and ESCO contracts are not regulated either in Spain.

Source:

- *Ley 24/2013, de 26 de diciembre, del Sector Eléctrico*
- *Real Decreto-ley 15/2018, medidas urgentes para la transición energética*
- *Real Decreto 244/2019, condiciones administrativas, técnicas y económicas del autoconsumo*
- *Real Decreto 1110/2007, de 24 de agosto, por el que se aprueba el Reglamento unificado de puntos de medida del sistema eléctrico*
- *Orden IET/2013/2013, de 31 de octubre, por la que se regula el mecanismo competitivo de asignación del servicio de gestión de la demanda de interrumpibilidad y posteriores modificaciones.*
- *Real Decreto 639/2016, de 9 de diciembre, por el que se establece un marco de medidas para la implantación de una infraestructura para los combustibles alternativos*
- *Reglamento de Instalaciones Térmicas de los Edificios. RITE*

3. How are prosumer and/or blockchain metering models allowed?

Smart meters have already been fully deployed in Spain. These metering devices are usually owned and integrated by the DSOs, but it is possible for users to buy and retain ownership of their own meters. All meters should comply with the metering regulation (RD 1110/2007 de 24 de Agosto).

Every meter is linked with a CUPS ("Unified Code of Supply"). The readings given by a smart meter are confidential information generated by the end users, who authorises the distributor to disclose it for billing purposes and for grid management issues only. Distributors usually share this information monthly with the retailer and daily with the consumer, with an interval of 24 hours. Some do it through the password-protected private user area of the web site or by means of specially-designed apps. Granularity of data is usually 15 minutes.

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According to RD 244/2019, for **self-consumption modalities with surpluses,** the energy fed to the grid will be compensated with a reduction on the monthly energy bill. Price variations between the kWh fed and the kWh compensated, being the latter cheaper than the former, do not allow to consider this as a net balancing. Differences will also apply depending on the peak power of the self-consumption installations and the contracted power with the electricity supplier.
There is not specific regulation related to blockchain metering models, but any model must follow Unified Electricity System Measurement Points Regulation (RD 1110/2007).

Source:

- *RD 244/2019 Real Decreto 244/2019, condiciones administrativas, técnicas y económicas del autoconsumo*
- *Real Decreto 1110/2007, de 24 de agosto, Unified Electricity System Measurement Points Regulation.*

4. Which RE sources can link to the grid?

Three categories of Renewable Energy Sources (RES) are regulated by the RD 413/2014:

- Cogeneration and electric generation form other residual energies,
- Energy valorization of waste, and
- Renewable Sources.

This last category is composed by:

1. Solar energy (photovoltaic and solar thermal).
2. Wind power (land and offshore).
3. Geothermal, hydrothermal, aerothermal, wave, tide, from hot and dry rocks, oceanic thermal and energy from sea currents.
4. Hydro power.
5. Biomass.
6. Liquid biofuels from biomass and biogas form landfills, from agricultural/cattle activities, etc.

Source:

- *Real Decreto 413/2014, de 6 de junio, por el que se regula la actividad de producción de energía eléctrica a partir de fuentes de energía renovables, cogeneración y residuos*

5. Which metering models are allowed (front of, back of, etc.)?

The type of meters allowed is defined by the Measurement Device Regulation, issued by RD 1110/2007. The metering device has to be a homologated digital metering of altern current with data storage capacity and communication enabled capabilities. These devices can be remotely accessed via IP or modem. They should be ready to measure active and reactive power, frequency, voltage and intensity in altern current. They should be calibrated and tested according to the regulation mentioned.

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Meters should be installed at the frontier between the DSO grid and the users' internal grid. This position enables to bill for the net energy received by the consumer after deducting distribution losses. Meters should work bi-directional so as to measure, not only energy supply from the grid, for settlement issues, but also self-generated energy excess poured into the grid, in the case of prosumers connected to the grid. The position of the meters in the case of self-consumption is given by the type of self-consumption modality subscribed by the prosumer. This is regulated in RD 244/2018.

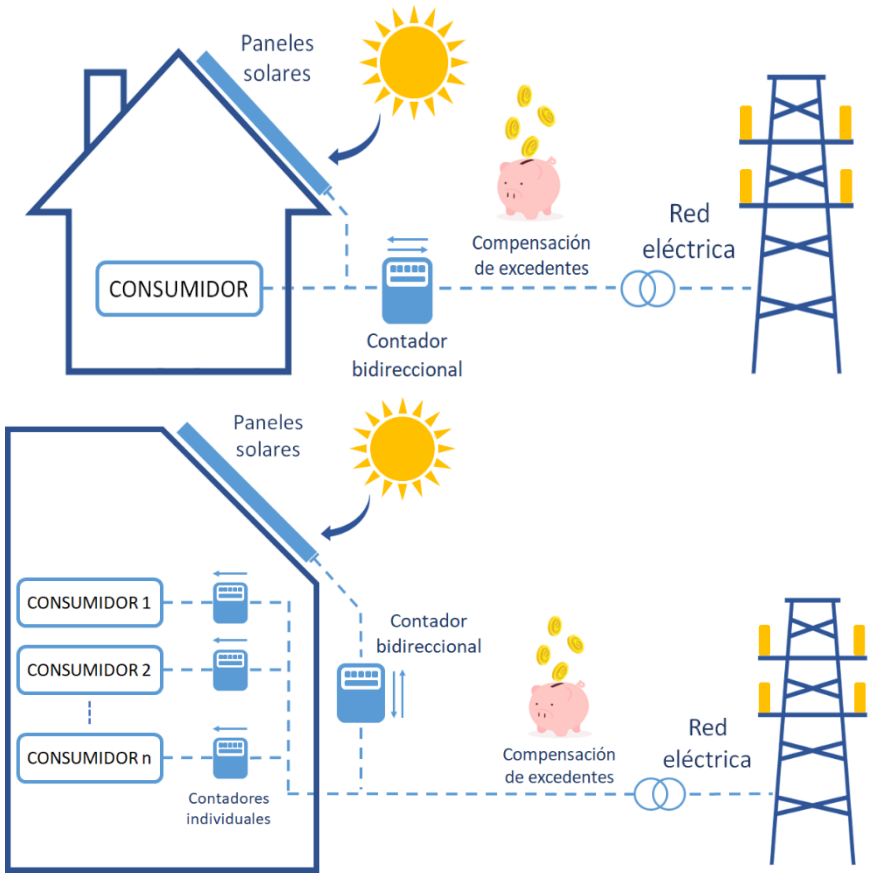

Figure 21 - Distribution of metering devices for a self-consumption modality with compensation of energy surplus 1) Individual. 2) Collective.

Sources:

- *Real Decreto 1110/2007, de 24 de agosto, por el que se aprueba el Reglamento unificado de puntos de medida del sistema eléctrico*
- *Real Decreto 244/2019, condiciones administrativas, técnicas y económicas del autoconsumo*

6. How is energy price determined (free, regulated, etc.)?

Spain has a free wholesale market for the mainland (both Spain and Portugal) and connected islands that determines the hourly energy price. There are three markets to trade in:

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- Day-ahead market: hourly auctions 24 hours before the actual programme starts
- Intra-day markets: 6 bids along the actual dispatching day
- Continuous intra-day market: aligned with the European Single Intraday Coupling (SIDC)

The markets are operated by OMIE (Operador del Mercado Ibérico de la Electricidad). The price is determined every hour considering the buy and sell offers made by the market agents. The buying and selling curves are overlapped and the crossing point will be the resulting energy price.

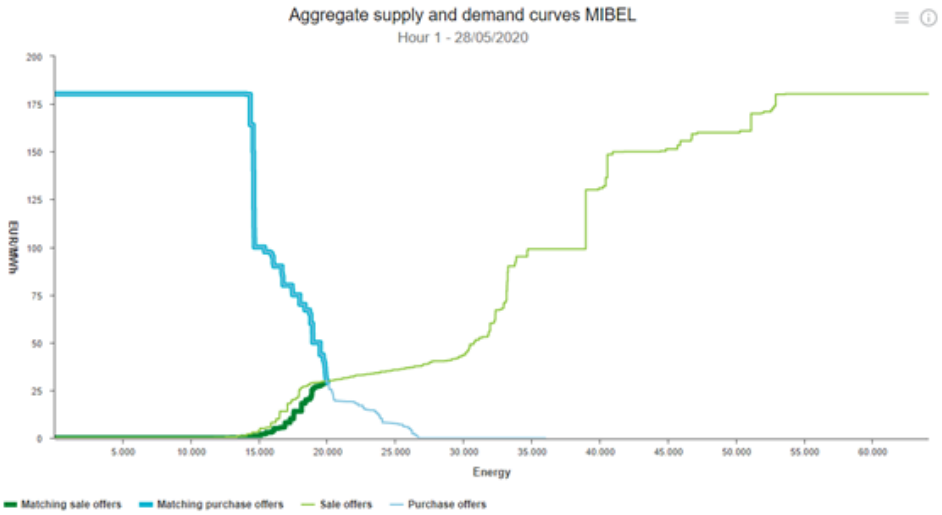

Figure 22 - Buy and sell prices (Source: OMIE)

Energy producers under that crossing point will enter the generation program for the hour. The price paid to the energy producers will be that crossing point and not the price offered.

The following graph shows the average electricity price in the daily markets since 2014:

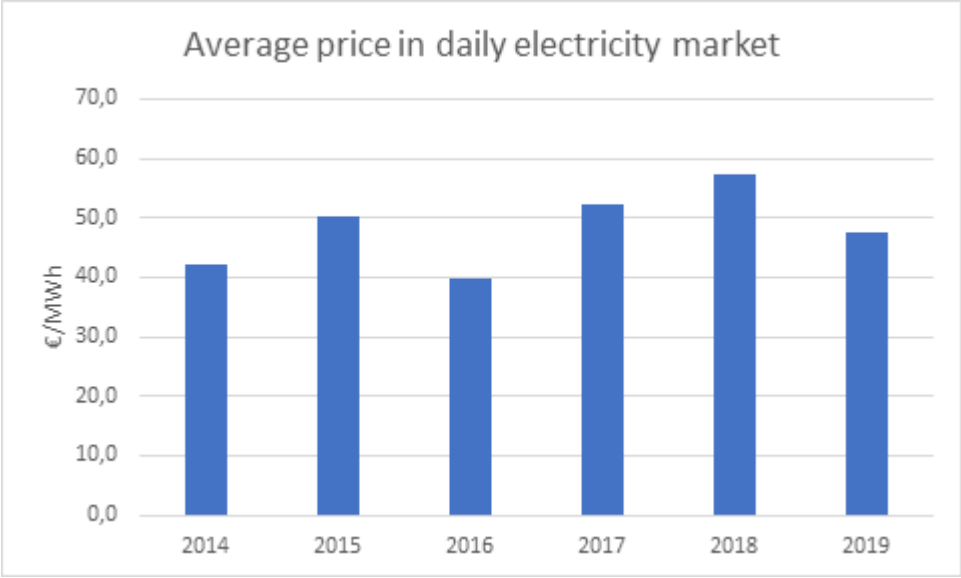

Figure 23 - Average price in daily electricity market

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In extrapeninsular territories (Canary Islands, Balearic Islands, Ceuta and Melilla), even though consumer pay similar prices by law, there is a regulated market to compensate energy producers. This market is defined in Real Decreto 738/2015.
Source:

- Real Decreto 2019/1997
- Real Decreto 2351/2004
- Real Decreto 134/2010
- Resolución de 18 de diciembre de 2015, de la Secretaría de Estado de Energía
- Resolución de 10 de octubre de 2019, de la Comisión Nacional de los Mercados y la Competencia
- Circular 3/2019, de 20 de noviembre, de la Comisión Nacional de los Mercados y la Competencia

7. Do small islands have a different status/regulatory set up?

Activities for the supply of electricity carried out in the electricity systems of non-mainland territories may be subject to a unique regulation that will take into account the specificities arising from their territorial location and their isolated nature (art. 10 Law 24/2013). Such systems are the one located outside the Iberian Peninsula, namely: Balearic Islands, Canary Islands and autonomous cities Ceuta and Melilla.
Generation activities in the islands is regulated by RD 738/2015. Generation costs in the islands is higher than in mainland territory. This law establishes that, for the sake of non-discrimination bases, extra costs of non-peninsular territories are compensated by the National Electricity System (a fixed yearly fee in all consumers' bills) and the Estate's General Annual Budget. These costs are pre-calculated based on each technology costs and updated in the regulatory orders from time to time. The most recent is Order TEC/1172/2018, where the weighted average daily cost at each island is used to calculate an equivalent hourly cost that is compared to the peninsular actual hourly costs. The difference is compensated thereafter on a 50%-50% basis between the Electricity System and the National Treasure.

Regulation related to energy production in non-mainland systems:

- Ley 17/2013, de 29 de octubre, para la garantía del suministro e incremento de la competencia en los sistemas eléctricos insulares y extrapeninsulares
- Real Decreto 680/2014, de 1 de agosto, por el que se regula el procedimiento de presupuestación, reconocimiento, liquidación y control de los extracostes de la producción de energía eléctrica en los sistemas eléctricos aislados de los territorios no peninsulares con cargo a los Presupuestos Generales del Estado
- Real Decreto 738/2015, de 31 de julio, por el que se regula la actividad de producción de energía eléctrica y el procedimiento de despacho en los sistemas eléctricos de los territorios no peninsulares
- Orden ITC/2370/2007, de 26 de julio, por la que se regula el servicio de gestión de la demanda de interrumpibilidad para los consumidores que adquieren su energía en el mercado de producción .
- Orden ITC/1559/2010, de 11 de junio, por la que se regulan diferentes aspectos de la normativa de los sistemas eléctricos insulares y extrapeninsulares.

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- Orden IET/1711/2013, de 23 de septiembre, por la que se establece el método de cálculo de los costes fijos y variables de la instalación de producción eléctrica hidroeólica de Gorona del Viento.
- Orden TEC/1172/2018, de 5 de noviembre, por la que se redefinen los sistemas eléctricos aislados del territorio no peninsular de las Illes Balears y se modifica la metodología de cálculo del precio de adquisición de la demanda y del precio de venta de la energía en el despacho de producción de los territorios no
- Orden TEC/1260/2019, de 26 de diciembre, por la que se establecen los parámetros técnicos y económicos a emplear en el cálculo de la retribución de la actividad de producción de energía eléctrica en los territorios no peninsulares con régimen retributivo adicional durante el periodo regulatorio 2020-2025, y se revisan otras cuestiones técnicas

8. Grid connection cost?

The plant operator shall bear the connection costs and the possible expansion of the grid (Art. 32.2 RD 1955/2000).
The plant operator can determine the constructor according to the DSO or TSO's technical specifications. Once the connection is completed, the owner of the connection line/expansion will be the owner of the line on which they were connected (DSO or TSO). In case the new installations were to be used by another generator or consumer in the next 5 years since commissioning, the new user shall contribute proportionally on their capacity use.
Every producer feeding into the grid is charged 0,5 €/MWh (IET 3586/2011)
Every consumer is subject to a fixed tariff proportional to the contracted supply power, regulated by the Electricity System. This fixed tariff depends on the voltage range and the type of tariff. For domestic supply it is around 38 €/kW per year. Grid connection costs also include a small variable amount (0,044 €/kWh for domestic supply)

Source:

- *Real Decreto 1955/2000*
- *Orden IET 3586/2011*

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Energy distribution

9. Who owns the networks?

The high voltage transport network is owned by Red Eléctrica Española (REE), half private – half public.
REE transports high voltage electrical energy. To do this, it manages the electrical infrastructures for the transmission grid and connect the generation plants with the distribution points to consumers.
As manager of the transmission grid, Red Eléctrica is responsible for the development and expansion of the grid, for its maintenance, for managing the transit of electricity between external systems and the Iberic Peninsula and for guaranteeing third party access to the transmission grid in equality conditions.

Electrical installation Law 17/2007, of July 4, confirmed the status of Red Eléctrica as manager of the transmission network and attributed the function of sole carrier, under an exclusive regime. In compliance with this law, Red Eléctrica acquired, in 2010, the assets of the Balearic and Canary Islands and the rest of the peninsular assets pending transfer from the electricity companies.

The distributors are the owners of the distribution network, which are those commercial companies or cooperative societies of consumers and users, that have the function of distributing electrical energy, as well as building, maintaining and operating the distribution facilities intended to locate the energy at the points of consumption.
In Spain there are 333 DSO registered. (their obligations, and rights are regulated on art. 40 of the LSE 2013)

Sources:

- *Red Eléctrica de España. Gestor de la red y transportista , https://www.ree.es/es/actividades/gestor-de-la-red-y-transportista, accesed in May 2020.*
- *Ley 24/2013, de 26 de diciembre, del Sector Eléctrico (LSE 2013)*
- *Ley 17/2007, de 4 de julio, por la que se modifica la Ley 54/1997, de 27 de noviembre, del Sector Eléctrico, para adaptarla a lo dispuesto en la Directiva 2003/54/CE, del Parlamento Europeo y del Consejo, de 26 de junio de 2003, sobre normas comunes para el mercado interior de la electricidad.*

10. Who can intervene through tech investments on the network?

Only grid owners are accountable for grid investment, enhancements and maintenance. However, level of service is regulated by law. The level of service includes the right of supply to every new connection request, the penalties and compensations for energy curtailment, and the annual binding targets of energy efficiency in the distribution (1,5 % per year)

11. How are grid investments remunerated?

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Grid investments are paid by the Electricity system, as a regulated part of the supply tariff payed by the consumers. This regulated part of the bill born by the consumers comprises both a fix tariff and a variable tariff.
The remuneration of grid investments to the DSOs is defined in Circular 6/2019. The principle for this retribution mechanism is to compensate the costs of the distribution activity for an efficient and well organised company.
The formulas defined in the articles define compensation for these activities:

- Investments
- Communication, protection and control proceedings
- Land purchase associated with new electrical installations
- Operation and maintenance of the installations
- Activities to extend the useful lifetime
- Other necessary regulated activities such as meter readings, billing, customer service, etc.
- Incentives for the reduction of energy losses
- Incentives regarding quality of supply

Source:

- *Circular 6/2019*

12. Who can be DSO and what is the procedure to become one?

Any company may become a DSO on the basis of open free market competition. However, the reality is that entry barriers are huge and there is not an actual possibility of entering the distribution market in Spain. The only possibility involves the creation and management of local specific private networks.
In this sense, the Law 24/2013, of 26 December, contemplates that for the commissioning of new transportation, distribution, production facilities and direct lines or modification of the existing ones, the following administrative authorizations are required, in general terms:
a) Prior administrative authorization, which will be processed with the installation's preliminary project as a technical document and, where appropriate, together with the environmental impact assessment. The owner also needs the access and connection permits to the corresponding transport or distribution networks.
b) Administrative construction authorization, which allows the owner to carry out the construction of the facility, complying with the technical requirements.
c) Operation authorization, which allows, once the project has been carried out, to put the facilities in tension and proceed to their exploitation.

Source:

- *Article 53 LSE 2013*
- *Ministerio para la Transición Ecológica y el reto demográfico. Distribuidores. https://energia.gob.es/electricidad/Distribuidores/Paginas/Distribuidores.aspx, accessed in May 2020.*

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- *Comisión Nacional de los Mercados y la Competencia – CNMC. Listado de Distribuidoreas de electricidad. https://sede.cnmc.gob.es/listado/censo/1, accessed in May 2020.*
- *38 a 42 de la Ley 24/2013, de 26 de diciembre, del Sector Eléctrico, en el Real Decreto 1048/2013, de 27 de diciembre*

13. Can there be more DSOs on the same network?

DSOs are free to operate in any geographical area, either by exploiting their own distribution assets or paying fees to the grid owning company.
As stated in Article 39 of the Real Decreto 1955/2000, the operator of each distribution zone will be the company that owns those installations. Two distribution operators can reach an agreement to establish only one operator for various zones but having multiples operators in a line or electric distribution zone is not regulated.

Source:

- *Real Decreto 1955/2000*

14. Which metering and storage and load balancing technologies are admitted by the regulator?

Metering

All electrical metering equipment has to comply the specifications described in the unified regulation of the electrical system's metering point, as defined in Real Decreto 1110/2007, and the national metrological control of electricity meters defined in Orden ITC/3022/2007.
These regulations state outline the requirements in terms of information stored, access, communication channels and granularity of the measurements.
Spain has been renovating the electromechanical meters for digital meters since the approval of (Orden ITC/3860/2007. As of 2018, 98,14% of electricity meters were digital, allowing for hourly discrimination and remote management.

Storage and Load balancing

There are no limitations regarding storage and load balancing technologies. Some technologies used in the system are:

- Large scale(GW): reversible hydroelectric, thermal storage.
- Medium scale (MW):

Consumer level (kW): batteries, condensers and superconductors, inertia flywheels

Source:

- *Real Decreto 1110/2007*

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- *Orden ITC/3022/2007*
- *Orden ITC/3860/2007*

15. Who is the regulator?

The Spanish electrical system is formed by different institutions:
The *Administration* through the Ministry of Industry, Tourism and Trade. It is responsible for Legislating and Regulating the electricity market and all participating entities. Their main responsibilities are: set the comprehensive tariffs, third-party network access rates as well as premiums and incentives to the special regime or the types of excise duty to be applied, annually.
The company in charge of market management is the Operating Company of the Iberian Energy Market (OMIE). They are in charge of clearing the wholesale spot market of electricity. It is a daily market in which generating companies offer their electricity (offer) at different prices depending on the time and type of generation, and the trading companies propose the purchase orders (demand) corresponding to the energy they need to meet the consumption of their customers. Grid operator is REE (Technical operator of the system). They are in charge of setting up the dispatching programme, clear up the technical issues and balance the grid. They are also responsible of congestion management.

The Regulator is the CNMC (Comisión Nacional de los Mercados y la Competencia) belonging to the Ministry of Industry and Energy (Government of Spain). It is the independent regulatory body responsible for ensuring effective competition in energy markets, and for its objectivity and transparency for the benefit of all subjects operating in the system, including consumers.

Supplier's Office of Change: OCSUM. It is in charge of assuring that the process of electricity supply is under transparent, objective and independent manner.

Sources:

- *Gobierno de España, Ministerio para la Transición Ecológica. La Energía en España 2017. ISSN 2444-7102, https://energia.gob.es/balances/Balances/LibrosEnergia/Libro-Energia-2017.pdf, accesed in May 2020.*
- *https://www.omie.es/, accessed in May 2020.*
- *Soto Simó, Raquel. El sector eléctrico en España, Julio 2016, https://repositorio.comillas.edu/rest/bitstreams/36297/retrieve, accesed in May 2020.*
- *Resolución de 23 de diciembre de 2015, de la Secretaría de Estado de Energía, por la que se aprueban las Reglas de funcionamiento de los mercados diario e intradiario de producción de energía eléctrica.*

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- *Real Decreto-ley 1/2019, de 11 de enero, de medidas urgentes para adecuar las competencias de la Comisión Nacional de los Mercados y la Competencia a las exigencias derivadas del derecho comunitari*
- *36 a 42 del Real Decreto 1955/2000, por el que se regulan las actividades de transporte, distribución, comercialización, suministro y procedimientos de autorización de energía eléctrica.*
- *Real Decreto 1048/2013, de 27 de diciembre, regula también el régimen de acometidas eléctricas y demás actuaciones necesarias para atender el suministro eléctrico*
- *Real Decreto 1047/2013, de 27 de diciembre, establece un pago por estudio de conexión y un pago por estudio de acceso que será sufragado por los productores de energía eléctrica por la realización de dichos estudios para las instalaciones de generación.*
- *Real Decreto 897/2017, de 6 de octubre, por el que se regula la figura de consumidor vulnerable, el bono social y otras medidas de protección para los consumidores domésticos de energía eléctrica*
- *182 a 187 del Real Decreto 1955/2000, de 1 de diciembre, por el que se regulan las actividades de transporte, distribución, comercialización, suministro y procedimientos de autorización de instalaciones de energía eléctrica.*

16. Do small islands have a different status/regulatory set up?

Insular electricity system for generation and distribution is regulated by RD 738/2015 about the generation, distribution and dispatch of electricity in the non-peninsular territories (Balearic islands, Canary islands, cities of Ceuta and Melilla).
The Balearic islands (Mallorca, Menorca, Ibiza and Formentera) are interconnected to each other and with the peninsular grid system. Therefore, they belong to the same network although distributions constraints and congestions are more frequent due to the capacity of the connections. This congestions are more frequent in the high touristic season, from April to October and pushes the TSO to rely on locally manageable generation resources for the ancillary service provision, congestion management and grid balancing.
The Canary islands are not interconnected. There are 6 isolated distribution grids, one per island (Tenerife, La Palma, Gran Canaria, La Gomera, El Hierro and Lanzarote-Fuerteventura), all managed by the DSO Endesa Distribución. Generation and distribution costs in the Canary Islands are about 3 times more expensive than mainland supply. For equality and non-discrimination issues, prices are regulated and the extra costs of the non-peninsular systems are shared among the full National Electricity System. According to the Order TEC/1172/2018 extra costs of non-peninsular electricity systems are charged 50 % to all system consumers as a fixed yearly fee proportional to the contracted power, and 50 % to the National Treasure through the annual Estate's General Budget.

- Real Decreto 738/2015, de 31 de julio, por el que se regula la actividad de producción de energía eléctrica y el procedimiento de despacho en los sistemas eléctricos de los territorios no peninsulares
- Orden TEC/1172/2018, de 5 de noviembre, por la que se redefinen los sistemas eléctricos aislados del territorio no peninsular de las Illes Balears y se modifica la

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metodología de cálculo del precio de adquisición de la demanda y del precio de venta de la energía en el despacho de producción de los territorios no peninsulares.

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Tendering

Public clients

Law 9/2017, of November 8, on Public Sector Contracts (LCSP), by which the Directives of the European Parliament and of the Council 2014/23 / EU and 2014/24 / EU, of February 26, are transposed into the Spanish legal system is the law that regulates the contracting rules in public sector.
Royal Decree 1098/2001 is the General Regulation of a previous Law, but it is in force as long as it is not contrary to Law 9/2017 and subsequent Royal Decree.
Royal Decree 817 / 2009 is a regulation that partially developed the previous Law 30/2007, approved on May 8, 2009. It is in force as long as it does not oppose the Law 9/2017.
The public sector is made up of: ▫

- public administrations▫
- public companies ▫
- public non-profit institutions

Within the public sector, organisations fall into two broad groups when it comes to their obligation to comply with the LCSP contracting rules when they buy:

1. Public Administrations to comply with the LCSP rules 100%.
2. The rest that only have to comply 100% from certain amount

If they are higher than those stipulated, it is said to be a tender or 'contract subject to harmonized regulation'. The thresholds for these amounts are:

a. 139,000 euros in services and supplies if the body belongs to the State Tax Administration Agency, its Autonomous Organizations, or the Management Entities and Common Services of the Social Security.
b. 214,000 euros in services and supplies if the organization belongs to NUTS 2 or Local Authorities
c. 5,350,000 euros in works, works concession and service concession.

There are other frameworks for tendering:
The framework agreement is a contracting tool that results in a regulatory type contract. In other words, rules are established to buy a series of goods and services in common use from one or more suppliers. Purchases based on this tool will be made when the organisations have specific needs. The maximum duration of these contracts is 4 years, except in duly justified exceptional cases. Therefore, we will have to wait for them to convene again if we are not in them.
Dynamic acquisition is very similar to the framework agreement. It is a tool for entirely electronic contracting that results in a regulatory contract. In other words, rules are established to purchase a series of works, goods or services for current use whose characteristics are generally available in the market and meet the needs of the contracting authorities. Awards based on this tool will also be made when the organisations have specific needs. The maximum duration of these systems will be set in the Specifications.

Private clients

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Tendering is only applied to public sector.

Source:

- *Real Decreto 3/2011 de 14 de noviembre Ley de Contratos del Sector Público (TRLCSP).*
- *UE. Normas de licitación pública. https://europa.eu/youreurope/business/selling-in-eu/public-contracts/public-tendering-rules/index_es.htm, accessed in May 2020.*
- *Dirección General de Industria y de la Pequeña y Mediana Empresa. Guía práctica de la Contratación Pública para las PYME, Diciembre 2019 ,http://www.ipyme.org/Publicaciones/GuiaPracticaContratacionPublicaPyme.pdf , accessed in May 2020.*

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A2 Questionnaires for validation of business models

This annex contains the detailed questionnaires that have been created for the national showcases for the validation phase of the business models.

A2.1 Croatia

Question
Is there any simplified bureaucracy process to become a prosumer? Process of becoming a prosumer of electricity is rather simplified, comparing to the process which applies to eligible producers of electricity. Prosumers shall not obtain a license to generate RES-electricity, building permit, nor they shall perform an energy impact assessment and an optimal technical solution study. Also, energy permit is generally not required (unless otherwise is set out by the competent local administrative department). Interested applicants shall arrange their status with the DSO, i.e. apply for a connection agreement / change their status from a user to a prosumer.
Do you need any permission to start self-generation of electricity from solar energy? Interested applicant must arrange relations with the DSO (i.e. obtain an electricity approval) and supplier of electricity (conclude a power purchase agreement for the excess electricity transferred to the grid). Also, in case it is required by the relevant administrative department (depending of the project location), an interested applicant must obtain an energy permit. Off-grid self-consumption models are not regulated in detail under Croatian law.
Are there any free available data about solar resource in a local/regional level so the prosumers can estimate the characteristics of their system? The data on projects registered with the Registry of renewable energy, high-efficiency cogeneration and eligible producers is available at https://oie-aplikacije.mzoe.hr/pregledi/PopupIzvjestaj.aspx?ReportId=17ed7352-2f8d-416b-b2fb-cec912e96428. At the European level, the data is registered with the Photovoltaic Geographical Information System (PVGIS) of the European Commission Joint Research Center: https://ec.europa.eu/jrc/en/pvgis.
Can the prosumer sell the electricity to the network? Prosumers may sell excess electricity to the suppliers or other market participants with whom they have entered the power purchase agreement, provided that within a calendar year the amount of electricity delivered to the grid is lower or equal to the amount of electricity taken from the grid. Otherwise, in referred calendar year, prosumers will be deemed as the "final customers of electricity with a self-generating facility" and the prices for electricity which has been taken from the grid will be calculated based on the statutory formula.
Can the prosumer obtain any economic benefit from selling the generated electricity? Under Croatian legal framework the prosumer is described as the "user of self-supply facility" and such model is generally not intended to gain profit. The only benefit of a prosumer is the reduction of prices for consumed electricity. If within a calendar year the prosumers have delivered to the grid the amount of electricity which exceeds the amount of electricity taken-over form the system, they will be deemed as the "final customers of electricity with a self-generating facility". Under such status, they may sell electricity to the DSO or TSO directly, and the prices of electricity will be calculated based on the statutory formula.

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Is there any specific regulation for this initiative? Local and Renewable Citizen Energy Communities are not yet implemented in Croatian legal system. Implementation shall be provided until January 2021 at latest.
Are there significant examples of energy communities in your local/regional area? Not yet, due to the missing legal framework. Irrespective of the fact that the detailed regulation has not yet been adopted, in past years there are several energy communities active in Croatian market, such as Green Energy Cooperative, Energy Community of Krk Island, BAN-UNION, etc.
Are public authorities in islands aware of the benefits of this initiative, especially in small or remote settlements or islands? And the population? Since the legal framework for Local and Renewable Citizen Energy Communities is not yet implemented, we assume that the public authorities, such as the island population, are for the most part not aware of key features of these advanced models and its benefits.
Are there significant examples of district heating in your local/regional area? District heating is not typically developed on islands. It is rather present in a continental part of Croatia.
Are there examples of district heating in combination with renewable energy in your area? Combination of CHP cogeneration, such as examples of combination with geothermal generation, biomass generation and biogas generation exist. However, it is not present on islands.
Are the public authorities aware of this technology and its advantages? And the general population? We assume that the public authorities and local population are generally aware of these technologies but not necessarily of its advantages.
Is this initiative legal in your country? The initiative is legal, but there is no regulated flexibility market. Until the fully functional electricity market is established, the responsibility for flexibility procurement (ancillary services) lies with the DSO/TSO, who are obligated to act under regulated conditions.
Are DSOs in your country/area interested in this initiative? In our understanding, DSO and TSO are basically interested in this initiative.
Is there any kind of platform, either private or driven by public authorities, that facilitates collection (donations) or allows investors to know the renewable energy projects that need financing through Crowdfunding? Due to lack of specific regulation on crowdfunding, promoters of collecting funds from the alternative means of financing are organized in accordance with the rules which applies to agencies, associations and cooperations. Some of these entities are focused on promoting "green" electricity, such as e.g. http://www.croenergy.eu/.
Are there mechanisms for regulating the actions of the Crowdfunding? Are there further limits on the amounts of investment above those imposed by the EU (5 million euros)? Specific regulation on crowdfunding has not yet been adopted in Croatia. Depending on the nature of crowdfunding (especially if the investor receives something in return), various mechanisms may apply (including different taxation regimes, regulatory regimes such as donations, purchasing, securities etc.).
As it is a virtual mechanism, in case of fraud, are there regulatory policies and guarantees backed by public authorities? There are no guarantees backed by public authorities. The risk of investment loss lies with the investor. General

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rules set out with the Criminal Act and the Civil Obligations Act for fraudulent conduct and unjust enrichment apply.
Is there some kind of system in place or as a pilot project?, There are no P2P marketplaces in Croatia. Prosumers may transfer the excess electricity to other market participants, provided that they have concluded the Power Purchase Agreement.
The population of the islands, that have photovoltaic installations in their homes, have access to information about P2P energy trading as a method of selling their stored surplus? N/a.
Are there any agreements or regulatory policies with the traditional electricity market agents regarding the possible establishment of P2P Energy trading systems or planning to establish them? There are no widespread agreements or regulatory policies agents regarding the possible establishment of P2P Energy trading systems. However, several projects are reportedly underway that aim to investigate the applicability and barriers of P2P energy trading.
Is there a legal regulation on the responsibility of their actions (prosumers, consumers, network platform) or motivated by situations of fraud at the time of the return on investment agreed with? Croatian law contains numerous regulatory and administrative barriers for full implementation of P2P trading models, including the absence of clear delineation between prosumers and other market participants, as well as registration, balancing and licensing requirements. For a proper implementation of P2P trading models, Croatian electricity market laws would have to be revised to include a clear, transparent and understandable outline of the model.
Is there any kind of tax benefit for the renting modality? General tax benefits may apply (e.g. investment support related tax benefits). However, the application of any tax benefits should be assessed on a case to case basis, as it depends on a variety of different factors (e.g. location of the asset, type of business model implemented, etc.)
Are there VAT tax deductions for the monthly expenditures fee? General VAT tax deductions may apply. However, the application of any tax deductions should be assessed on a case to case basis, as it depends on a variety of different factors.

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Is there any public programme in operation to promote energy efficiency systems?
The Environmental Protection and Energy Efficiency Fund conducts various programmes aimed at the promotion of energy efficiency:
- energy renovation programme for family houses which will support renovation with grant of 60% funding rate intended at increasing thermal protection of all elements at the outer shell of heated space: energy renovation of the outer wall, ceiling, floor, roof (including waterproofing, replacement of old construction roof elements, etc.), replacement of woodwork and complete energy renovation, including a combination of measures on the outer envelope and installation of RES facilities (such as solar thermal collectors, wood chip / pellet systems, heat pumps and PVs for own electricity consumption). The maximum amount of grant which may be allocated to individual project is HRK 204.000.
https://www.fzoeu.hr/hr/energetska_ucinkovitost/enu_u_zgradarstvu/energetska_obnova_obiteljskih_kuca/

- co-financing programme aimed at utilization of renewable energy sources for own consumption in households, which will grant support between 40% and 80% of justified costs intended for installation of PVs on family houses (depending of the project location). The program is announced for 24 August 2020, with a grant in the amount of HRK 75.000 (approx. EUR 10.000) per project maximum .
https://www.fzoeu.hr/docs/tekst_javnog_poziva_fne_2020_v1.pdf

- co-financing programme aimed at utilization of renewable energy sources in public buildings, which will grant support between 40% and 80% of justified costs intended for installation of wood chip boilers, heating pumps, solar thermal collectors and PV plants (depending of the project location). The tender will start on 21 September 2020 and will be opened for public administrative bodies, self governing units, public companies etc. The amount of maximum grant per project is HRK 500.000 (approx. EUR 66.700).
https://www.fzoeu.hr/docs/tekst_javnog_poziva_zgrade_javne_namjene_2020_v1.pdf

When an islander decides to replace household appliances or industrial machinery, in the case of industry, for more energy-efficient products, do they receive any financial or economic compensation (grants, discounts…)?
Previously there have been incentives aimed at providing financial support for replacement of old appliances with the energy efficient ones. However, such incentives were offered on the national level and not to islanders specifically.

Is there a district heating system in operation at a domestic level (residential/housing or office building) or at an industrial level on the islands?
No, see answer for 'district heating'.

For the construction of new infrastructures (buildings/offices) on the islands, the planning of centralized hot water or cooling systems is promoted as an energy efficiency measure?
No, such incentive currently does not exist in Croatia.

Is there any programme, public or private, to promote the development of ESCOs?
To our knowledge, there are no programmes which would promote the development of ESCO models.

Are ESCO contracts legally regulated?
A specific form and the content of ESCO contracts are determined for providing ESCO services in buildings public sector. ESCO contracts for providing services in buildings of private sector (excluding the multi-dwelling buildings) are regulated only generally, by setting out key responsibilities of the provider and the user.
Additional requirements regarding the content of ESCO contract and some specific rules (i.e. that the decision on entering the ESCO service shall be made by majority votes of the co-owners of building) are set out for providing ESCO services in multi-dwelling buildings. The rules are stipulated in the Energy Efficiency Act.

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Is there any technical standard that defines the general requirements of companies offering energy services? Pursuant to the Energy Efficiency Act, a provider of energy services is natural or legal person which offers energy service or ensures other measures aimed at increasing energy efficiency of buildings and / or facilities of the user of such services. Specific technical requirements are not determined. The list of ESCOs in Croatia is managed by the National Energy Efficiency Portal.
Is the population aware of the great advantages and small inconvenience that this initiative may cause? This question may only be answered based on interviews conducted with island population. However, we assume that this model is unknown to island population at the most, because it is yet performed as a pilot project by the TSO. https://www.hops.hr/upravljiva-potrosnja
Is the population open to install automatic demand-response devices in their houses? This question may only be answered based on interviews conducted with island population. We assume that by spreading of DR model in practice the interest of local population will grow.
Is the electric market willing to offer competitive tariffs or other incentives for customers in a demand-response scheme? We are not aware that the electric market is considering to offer competitive tariffs. Consumers' habits of managing electricity consumption are typically handled by arranging various tariff models offered by the TSO / DSO. According to the contracted tariff model, prices of electricity may be determined on the same day basis or based on the higher and lower daily tariff.
Is the population open to consciously modify their electricity consumption habits depending on the electricity rates? This question may only be answered based on interviews conducted with island population.
Is ISO 50001 certification a requirement for some companies? What is the criteria to demand this standard? Implementation of ISO 50001 management system is optional. Under the Energy Efficiency Act, large enterprises are required to either (i) perform independent energy audit every four years, or (ii) implement energy management system in accordance with the ISO 50001 standard and obtain relevant certificate issued by the accredited independent body. Pursuant to the Croatian accounting laws, some enterprises are deemed large automatically (e.g. banks, leasing companies, funds etc.). Other enterprises must exceed two of the following thresholds: (i) HRK 150 M (approx. EUR 20.000.000) in liquid funds; (ii) revenue in amount of HRK 300 M (EUR 40.000.000); (iii) average number of 250 employees in a business year.
Are there significant ISO 50001 certification companies in your country/area? To our knowledge, some of the well known ISO 50001 certification companies in Croatia include TÜV Nord Croatia, URS Adriatica, Adriacert d.o.o., DNV GL - Business Assurance etc.
How do storage systems integrate into the ancillary service market? The ancillary service market in Croatia is still under development. Until the fully functional market is established, the responsibility for ancillary services lies with the DSO/TSO, who are obligated to act under regulated conditions.
Which grid fees apply for energy storage? Connection fees have not yet been determined, as the energy storage is not specifically regulated in detail.
Which incentive schemes apply for prosumers who share the energy produced and stored to the grid? There is no specific incentive scheme prescribed for this model. General incentives offered under the Renewable Energy Sources and High-Efficiency Cogeneration Act for construction of RES facilities applies.

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In the case of big storage installations, such as pumped hydro storage, which are the licenses required to develop the projects? At the moment, storage of electricity is not specifically regulated in Croatian legal framework. Expected amendments to the Energy Market Act will set out specific licensing and technical requirements for the connection of storage installations. For pumped hydro storage licensing procedure prescribed for hydropower plants apply accordingly (e.g. perform an environmental impact assessment, obtain building and usage permits, license to generate RES-electricity etc.).
Who is responsible of providing grid connection to offshore wind energy plants? Due to lack of specific regulation set out for offshore wind, such as the practical solutions, we have not been able to identify a responsible party. However, as such facilities must be connected to high voltage grid, we may assume that the TSO will be responsible in future.
Which are grid regulation requirements for offshore wind energy plants (such as cost of access to the grid, duration of connection period, etc.)? N/a.
Are there any environmental permits that restrict the location of these installations? N/a.
Are there any effective ways of accessing to credit to finance offshore wind energy projects on islands? N/a.
Are there any players on islands, such as aggregators, that facilitate the integration of solar PV consumers to the system? Facilitators of PV integration on islands are the Government, local authorities and the DSO.
Which permits are needed for the installation of off-grid and distributed PV solutions? - Off-grid system: No permit is required. - DG system: Permitting obligations set out for prosumers / generators of electricity apply.
Are there any constraints, in the regulatory field, for installing off-grid solar PV systems? As this question is not specifically regulated by law, we have not identified any obvious constraints.
Do islands have an appropriate network to meet applicable rules regarding safety and reliability for distributed solar PV? Entire electricity grid in Croatia (whether on islands or mainland) is owned by the national DSO / TSO and complies with all necessary technical and safety requirements. For reliability reasons, DSO and TSO shall assess the impact of any new connected asset to operation of the system.
Are there any restrictions for connecting distributed generation solar PV plants to the grid? Technical conditions for connection to the distribution grid are determined by the DSO upon individual application of an interested grid user (i.e. generator of electricity). Such characteristics are set out with respect to frequency, voltage, powertrain and protective grounding, short-circuit stream value, insulation level and protection from breakdowns. Some high-level requirements are provided in the Network Code of the DSO.

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Are there any requirements for covering a minimum percentage of domestic hot water with solar thermal energy in renovated buildings? General requirements regarding the use of renewable energy and thermal protection in both new and renovated buildings heated to an internal temperature higher than 12 °C are set out under the Technical regulation on rational use of energy and thermal protection in buildings ("Technical Regulation"). According to the Technical Regulation new buildings are required to comply with the minimum of 20% energy used from renewable sources. The requirement for the use of renewable energy may also be met if at least 25 % of total energy used is solar energy. These requirements cover the complete heat demand, including the preparation of domestic hot water. In addition, these requirements shall apply to extended and / or upgraded parts of renovated buildings if such parts have a useful surface over 50m2 and are heated to a temperature higher than 12 °C.
Which are the regulatory laws that apply for waste-to-energy processes? The general regulatory framework for waste-to-energy processes is set out in the Act on Sustainable Waste Management, while more detailed operational rules and requirements are set out by the Regulation on thermal processing of waste. Additional rules governing certain aspects of the waste-to-energy process (e.g. environmental requirements, tariff classification system, etc.,) are set out by various different acts and related bylaws (e.g. Environmental protection Act, Energy Act, Renewable Energy Sources and High-Efficiency Cogeneration Act, Regulation on emission limit values for air pollutants from stationary sources, Regulation on the environmental pollution register etc.).
Which environmental specifications should be compiled in order to enable the construction of waste-to-energy facilities? Under the Regulation on thermal processing of waste ("Regulation"), in order to conduct waste-to-energy processes, facilities are required to obtain the relevant operational permit. In order to obtain such permit, applicant must guarantee that the following requirements are met: - the facility must be designed, equipped, maintained and operated in accordance with the project documentation and the Regulation, taking into account the category of waste processed - thermal energy generated during the waste-to-energy process should be recovered as far as practicable, through the production of heat, steam or energy - waste-to-energy process must comply with a high level of energy efficiency - residues should be minimized, and if possible recycled - disposal of residues that cannot be prevented, reduced or recycled must be carried out in accordance with the Act on Sustainable Waste Management. Additional environmental requirements (e.g. requirements regarding pH, temperature and flow of wastewater discharge) may apply in case it is not necessary to obtain separate environmental permit.
Who has the jurisdiction over generated and hazardous waste on islands? Who is responsible of its management? The jurisdiction is performed by the local and regional island authorities which are competent for the implementation of the prescribed waste management measures. However, certain waste management authorities such as issuance of the hazardous waste management permit or thermal treatment of waste are still held by the Ministry of Environmental Protection and Energy. On a technical level, the waste management is performed by either publicly or privately owned waste management companies, and in certain aspects by the communal service of the local authority.
Are there any permitting requirements for using vitrified slag for construction? Technical requirements related to construction, including essential properties of construction products are set out by the Technical regulation on technical specifications for construction products in the harmonized area ("Technical Regulation"). In accordance with the Technical Regulation, requirements set out under the standard EN 450-1:2012 (title of the harmonized standard in Croatian: HRN EN 450-1:2013) shall apply to this matter.

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Is there any public scheme incentivizing the use public buses using hydrogen on islands?
No such incentive has been offered at the moment. However, with the Integrated National Energy and Climate Plan for the period 2021-2030, Croatia has undertaken to perform a detailed research and analysis of production possibilities from advanced bio-fuels. As part of the regulatory framework development, financial mechanisms shall be established in order to support the development and use of alternative options.
The Act on Promotion of Clean and Energy-Efficient Road Transport Vehicles which is currently in force, defines that all purchasers and carriers performing public liner transport services, must take into account while purchasing the new vehicles the energy and environmental effects in the period of their utilization. During a calendar year, at least 70% of rent or purchased vehicles should use the alternative energy source (i.e. biogas, hydrogen, electricity etc.).
As regards the use of hydrogen in transport, the National Politics Framework assesses that there is no need of installation of a hydrogen infrastructure in Croatia prior to 2030 (as pursuant to expected developments in transport, a ratio of hydrogen consumption in total energy consumption by 2030 will amount 0%). However, the pilot projects may be launched in case of unforeseen developments in Croatian hydrogen market, the performance of pilot projects for hydrogen infrastructure is possible.

Are there any technical standards for the usage of "green gases" such as hydrogen or biogas?
Quality standards for placing biofuels on Croatian market which substitutes diesel and petrol in transport are determined with the Regulation on quality of biofuels. The aim is to reach the objectives with respect to climate change challenges, meeting the environmental requirements in energy supply and overall promotion of renewable energy sources.

Which are the conditions of use and access of power-to-gas technologies to the network?
These technologies are currently implemented as the pilot / demonstrative projects. However, it may be expected that P2G and P2L systems will play an important role in future, in the gas consumption segment primarily. Due to the current lack of necessary implementing regulation and existence of such models in practice, we are unable to answer this question.

Is there any regulatory support to promote deployment of power-to-heat technologies?
Public programmes by the Environmental Protection and Energy Efficiency Fund which promote energy efficiency systems (as described above) incentivize the installation of heat pumps. The co-financing rate for renovation of family houses amounts to 60%. For installation of innovative RES models with the public buildings, grant amounts from 40% up to 80% of justified costs per project depending of the project location.

Does the regulation allow decentralized resources to provide services to local grids?
Ancillary services are provided by the DSO and TSO. DER will be able to provide additional non-frequency ancillary services after the full market implementation of the electricity market directive (EU) 2019/944.

Are there any policies or incentives to support innovative technologies (specify for each of the technologies described in the business models)?
The Environmental Protection and Energy Efficiency Fund grants financial support for installation of solar thermal collectors, heat pumps and PVs in family houses
https://www.fzoeu.hr/hr/energetska_ucinkovitost/enu_u_zgradarstvu/energetska_obnova_obiteljskih_kuca/.
Also, an incentive intended at support of the same innovative business models in public buildings is announced for 21 September 2020 https://www.fzoeu.hr/docs/tekst_javnog_poziva_zgrade_javne_namjene_2020_v1.pdf (see above under the"public programmes in operation to promote energy efficiency systems".
Incentives are also legally possible pursuant to the Renewable Energy Sources and High-Efficiency Cogeneration Act, for installation of generation facilities using renewable energy sources (such as wind, solar, aerothermal, geothermal, hydrothermal and oceanic waves, hydraulic, biomass and biogas) to generate electricity. However, there are no opened tenders for granting such incentives at the moment.

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Which are the transmission access requirements for renewable energy plants? Are they different in the case of islands? A contract with the TSO is necessary. General technical and other requirements which should be met are set out in the Network Code by the TSO. The same rules apply to entire transmission network in Croatia (terms are not different on islands).
Are there any restrictions on sitting and construction of renewable energy plants? In general, a building permit is required to build RES facilities, with an exception applying to PV installations constructed on existing buildings for their own use. Also, environmental impact assessment ("EIA") shall be performed to obtain a location permit for construction of RES facilities above 100 MW power (or 20 MW, in case of a wind power plant). For smaller RES facilities EIA shall be performed only if the competent body decides it is necessary upon conducting a preliminary screening.
Which are the investment limitations (according to regulation) regarding financial models? Depending on the investment model, different rules may apply with regard to thresholds and documentation which is required to obtain financing. However, there are no general limitations on investments in Croatia.
Are there any financing methods (such as grants, preferential loans, etc.) that incentivize the inversions in the energy efficiency sector? Commercial banks offer various financing models of so-called "green loans" aimed at individuals to improve energy efficiency and perform renovation of buildings, install renewable energy facilities, etc. For companies and investors, commercial banks offer grants in cooperation with the European institutions. Also, Croatian Bank for Reconstruction and Development offers loans intended for investments in land, buildings, equipment and appliances to local and regional government units, public and government bodies, institutions engaged in social activities, etc.
Are renewable energy sources demanded to meet balancing requirements? Small RES facilities (below 1 MW power) are not responsible for system balancing. In this case, balancing is performed by the supplier or other market participant which is taking the excess electricity generated in the RES facility, based on the concluded Power Purchase Agreement. RES facilities above 1 MW power may arrange their balancing responsibilities in one of the following ways: (i) they may become a balance group manager and thus perform the system balancing on their own; or (ii) transfer their balancing responsibility to one of the existing balance group managers by entering the membership agreement with a balance group manager.

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A2.2 France

Is there any simplified bureaucracy process to become a prosumer?
According to the Energy Code, everybody (both domestic as industrial actors) can generate electrical energy, as long as the following conditions are fulfilled by the generator:
- Large units (in general with capacity higher than 50 MW, or 10 MW for fossil fuel-based units) have to comply with the multi-annual energy planning (Programmation Pluriannuelle de l'Energie – PPE). The PPE is elaborated by the French government for the mainland, and together with local authorities for non-interconnected areas (ZNIs – see below). Furthermore, project developers have to obtain an administrative authorization delivered by the national administration. In addition, on the mainland, there is a strict upper boundary of 2.2 kg CO2 per MW of installed capacity per year, which limits the number of hours during which fossil fuel units can work.
- For small units, for instance rooftop PV panels at households, there is no need for such administrative authorization, but a declaration must be done at the municipal authority and specific urban constraints must be checked. Within historical areas, the national authority in charge of maintaining the French cultural patrimony (Architecte des Bâtiments de France - ABF) is consulted, and may not approve the project (for instance, in city centres, in picturesque villages, or close to churches or any other historical building, it's impossible to install PV panels). Furthermore, even for self-consumption installations, connection to the distribution network is required.

Do you need any permission to start self-generation of electricity from solar energy?
See answer to above question.

Are there any free available data about solar resource in a local/regional level so the prosumers can estimate the characteristics of their system?
Yes, in France there are different free databases available on regional level. See also https://www.photovoltaique.info.
On European scale, it is recommended to use the Photovoltaic Geographical Information System (PVGIS) of the European Commission Joint Research Center which is scalable onto the individual member states: https://ec.europa.eu/jrc/en/pvgis

Can the prosumer sell the electricity to the network?
Yes, according to the Energy Code. Prosumers can either sell 100% of the electricity generated to the incumbent operator or sell only the surplus in case of self-consumption.

Can the prosumer obtain any economic benefit from selling the generated electricity?
Yes. Renewable energy is supported by feed-in tariffs and feed-in premiums, allocated through tendering procedures or administrative procedures. Amounts of feed-in tariffs and feed-in premiums are updated each quarter and published by the Energy Regulatory Authority (CRE).

Is there any specific regulation for this initiative?
The recently adopted Energy-Climate Law intends to facilitate the deployment of Renewable Energy Communities. The legal framework is defined, transposing the EU Clean Energy Package directive.

Are there significant examples of energy communities in your local/regional area?
Most existing examples are about renewable plants (wind or PV farms) owned by citizen communities.
See for instance:
- https://energie-partagee.org/actualites-des-projets/
- http://www.centralesvillageoises.fr/panorama-des-projets

Are public authorities in islands aware of the benefits of this initiative, especially in small or remote settlements or islands? And the population?
Yes, public authorities are aware and promote this initiative. See website of the national energy agency ADEME: https://www.ademe.fr/collectivites-secteur-public/animer-territoire/mobiliser-acteurs-territoire/developpement-projets-denergie-renouvelables-a-gouvernance-locale

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Are there significant examples of district heating in your local/regional area? Yes, in France there are 760 district heating networks, mainly in urban areas.
Are there examples of district heating in combination with renewable energy in your area? Public authorities strongly support the development of such heating networks using renewable energy sources. A specific fund ("Fonds Chaleur") is managed by the national energy agency ADEME: https://www.ademe.fr/sites/default/files/assets/documents/grandes-orientations-modalites-fonds-chaleur-2020.pdf. Many examples exist combining district heating with waste-to-energy, biomass, geothermal energy. See http://reseaux-chaleur.cerema.fr/district-heating-and-cooling-in-france.
Is this initiative legal in your country? In France, demand response is well developed. According to the multi-annual energy planning (PPE), 6 GW of actionable demand response capacity should be developed by 2023. Demand response can be valued as energy or as capacity. Furthermore, has a clear framework on the status of independent aggregators and their role and responsibilities in the market.
Are DSOs in your country/area interested in this initiative? Yes. The main DSO in France, ENEDIS, is participating in many pilot projects on flexibility.
Is there any kind of platform, either private or driven by public authorities, that facilitates collection (donations) or allows investors to know the renewable energy projects that need financing through Crowdfunding? The national crowdfunding association is a central platform that links to different key market actors offering crowdfunding for renewable energy projects which can be accessed under https://financeparticipative.org/. See also https://tousnosprojets.bpifrance.fr/.
Are there mechanisms for regulating the actions of the Crowdfunding? Are there further limits on the amounts of investment above those imposed by the EU (5 million euros)? There is a specific label "crowdfunding for green growth": https://www.economie.gouv.fr/entreprises/label-crowdfunding-croissance-verte-financement-collaboratif. 21 crowdfunding platforms are allowed to use this label.
As it is a virtual mechanism, in case of fraud, are there regulatory policies and guarantees backed by public authorities? There are no guarantees backed by public authorities: https://www.economie.gouv.fr/dgccrf/Publications/Vie-pratique/Fiches-pratiques/financement-participatif. There is however a specific decree which provides a strict framework which crowdfunding platforms have to comply with: https://www.legifrance.gouv.fr/eli/decret/2014/9/16/2014-1053/jo/texte.

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Is there some kind of system in place or as a pilot project? Several experiments of collective self-consumption and peer-to-peer trading based on blockchain are ongoing. Major French energy players are currently experimenting blockchain: - As part of the Confuences eco-district in Lyon, Bouygues Immobilier is exploring the Blockchain to trace the distribution of energy produced by photovoltaic panels on the roofs of buildings in the district and consumed locally by its residents. The group draws on the expertise of startups Energisme and Stratumn. If the pilot proves successful, the system could be extended to other eco-neighborhoods in France. - In South-West of France, the Digisol project, winner of an ADEME call for projects, started in 2017. Led by SUNCHAIN, a spin-off of the engineering company TECSOL, this project is experimenting with the use of blockchain as part of a collective self-consumption project. It is based on the Blockchain Hyperledger, a private platform for the development of the Blockchain supported by the Linux foundation. ENEDIS, the France DSO, has joined this experiment. Its information system can connect directly to the blockchain and collect for each consumer the share of electricity coming from local production and its electricity supplier (for billing and balancing), as well as any surplus of local production. This information is then transmitted to the suppliers and the legal entity. Eventually, up to 1,000 sites could be equipped within the DIGISOL project. - GREENFLEX, a subsidiary of TOTAL, has announced a blockchain demonstrator for local energy communities. Blockchain would be mobilized to trace the source of energy to facilitate the market between individuals. Greenflex is relying on the startup Blockchain Partner to model and simulate these exchanges and build a digital demonstrator. A first virtual demonstrator, bringing together supermarkets, industries and private homes, was launched on a neighborhood scale at the end of 2017. - The DAISEE start-up based in Villeurbanne is working on an Open Source program aimed at making energy a common good based on Blockchain technology. The structure aims to create the Energy Internet based on a resilient, distributed, secure and trusted infrastructure for all stakeholders in the energy system.
The population of the islands, that have photovoltaic installations in their homes, have access to information about P2P energy trading as a method of selling their stored surplus? This question can only be seriously answered based on interviews conducted with island population. However, it can be assumed that all relevant information is available online.
Are there any agreements or regulatory policies with the traditional electricity market agents regarding the possible establishment of P2P Energy trading systems or planning to establish them? See examples provided in the answer to the above question. Also note that EDF has created the company EXAION that will provide blockchain as a service: https://www.edf.fr/groupe-edf/espaces-dedies/journalistes/tous-les-communiques-de-presse/avec-sa-nouvelle-filiale-exaion-edf-lance-une-offre-numerique-ecoresponsable-specialisee-dans-les-projets-blockchain.
Is there a legal regulation on the responsibility of their actions (prosumers, consumers, network platform) or motivated by situations of fraud at the time of the return on investment agreed with? There is no clear legal regulation yet.
Is there any kind of tax benefit for the renting modality? Any tax benefit may result from the specific asset, the specific implementation of the Business Model and many other factors. This question is impossible to answer in a generic way.
Are there VAT tax deductions for the monthly expenditures fee? Any tax deduction may result from the specific leasing contract, the specific implementation of the Business Model and many other factors. This question is impossible to answer in a generic way.
Is there any public programme in operation to promote energy efficiency systems? Energy efficient systems are promoted by the national energy agency ADEME: https://www.ademe.fr/.

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When an islander decides to replace household appliances or industrial machinery, in the case of industry, for more energy-efficient products, do they receive any financial or economic compensation (grants, discounts…)? There are some incentives for switching to energy-efficient technologies. The overall French policy for building renovation is currently being revised (from tax credit to direct financial support). For households, possible financial support is described in this guide: https://www.ademe.fr/sites/default/files/assets/documents/guide-pratique-aides-financieres-renovation-habitat-2020.pdf.
Is there a district heating system in operation at a domestic level (residential/housing or office building) or at an industrial level on the islands? As far as we know, there is a heat network in the city of Corte in Corsica.
For the construction of new infrastructures (buildings/offices) on the islands, the planning of centralized hot water or cooling systems is promoted as an energy efficiency measure? Yes
Is there any programme, public or private, to promote the development of ESCOs? Some regions have created public or semi-public ESCOs. There is no specific programme at national level.
Are ESCO contracts legally regulated? No, but some standard clauses exist for energy performance contracts (EPCs) for public bodies. Observatory of EPCs in France: https://www.ademe.fr/sites/default/files/assets/documents/ocpe_chiffres-cles_n2.pdf.
Is there any technical standard that defines the general requirements of companies offering energy services? No. However, according to Observatory of EPCs in France, energy service companies are "providers of energy efficiency improvement measures aimed at ensuring, compared to a contractual baseline, a verified and measured reduction in the energy consumption of the building or stock of buildings over time through investment in works, supplies or services. The remuneration of the measurement provider shall, at least in part, be correlated to the level of energy efficiency improvement generated by this investment."
Is the population aware of the great advantages and small inconvenience that this initiative may cause? This question can be answered based on interviews conducted with island population. However, it can be assumed that all relevant information is available online but demand response as very technical term is not very well known in general.
Is the population open to install automatic demand-response devices in their houses? This question can be answered based on interviews conducted with island population.
Is the electric market willing to offer competitive tariffs or other incentives for customers in a demand-response scheme? Yes, demand response is well developed in France. It is valued either as energy or capacity.
Is the population open to consciously modify their electricity consumption habits depending on the electricity rates? This question can be answered based on interviews conducted with island population.
Is ISO 50001 certification a requirement for some companies? What is the criteria to demand this standard? Since 2015, companies have more than 250 employees have to - either conduct an energy audit covering at least 80% of their energy bill; - or have an ISO 50001 certification covering at least 80% of their energy bill.
Are there significant ISO 50001 certification companies in your country/area? The following companies are recognised by Cofrac (the national body for accreditation) as ISO 50001 certifiers: AB CERTIFICATION; AFNOR CERTIFICATION; APAVE CERTIFICATION; BCS – BCS CERTFICATION; BUREAU VERITAS CERTIFICATION France; DEKRA CERTIFICATION; SGS ICS; SOCOTEC CERTIFICATION France; UTAC.

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How do storage systems integrate into the ancillary service market? Services provided to transmission and distribution operators must be done in a competitive environment. Network operators do not have the vocation to develop, manage or operate storage assets in accordance with Articles 36 (concerning the operators of distribution networks) and 54 (concerning transmission system operators) of the (EU) Directive 2019/944. Indeed, the exercise by a monopoly network operator of a such activity could delay or even prevent the development of this segment, ultimately leading to higher costs borne by the community, in addition to generating potential subsidies between electricity storage and regulated activities. However, by way of derogation, in accordance with the Directive, system operators can own, manage, operate or develop storage facilities, subject to the approval of CRE, and if the following conditions are met: - a market failure has been identified following an open tender procedure in an area concerned; - such facilities are necessary for network operators to fulfil the obligations for the efficient, reliable and secure operation of their networks, and These are not used to buy or sell electricity on the markets of electricity. It should be noted that this derogation, if implemented, can only be temporary. In this sense, consultations will have to be held at regular intervals to reassess the potential interest of other market players to engage in this sector. If this consultation is positive, network operators will have to gradually phase out their activities in this area. The situation is different in non-interconnected areas (ZNIs) – see below. Furthermore, in accordance with the derogation provided for in the Directive, in "micro isolated grids", system operators can own and manage storage assets. Within non-interconnected areas (ZNIs), there is a specific regulatory set-up for storage. According to article L. 121-7 of Energy Code, DSOs are allowed to manage storage facilities if they allow avoiding additional production costs. The regulator (CRE) has established a specific support mechanism for the development of centralised storage in ZNIs to make sure that storage costs would be covered only to the level of avoided production costs. A first call for storage projects has been held in 2017 in Corsica, Guadeloupe, Martinique and La Réunion islands. 46 applications were received and 11 were selected, for a total capacity of 50 MW (27 MW for arbitrage services and 23 MW for fast reserve). A new call for projects should be launched by CRE soon, depending on the proven economic efficiency of storage.
Which grid fees apply for energy storage? Regarding electricity storage, grid connection requirements are currently being revised to facilitate the development of storage. Storage is treated specifically in non-interconnected areas (see above).
Which incentive schemes apply for prosumers who share the energy produced and stored to the grid? See above.
In the case of big storage installations, such as pumped hydro storage, which are the licenses required to develop the projects? Most of the hydroelectricity potential in France is already exploited. Big installations are managed by operators which are granted by the State a delegation contract for a long period of time.
Who is responsible of providing grid connection to offshore wind energy plants? The responsibility of the grid connection depends on the voltage level at which the wind energy plant shall be connected to. Very few offshore wind farms exist in France. All are connected to the Transmission System.
Which are grid regulation requirements for offshore wind energy plants (such as cost of access to the grid, duration of connection period, etc.)? All new offshore wind farms shall be build based on existing offshore development clusters and tendering procedures. Grid connection will only be granted for the winners of the tendering procedures. Therefore, offshore wind energy in France is very unlikely for NESOI projects, especially from a cost and planning perspective.
Are there any environmental permits that restrict the location of these installations? Yes, very many. These permits will be given based on a comprehensive environmental impact assessment.
Are there any effective ways of accessing to credit to finance offshore wind energy projects on islands? Meeting with investors.

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Are there any players on islands, such as aggregators, that facilitate the integration of solar PV consumers to the system? The "Energy Transition for Green Growth" law (LTECV) has set ambitious objectives for islands: to cover 50% of their energy mix with renewable energies by 2020; and to achieve energy autonomy by 2030. Furthermore, the law has set up specific multiannual energy programmes (Programmation Pluriannuelle de l'Energie – PPE) for each non-interconnected area. Co-developed by the government and local authorities, they are the tool for steering energy policy and involve local authorities in the energy policy of their territories. Local authorities may ask the Minister of Energy to issue a call for tenders or the Energy Regulatory Authority (CRE) to analyse a tariff provision if the rate of development of the sector concerned is not in line with the objectives of the area. Therefore, many actors are developing solar PV on islands and DSOs are closely involved in its integration into the energy system.
Which permits are needed for the installation of off-grid and distributed PV solutions? Large units (in general with capacity higher than 50 MW) have to comply with the multi-annual energy planning (Programmation Pluriannuelle de l'Energie – PPE). The PPE is elaborated by the French government for the mainland, and together with local authorities for non-interconnected areas. Furthermore, project developers have to obtain an administrative authorization delivered by the national administration. For small units, for instance rooftop PV panels at households, there is no need for such administrative authorization, but a declaration must be done at the municipal authority and specific urban constraints must be checked. Within historical areas, the national authority in charge of maintaining the French cultural patrimony (Architecte des Bâtiments de France - ABF) is consulted, and may not approve the project (for instance, in city centres, in picturesque villages, or close to churches or any other historical building, it's impossible to install PV panels). Furthermore, even for self-consumption installations, connection to the distribution network is required.
Are there any constraints, in the regulatory field, for installing off-grid solar PV systems? There are no obvious constraints.
Do islands have an appropriate network to meet applicable rules regarding safety and reliability for distributed solar PV? Yes, French islands have an appropriate network.
Are there any restrictions for connecting distributed generation solar PV plants to the grid? No specific restrictions, unless grid constraints are observed. In this case, a "queue" is put in place by the system operators.
Are there any requirements for covering a minimum percentage of domestic hot water with solar thermal energy in renovated buildings? No such constraint for renovation projects. According to the "Energy Transition for Green Growth" law (LTECV), new buildings owned by any public body (State, Local Authorities etc.) have to generate clean energy and if possible be energy-positive. In addition, local authorities can impose, for new districts, a mandatory threshold for renewable energy production.
Which are the regulatory laws that apply for waste-to-energy processes? The "Energy Transition for Green Growth" law (LTECV) is the main legislative text which provides a framework to waste-to-energy.
Which environmental specifications should be compiled in order to enable the construction of waste-to-energy facilities? This is detailed in the national plan for waste management, available at https://www.ecologique-solidaire.gouv.fr/sites/default/files/Plan%20national%20des%20dechets_octobre%202019.pdf. According to this plan, energy performance of waste-to-energy facilities should exceed 65%. In addition, once a year, the operator of waste-to-energy facilities shall submit to the administration an activity report containing a summary of any relevant information on the performance of the installation in the previous year and any requests made to the operator by the public. The report shall also specify, for incineration plants, the annual rate of energy recovery and present the overall energy balance taking into account the waste stream

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entering the plant, the energy leaving the boiler and the energy recovered in thermal or electrical form and actually consumed or disposed of to a third party.
Who has the jurisdiction over generated and hazardous waste on islands? Who is responsible of its management? Municipalities or their groupings are in charge of waste management.
Are there any permitting requirements for using vitrified slag for construction? The use of slag in the construction sector has to comply with standards for cement, asphalt, etc.
Is there any public scheme incentivizing the use public buses using hydrogen on islands? The use of hydrogen for transport is promoted with the national multi-annual energy planning (Programmation Pluriannuelle de l'Energie – PPE). Each non-intreconnected area has its own PPE.
Are there any technical standards for the usage of "green gases" such as hydrogen or biogas? Regarding hydrogen, in the short term gas networks in France can accommodate a 6% share - except where sensitive facilities are located. In the longer-term, a share of 10% up to 20% can be considered. Several research and demonstration projects have been launched in France. Regarding biogas, it can be injected into the gas distribution or transmission systems after treatment (purification and odorisation).
Which are the conditions of use and access of power-to-gas technologies to the network? To support the development of biogas, public authorities have introduced a feed-in tariff for biogas injected into natural gas networks. Thanks to this mechanism, a producer is guaranteed to sell the biomethane produced by its installation to a natural gas supplier at a rate fixed by decree and for a period of 15 years.
Is there any regulatory support to promote deployment of power-to-heat technologies? Heat pumps are supported by different financial mechanisms (tax credit, subsidies, …). The overall French policy for building renovation is currently being revised, new financial schemes should be available in 2021.
Does the regulation allow decentralized resources to provide services to local grids? The current commonly provided service is top-down redispatch of DER in case of grid constraints, but DER will be able to provide additional non-frequency ancillary services after the full market implementation of the electricity market directive (EU) 2019/944.
Are there any policies or incentives to support innovative technologies (specify for each of the technologies described in the business models)? An experimental system (also known as a "regulatory sandbox") is introduced in the energy sector. The scheme provides that the regulator (CRE) and other competent authorities "may, by reasoned decision, grant derogations from the conditions of access to and use of networks and facilities to deploy (as experimentations) innovative technologies or services in support of energy transition and smart systems". This system provides a legal framework adapted to projects that test innovations that would ultimately require changes to the applicable regulatory and legislative framework.
Which are the transmission access requirements for renewable energy plants? Are they different in the case of islands? There are no transmission systems on French islands.

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Are there any restrictions on sitting and construction of renewable energy plants? According to the Energy Code, everybody (both domestic as industrial actors) can generate electrical energy, as long as the following conditions are fulfilled by the generator: - Large units (in general with capacity higher than 50 MW, or 10 MW for fossil fuel-based units) have to comply with the multi-annual energy planning (Programmation Pluriannuelle de l'Energie – PPE). The PPE is elaborated by the French government for the mainland, and together with local authorities for non-interconnected areas (ZNIs – see below). Furthermore, project developers have to obtain an administrative authorization delivered by the national administration. - For small units, for instance rooftop PV panels at households, there is no need for such administrative authorization, but a declaration must be done at the municipal authority and specific urban constraints must be checked. Within historical areas, the national authority in charge of maintaining the French cultural patrimony (Architecte des Bâtiments de France - ABF) is consulted, and may not approve the project (for instance, in city centres, in picturesque villages, or close to churches or any other historical building, it's impossible to install PV panels). Furthermore, even for self-consumption installations, connection to the distribution network is required.
Which are the investment limitations (according to regulation) regarding financial models? In case of classic investment models (via banks, investment funds etc.), there is no formal limitation on the investment volume for each investor. For crowdlending, maximum loans per person are 2000 € (loan with interest rate) or 5000 € (loan with no interest rate).
Are there any financing methods (such as grants, preferential loans, etc.) that incentivize the inversions in the energy efficiency sector? Yes, energy efficiency in the building sector is supported by many schemes at national and regional level. In addition, energy renovation is part of the national post-COVID recovery plan.
Are renewable energy sources demanded to meet balancing requirements? Yes, RES installations participate in balancing and system services.

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A2.3 Germany

Is there any simplified bureaucracy process to become a prosumer? There is only a standardized process which equally applies to all prosumers. The customer needs to apply for a connection agreement at the relevant DSO, including provision of relevant technical certification such as unit certificates according to German network connection codes (e.g. VDE-AR-N 4105 for low voltage). Basically, the whole installation shall be erected according to the technical state-of-the-art, meaning according to all applicable VDE standards. In case of RES infeed falling under the renewable energy act (EEG), the customer furthermore need to choose and confirm the relevant incentive scheme (direct incentives, market premium or direct selling).
Do you need any permission to start self-generation of electricity from solar energy? For grid-connected self-generation, the same process applies as the 'bureaucracy process to become a prosumer', meaning a customer applies for RES connection and awaits the permission from the relevant DSO. Just in case of offgrid self-consumption models, there is no formal permission required.
Are there any free available data about solar resource in a local/regional level so the prosumers can estimate the characteristics of their system? Yes, in Germany there are different free databases available on regional/state level. On European scale, it is recommended to use the Photovoltaic Geographical Information System (PVGIS) of the European Commission Joint Research Center which is scalable onto the individual member states: https://ec.europa.eu/jrc/en/pvgis
Can the prosumer sell the electricity to the network? The renewable energy act (EEG) provides the option for prosumers of selling their generated electricity directly on the electricity exchange, including the provision of an incentive called market premium. It is also possible to sell generated electricity directly without application of the renewable energy act (EEG) incentive scheme, but in this case the market premium will be waived. In any case, the direct selling requires a regulated service provider (direct seller) which performs all administrative tasks as required by the electricity act (EnWG).
Can the prosumer obtain any economic benefit from selling the generated electricity? An economic benefit is reached when the revenue of selling electricity is higher than the costs of generating electricity. In general, there a clearly a benefit in case of the incentivised renewable energy act (EEG) scheme. For any other cases outside of the EEG incentive scheme, a benefit is easier to reach in case of depreciated installations.
Is there any specific regulation for this initiative? Not yet - the relevant legal framework derived from the Clean Energy Package is still under national development and shall be provided until Jan 2021 at latest.
Are there significant examples of energy communities in your local/regional area? Not yet due to the missing legal framework.
Are public authorities in islands aware of the benefits of this initiative, especially in small or remote settlements or islands? And the population? This question can only be seriously answered based on interviews conducted with such authorities. However, it can be assumed the public authorities are generally aware of the key features of the Clean Energy Package.

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Are there significant examples of district heating in your local/regional area? Nearly all major islands in Germany have already commissioned district heating system such as Norderney, Sylt, Rügen or Föhr. Specific examples can be elaborated on these islands in more details on specific demand.
Are there examples of district heating in combination with renewable energy in your area? While most of the district heating systems are connected with CHP cogeneration, relevant examples of renewable energy are: - Geothermal generation (e.g. on Usedom) - Biomass generation (e.g. on Fehmarn)
- Biogas generation (e.g. on Pellworm)
Is this initiative legal in your country? This initiative is basically legal, although there is currently no regulated flexibility market in Germany on DSO level. Flexibility on DSO level is currently procured by top-down measures such as feed-in management or switching of controllable loads according to the electricity act (EnWG) in order to avoid the potential risk of 'gaming' by causing market congestions by large market participants. However, different flexibility procurement platforms are currently being tested in Germany under the SINTEG funding scheme.
Are DSOs in your country/area interested in this initiative? DSOs are basically interested in this initiative, however the commercial benefit need to be elaborated in comparison to current top-down flexibility measures.
Is there any kind of platform, either private or driven by public authorities, that facilitates collection (donations) or allows investors to know the renewable energy projects that need financing through Crowdfunding? The national German crowdfunding association is a central platform that links to different key market actors offering crowdfunding for renewable energy projects which can be accessed under: https://www.bundesverband-crowdfunding.de/crowdfunding-und-erneuerbare-energien/
Are there mechanisms for regulating the actions of the Crowdfunding? Are there further limits on the amounts of investment above those imposed by the EU (5 million euros)? The relevant regulations for crowdfunding are part of the Asset Investment Act (Vermögensanlagengesetz - VermAnlG). A private investor can invest up to 10 k€ or 200% of his monthly net income up to 25 k€ if he provides information on his financial status which proves that the investor has freely available resources of at least 100 k€. Furthermore, the act puts the threshold for a prospectus-free emission at 6 Mio €.
As it is a virtual mechanism, in case of fraud, are there regulatory policies and guarantees backed by public authorities? There are no guarantees backed by public authorities, the risk of total investment loss is always with private investors. The Asset Investment Act with its relatively low thresholds in intended to provide the protection regime for the private investors. Larger emissions above 2.5 Mio € include a minimum level of supervision by the Federal Financial Supervisory Authority (BaFin). In case of fraud, investors will still have the legal possibility to sue the fraudster at the responsible court and claim compensation.
Is there some kind of system in place or as a pilot project? In Germany, few P2P marketplaces have been recently established such as Talmarkt (Wuppertaler Stadtwerke), Bayernwerk Regio Energie (E.ON), enyway or Lition and while label suppliers as Lumenaza.

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The population of the islands, that have photovoltaic installations in their homes, have access to information about P2P energy trading as a method of selling their stored surplus? This question can only be seriously answered based on interviews conducted with island population. However, it can be assumed that all relevant information is available online.
Are there any agreements or regulatory policies with the traditional electricity market agents regarding the possible establishment of P2P Energy trading systems or planning to establish them? Also traditional market players such as E.ON are currently developing P2P energy trading systems, see Bayernwerk Regio Energie example. Basically, P2P is quite complex from a regulatory perspective so that traditional market players can be good enablers with their background knowlegde.
Is there a legal regulation on the responsibility of their actions (prosumers, consumers, network platform) or motivated by situations of fraud at the time of the return on investment agreed with? The lack of regulatory delimitation of the prosumer results in a large number of regulations and legal obligations, to which every seller of electricity is bound. According to the Electricity Act (EnWG), prosumers who want to participate in a P2P trading are officially suppliers according to the EnWG with all possible obligations. Furthermore, a supplier (prosumer) participating in a P2P market is also an energy supply company and thus obliged to appoint a balancing group manager and to report load forecasts to system operators, incl. subject to electricity tax and payment of the EEG surcharge to the TSO. Another regulatory barrier to P2P trading is the Renewable Energy Act (EEG). Due to the promotion of renewable energies, RES run the risk of double marketing, which means that they are not allowed to participate in P2P markets as long as they are incentivised by the EEG. Since most of the renewable energy sources in Germany make use of this type of funding, only a few systems are now available for P2P trading. P2P trading in Germany can be represented theoretically in accordance with the law, but due to the lack of delimitation from prosumers to energy supply companies and suppliers, it can only be managed with very large bureaucratic hurdles and thus opens up the possibility for utilities as an enabler for regulatory needs and bureaucracy acts to realize this application.
Is there any kind of tax benefit for the renting modality? Any tax benefit may result from the specific asset, the specific implementation of the Business Model and many other factors. This question is impossible to answer in a generic way.
Are there VAT tax deductions for the monthly expenditures fee? Any tax deduction may result from the specific leasing contract, the specific implementation of the Business Model and many other factors. This question is impossible to answer in a generic way.
Is there any public programme in operation to promote energy efficiency systems? The Federal Office of Economics and Export Control (BAFA) and the German energy agency are the federal associations which cooperates with the regional energy agencies on state level. These energy authorities promote specific energy efficiency systems and carry out public programmes, such as consultation of final customers regarding the efficient use of energy and energy related products (ESCO). For the specific needs on German islands, the northern energy agencies of Schleswig-Holstein and Mecklenburg-Western Pomerania could be addressed https://www.ib-sh.de/ https://www.leka-mv.de/

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When an islander decides to replace household appliances or industrial machinery, in the case of industry, for more energy-efficient products, do they receive any financial or economic compensation (grants, discounts…)?
Financial support is generally provided by the Federal Office of Economics and Export Control (BAFA). It generally applies to energy services and investments into efficient modern technologies incl. the replacement of non-efficient assets. Currently, the following clusters for financial support apply:

Private persons
- energy consulting (e.g. via the energy agencies, ESCOs)
- electric vehicle with support up to 3 k€
- renewable energy heating systems with support up to 45% for an efficient heat pump
- high efficient building installations and heat recovery with support up to 25 k€
- micro CHP up to 20kW_el with support up to 3.5 k€

Industry/enterprises
- pilot projects for innovative energy savings with support up to 2 Mio €
- efficient heat networks with support up to 15 Mio €
- energy consulting (e.g. via the energy agencies, ESCOs)
- Industrial energy efficiency with support up to 10 Mio €
- electric vehicle with support up to 3 k€
- renewable energy heating systems with support up to 45% for an efficient heat pump
- high efficient building installations and heat recovery with support up to 25 k€
- refrigeration plants and AC with support up to 150 k€
- specific products for climate protection with support up to 30%
- micro CHP up to 20kW_el with support up to 3.5 k€

Communities
- efficient heat networks with support up to 15 Mio €
- energy consulting (e.g. via the energy agencies, ESCOs)
- renewable energy heating systems with support up to 45% for an efficient heat pump
- high efficient building installations and heat recovery with support up to 25 k€
- refrigeration plants and AC with support up to 150 k€
- specific products for climate protection with support up to 30%
- micro CHP up to 20kW_el with support up to 3.5 k€

Is there a district heating system in operation at a domestic level (residential/housing or office building) or at an industrial level on the islands?
Yes, see answers for 'district heating'.

For the construction of new infrastructures (buildings/offices) on the islands, the planning of centralized hot water or cooling systems is promoted as an energy efficiency measure?
Yes, see financial support schemes of the Federal Office of Economics and Export Control (BAFA) - Communities; efficient heat networks.

Is there any programme, public or private, to promote the development of ESCOs?
Yes, ESCOs can participate in any of the BAFA support programs as listed above. Furthermore, ESCOs also benefit from the Renewable Energy and Cogeneration support schemes.

Are ESCO contracts legally regulated?
The form of ESCO contracts is based common legal requirements for contracts. The content of ESCO contracts is not legally regulated, although the contract shall not contradict to current legislation e.g. the Energy Efficiency and Service Act (EDL-G).

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Is there any technical standard that defines the general requirements of companies offering energy services? The Energy Efficiency and Service Act (EDL-G) provides a definition of energy services, meaning that energy service providers shall fulfil these requirements which are: - Activities performed on the basis of a contract - generally abased on verifiable and measurable or estimable energy efficiency improvements or primary energy savings as well as a physical benefit - providing a value in use or advantages as a result of combining energy with energy efficient technology or with measures like operational, maintenance and control activities In addition, an applied quality management system such as ISO 9001 will provide additional trust to energy service providers.
Is the population aware of the great advantages and small inconvenience that this initiative may cause? This question can only be seriously answered based on interviews conducted with island population. However, it can be assumed that all relevant information is available online but demand response as very technical term is not very well known in general.
Is the population open to install automatic demand-response devices in their houses? This question can only be seriously answered based on interviews conducted with island population.
Is the electric market willing to offer competitive tariffs or other incentives for customers in a demand-response scheme? The electricity market (suppliers) are already offering specific incentivised tariffs for demand response redispatch (former demand side management based on 2009/72/EC) based on controllable loads according to §14a Electricity Act (EnWG). Generally, the 'willingness' depends on an individual cost benefit analysis of procuring market-based DR services as one possible tool on the future DSO flexibility market.
Is the population open to consciously modify their electricity consumption habits depending on the electricity rates? This question can only be seriously answered based on interviews conducted with island population.
Is ISO 50001 certification a requirement for some companies? What is the criteria to demand this standard? According to the Energy Efficiency and Service Act (EDL-G), companies can choose between the following options: - perform energy audits according to DIN EN 16247-1 at least every 4 years - implement an energy management system according to ISO 50001 - implement an environmental management system according to EMAS This requirement applies to all companies in Germany which are larger than SME. So the implementation of ISO 50001 is a voluntary option, but many companies have adopted this standard as an integrated management system in combination with other management systems such as ISO 9001.
Are there significant ISO 50001 certification companies in your country/area? There are actually 78 accredited certification companies in Germany offering ISO 50001 certification and audits. A full list of all companies can be obtained from the federal German Accreditation Body (DAkkS) under https://www.dakks.de/en/content/accredited-bodies-dakks
How do storage systems integrate into the ancillary service market? The ancillary service market is currently under development in Germany, resulting from the national implementation of the electricity market directive (EU)2019/944. Based on a current approach by the responsible German authority, the federal Ministry of Economics (BMWi), a new article §12h will be established in the Electricity Act (EnWG) which contains requirements for the procurement of non-frequency ancillary services by both TSO and DSO which can then also be provided by storage systems.

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Which grid fees apply for energy storage? According to §19 of the Regulation on Charges for Access to Electricity Supply Systems (StromNEV), system operators shall offer individual grid fees to final consumers which only consume and feedback electricity with storage. This specific tariff is based on the capacity of the storage, typically in the range between ~100 €/kW*a (high voltage) to ~150 €/kW*a (low voltage) and depending on the specific system operator.
Which incentive schemes apply for prosumers who share the energy produced and stored to the grid? There is no specific incentive scheme for this model. Incentives are granted according to the Renewable Energy Act (EEG) if electricity is generated by RES. A potential benefit can occur if renewable energy is stored and sold on the market via direct sellers when energy prices a high (see 'Can the prosumer sell the electricity to the network?').
In the case of big storage installations, such as pumped hydro storage, which are the licenses required to develop the projects? Generally, the project developer must hold all technical and commercial capabilities according to the Federal Commercial Code (GewO), where several clusters of experts need to be involved (e.g. architects, building surveyors, other appointed experts for specific areas such as noise emissions and environmental protection etc.) which require specific personal licenses. These licensed experts can be sourced externally on the market without being necessarily employed by the project developing company.
Who is responsible of providing grid connection to offshore wind energy plants? The responsibility of the grid connection depends on the voltage level and the grid area in which the wind enegry plant shall be connected to. In Germany, currently all offshore wind farms are connected on TSO level by TenneT and 50Hertz.
Which are grid regulation requirements for offshore wind energy plants (such as cost of access to the grid, duration of connection period, etc.)? The overall further development of offshore wind energy in Germany is limited by the Federal Offshore Wind Energy Act (WindSeeG). All new offshore wind farms shall be build based on existing offshore development clusters and tendering procedures. Grid connection will only be granted for the winners of the tendering procedures. Therefore, offshore wind energy in Germany is very unlikely for NESOI projects, especially from a cost and planning perspective. Specific studies will be necessary to assess these factors.
Are there any environmental permits that restrict the location of these installations? Yes, very many. These permits will be given based on a comprehensive environmental impact assessment.
Are there any effective ways of accessing to credit to finance offshore wind energy projects on islands? Meeting with investors.
Are there any players on islands, such as aggregators, that facilitate the integration of solar PV consumers to the system? The facilitators of PV integration are normally the DSOs.
Which permits are needed for the installation of off-grid and distributed PV solutions? - Offgrid system: No permit is required - DG system: Permit is required from the connected system operator based on formal application.
Are there any constraints, in the regulatory field, for installing off-grid solar PV systems? There are no obvious constraints.
Do islands have an appropriate network to meet applicable rules regarding safety and reliability for distributed solar PV? All networks in Germany (whether on islands or mainland) have the same technical and safety requirements. According to §49 Electricity Act (EnWG), all technical installations shall be erected and operated based on the same state-of-the-art standards. For reliability reasons, every system operator shall assess the impact of any new connected asset on the system operation.

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Are there any restrictions for connecting distributed generation solar PV plants to the grid? The DG system shall comply with the applicable German network connection codes (e.g. VDE-AR-N 4105 for low voltage) and requires technical certification such as unit certificates.
Are there any requirements for covering a minimum percentage of domestic hot water with solar thermal energy in renovated buildings? According to the Renewable Energy Heat Act (EEWärmeG), there is a requirement for a minimum percentage of renewable energy up to 14% only for new build buildings. This covers the complete heat demand (incl. hot water) of a building with the possibility of choosing between different renewable energy sources (incl. solar energy).
Which are the regulatory laws that apply for waste-to-energy processes? The key regulations for waste-to-energy are basically: - The Recycling Economy Act (KrWG) regulates the recycling and utilization of waste, incl. waste-to-energy - The Landfill Act (DepV) regulates the utilization and combustion of sewage sludge - The Act on Combustion and Co-combustion of Waste (17th BImschV) outlines requirements for the erection and operation of combustion and co-combustion plants - The Regulation on the EU List of Waste (AVV) implements the coding of waste and the classification of hazard levels on national level
Which environmental specifications should be compiled in order to enable the construction of waste-to-energy facilities? The key requirements are outlined in the Act on Combustion and Co-combustion of Waste (17th BImschV), incl. - supply and storage of waste - erection and quality of waste combustion plants - operating conditions incl. emission limits for different clusters of waste - treatment of residues - measuring and surveillance
Who has the jurisdiction over generated and hazardous waste on islands? Who is responsible of its management? The jurisdiction is performed by the island authorities which are in charge of implementing the requirements of the federal acts on local level. The management of the technical processes is performed by the combustion plant operators in line with the legal requirements and conditions set by the local authorities.
Are there any permitting requirements for using vitrified slag for construction? This basically depends on the pollutant level of slag. Virtrified slag with a low pollutant level can be used as aggregate to cement, asphalt etc. based on DIN EN 450 in accordance with the EU Construction Products Directive. Virtrified slag with a high pollutant level need to be stored on landfills according to the Landfill Act (DepV) and is not available for construction products.
Is there any public scheme incentivizing the use public buses using hydrogen on islands? Based on the government's 2016 to 2026 hydrogen and fuel cell technology programme, the interdisciplinary National Innovation Programme Hydrogen and Fuel Cell Technology (NIP) ensures the continuation of research and development in the area while simultaneously addressing the issue of market activation and providing necessary support for initial products. The initiative is led by the Federal Ministry for Economic Affairs and Energy (BMWi) supporting applied research and development in hydrogen and fuel cell technology with around 25 million euros annually. This is also open to islands and includes public transport as well. Several new calls on hydrogen buses are expected within the next years: https://www.now-gmbh.de/en/national-innovation-programme/funding-programme

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Are there any technical standards for the usage of "green gases" such as hydrogen or biogas? The German standardization body DKE has made a comprehensive assessment on Power-to-X technologies also including green gases, logically being assigned to the area of chemical storage. As the standardization landscape for Power-to-X is very broad in scope and involves a multitude of technical committees and disciplines, a specific standardization roadmap has been drafted (section 5 applies to Power-to-X): https://www.dke.de/resource/blob/1741554/c50a109e0072c8f83897a6f95d91dbd7/deutsche-normungsroadmap-energiespeicher-version-1-0-data.pdf
Which are the conditions of use and access of power-to-gas technologies to the network? Feed-in of hydrogen and synthetic methane, which was produced from renewable energies using water electrolysis and methanation with electricity and carbon oxides, enjoy the privileges of Part 6 of the Gas Network Access Regulation (GasNZV), e.g.: - privileged connection - privileged feed-in - no feed-in tariffs According to §20 of the Gas Network Fee Regulation (GasNEV), the costs for the gas connection will be allocated to all grid users.
Is there any regulatory support to promote deployment of power-to-heat technologies? Financial support is generally provided by the Federal Office of Economics and Export Control (BAFA). It generally applies to energy services and investments into efficient modern technologies with financial support up to 45% for an efficient heat pump. Furthermore, power-to-heat installations generally apply to controllable loads and receive further benefits such as specific tariffs.
Does the regulation allow decentralized resources to provide services to local grids? The current commonly provided service is top-down redispatch of DER in case of grid constraints, but DER will be able to provide additional non-frequency ancillary services after the full market implementation of the electricity market directive (EU) 2019/944 (see 'How do storage systems integrate into the ancillary service market?').
Are there any policies or incentives to support innovative technologies (specify for each of the technologies described in the business models)? The following innovative technologies receive incentives/funding from the Federal Office of Economics and Export Control (BAFA) or the Federal Ministry for Economic Affairs and Energy (BMWi): - efficient heat networks - efficient heating with renewables, incl. biomass (pellets), heat pumps, solarthermal, biogas - CHP/heat and power cogeneration - innovative cooling units and air conditioning - decentral heat recovery units from waste water - geothermal energy - micro hydropower plants - Power-to-gas in transport - Power-to-gas in large scale industrial application (Reallabore) - testbeds for new wind energy technologies
Which are the transmission access requirements for renewable energy plants? Are they different in the case of islands? There are no transmission systems on German islands. Generally, the German Network Code for High Voltage VDE-AR-N 4130 as national implementation of NC RfG applies to all transmission system connected facilities incl. RES.

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Are there any restrictions on sitting and construction of renewable energy plants? There are only few restrictions for smaller RES on domestic level, such as the availability of sufficient network capacity. Large renewable energy plants have to follow a specific planning procedure, incl. environmental impact assessment and connection request to TSO or DSO systems. They can only be erected in specific areas according to the land use and development plans or in case of offshore wind farm in specific cluster areas.
Which are the investment limitations (according to regulation) regarding financial models? For crowdfunding, a private investor can invest up to 10 k€ or 200% of his monthly net income up to 25 k€ if he provides information on his financial status which proves that the investor has freely available resources of at least 100 k€. Furthermore, the Asset Investment Act (Vermögensanlagengesetz - VermAnlG) puts the threshold for a prospectus-free emission at 6 Mio €. Beside the individual investors' limitation, there is no formal limitation for the total volume of the project. A prospectus emission will have a minimum level of supervision by the Federal Financial Supervisory Authority (BaFin). In case of classic investment models (via banks, investment funds etc.), there is no formal limitation on the investment volume for each investor.
Are there any financing methods (such as grants, preferential loans, etc.) that incentivize the inversions in the energy efficiency sector? The Reconstruction Loan Corporation (KfW) as Germany's third largest bank offers numerous specific grant and loan programs related to renewable energies, energy efficiency and building renovation. These programs apply to private persons, companies and industry.
Are renewable energy sources demanded to meet balancing requirements? With the current applied market model, the relevant system operator is responsible for the balancing also the RES in his network. With the full implementation of the electricity market regulation (EU) 2019/943, all market participants shall be responsible for the imbalances they cause in the system (Article 5) which logically also include RES.

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A2.4 Greece

Is there any simplified bureaucracy process to become a prosumer? Yes, there is, but depends on the production power size. The customer needs to apply for a connection agreement at the relevant DSO.
Do you need any permission to start self-generation of electricity from solar energy? For grid-connected self-generation, the same process applies as the *bureaucracy process to become a prosumer*. For off-grid generation, a permit is required for high power production
Are there any free available data about solar resource in a local/regional level so the prosumers can estimate the characteristics of their system? There are some Greek-based databases (https://www.atmosphere-upatras.gr/solarmaps) regarding PV but with limited use. On European scale, it is recommended to use the Photovoltaic Geographical Information System (PVGIS) of the European Commission Joint Research Center https://ec.europa.eu/jrc/en/pvgis
Can the prosumer sell the electricity to the network? No, net-tariff model is applied. Extra energy provided into the network is not providing any income. The clearance takes place every 3 years.
Can the prosumer obtain any economic benefit from selling the generated electricity? No
Is there any specific regulation for this initiative? Not yet - the relevant legal framework derived from the Clean Energy Package is still under national development and shall be provided until Jan 2021 at latest.
Are there significant examples of energy communities in your local/regional area? Energy communities have been established but we are not aware of their impact.
Are public authorities in islands aware of the benefits of this initiative, especially in small or remote settlements or islands? And the population? Not easy to know
Are there significant examples of district heating in your local/regional area? No district heating systems are installed in Greek Islands. DH Systems are installed in northern mainland Greece
Are there examples of district heating in combination with renewable energy in your area? No. There are some proposals/ideas for geothermal DH in a Greek Island
Is this initiative legal in your country? Flexibility (DR) is enabled for large scale consumers. For smaller consumers no flexibility market exists in Greece. Greek Electricity Market is in transition in order to apply the target model. Flexibility services will be enabled in the next years.
Are DSOs in your country/area interested in this initiative? There Is only one DSO (HEDNO) in Greece and as far as we are aware is interested.
Is there any kind of platform, either private or driven by public authorities, that facilitates collection (donations) or allows investors to know the renewable energy projects that need financing through Crowdfunding? There are horizon projects (all Greek partners) that facilitate renewable energy projects with crowdfunding and innovative funding www.prodesa.eu
Are there mechanisms for regulating the actions of the Crowdfunding? Are there further limits on the amounts of investment above those imposed by the EU (5 million euros)? We are not aware of such mechanisms even after an online search was held.
As it is a virtual mechanism, in case of fraud, are there regulatory policies and guarantees backed by public authorities? As we are not aware of such mechanisms so we cannot answer

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Is there some kind of system in place or as a pilot project? We are aware that the Greek DSO and TSO participates in EU projects regarding innovative p2p and flexibility projects (https://coordinet-project.eu/projects/coordinet)
The population of the islands, that have photovoltaic installations in their homes, have access to information about P2P energy trading as a method of selling their stored surplus? No regulatory framework exists
Are there any agreements or regulatory policies with the traditional electricity market agents regarding the possible establishment of P2P Energy trading systems or planning to establish them? No there are not. We are aware that the Greek DSO and TSO participates in EU projects regarding innovative p2p and flexibility projects (https://coordinet-project.eu/projects/coordinet)
Is there a legal regulation on the responsibility of their actions (prosumers, consumers, network platform) or motivated by situations of fraud at the time of the return on investment agreed with? The lack of regulatory delimitation of the prosumer results in a large number of regulations and legal obligations, to which every seller of electricity is bound. According to the Electricity Act, prosumers who want to participate in a P2P trading are officially suppliers according to the Act with all possible obligations. Furthermore, a supplier (prosumer) participating in a P2P market is also an energy supply company and thus obliged to appoint a balancing group manager and to report load forecasts to system operators, incl. subject to electricity tax and payment of the EEG surcharge to the TSO. Another regulatory barrier to P2P trading is the Renewable Energy Act. Due to the promotion of renewable energies, RES run the risk of double marketing, which means that they are not allowed to participate in P2P markets as long as they are incentivised. Since most of the renewable energy sources in Germany make use of this type of funding, only a few systems are now available for P2P trading. P2P trading can be represented theoretically in accordance with the law, but due to the lack of delimitation from prosumers to energy supply companies and suppliers, it can only be managed with very large bureaucratic hurdles and thus opens up the possibility for utilities as an enabler for regulatory needs and bureaucracy acts to realize this application.
Is there any kind of tax benefit for the renting modality? Any tax benefit may result from the specific asset, the specific implementation of the Business Model and many other factors. This question is impossible to answer in a generic way.
Are there VAT tax deductions for the monthly expenditures fee? Any tax deduction may result from the specific leasing contract, the specific implementation of the Business Model and many other factors. This question is impossible to answer in a generic way.
Is there any public programme in operation to promote energy efficiency systems? In September 2020 will start the 3rd program for upgrading residential buildings (Eksikonomo kat Oikon III)
When an islander decides to replace household appliances or industrial machinery, in the case of industry, for more energy-efficient products, do they receive any financial or economic compensation (grants, discounts…)? Financial support is provided by the Ministry of Environment and Energy via Eksikonomo kat Oikon III Program. Eligible actions are: • Frame replacement. • Installation of shading systems. • Installation of thermal insulation in the building shell including the roof • Heating system upgrade. • Upgrade hot water supply system use The financial support varies as it takes into account the income of each person, the household members and area of building.
Is there a district heating system in operation at a domestic level (residential/housing or office building) or at an industrial level on the islands? See answers for 'district heating'.

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For the construction of new infrastructures (buildings/offices) on the islands, the planning of centralized hot water or cooling systems is promoted as an energy efficiency measure? No, its not promoted
Is there any programme, public or private, to promote the development of ESCOs? Programs related to the development of ESCOs doesn't exits (as far as we know)
Are ESCO contracts legally regulated? There are ESCO contracts templates in the website of ministry of Energy and Environment (www.escoregistry.gr)
Is there any technical standard that defines the general requirements of companies offering energy services? No there are not technical standards. The definition of an ESCO is given in Law 4342/2015 which is the greek implementation of 2012/27/EU. Requirements for ESCOs are described in Ministerial Decision Δ6/13280
Is the population aware of the great advantages and small inconvenience that this initiative may cause? This question can only be seriously answered based on interviews conducted with island population. Demand Response is not very well known in general. Currently DR is applied only in intensive consumers
Is the population open to install automatic demand-response devices in their houses? This question can only be seriously answered based on interviews conducted with island population.
Is the electric market willing to offer competitive tariffs or other incentives for customers in a demand-response scheme? Demand Response is not commercially offered as an option to retail clients. As the Greek electricity market advances to target model and smart meters are going to be applied, DR market will rise. In general, private companies have consider these options
Is the population open to consciously modify their electricity consumption habits depending on the electricity rates? This question can only be seriously answered based on interviews conducted with island population.
Is ISO 50001 certification a requirement for some companies? What is the criteria to demand this standard? Energy audits are carried out in accordance with the European standards of EN 16247 series on energy audits, as it is noted in the Greek Law 4342/2015
Are there significant ISO 50001 certification companies in your country/area? After a short online research, there are companies offering ISO 50001 certification
How do storage systems integrate into the ancillary service market? Currently, there is not an ancillary service market. Balance market is in development as a part of the Target Model. Hydro-storage and BESS are the main storage technologies that will participate in this market. The remuneration for the provided services is still in discussion (Hydro: www.e-mc2.gr/el/news/tsiknakoy-hreiazetai-apotimisi-epikoyrikon-ypiresion-gia-tin-antlisiotamieysi and BESS: energypress.gr/news/oi-theseis-toy-spef-gia-tin-apothikeysi-ilektrikis-energeias-ti-apantise-se-erotimatologio-tis)
Which grid fees apply for energy storage? No special grid fees exist. Regular prices are applied
Which incentive schemes apply for prosumers who share the energy produced and stored to the grid? There is no specific incentive scheme for this model. The benefit is the lower grid usage and thus, lower bills.
In the case of big storage installations, such as pumped hydro storage, which are the licenses required to develop the projects? Pump hydro systems are treated in the existing regulatory framework as generic hybrid energy systems. The first license is the Special Works license that is provided by the president of the Greek Regulatory Authority. Other licenses required, installation license, operation license and environmental permit.
Who is responsible of providing grid connection to offshore wind energy plants? There are no installed offshore systems in Greece. There is not specific framework, although specific rules and regulations have been into effect. The TSO is responsible for providing the technical studies for the grid connection, but the owner pays and provide the connection

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Which are grid regulation requirements for offshore wind energy plants (such as cost of access to the grid, duration of connection period, etc.)? i Issuance of Electricity Generation License (competent authority Ministry Development) ii. At the same time applications must be made for: • Formulation of a Station Connection Offer with the Network Operator • Approval of Environmental Terms or for Exemption • Intervention Permit e.g. Necessary permits to obtain the right to use the position for the installation of the project - Concession of seashore and beach for RES projects iii. At the same time applications must be made for: • Issuance of Installation Permit (competent authority Region) • Issuance of Building Permits (competent authority Urban Planning or against case authority). • Signing a Connection Agreement with Network Operator • Signing of an Electricity Purchase Agreement or entering the competitive Market iv. Trial period and issuance of Operating License
Are there any environmental permits that restrict the location of these installations? A strategic impact assessment has been contacted by the state to find the optimal places without many restrictions. 12 Places has been identified. This assessment included other reasons for excluding areas such military zones. In general, the environmental framework for the offshore systems consists of the following: • National Spatial Framework for RES (Ministerial Decision 49828/2008) • National Spatial Framework for Tourism (Ministerial Decision 67659/2013) • Draft National Spatial Framework for the coastal area and the islands (Ministerial Decision 24208/2009) • Law for the conservation of biodiversity (Law 3937/2001) • Marine Spatial Planning • Seashore and beach Regulations (Law 2971 / 2001)
Are there any effective ways of accessing to credit to finance offshore wind energy projects on islands? Meeting with investors.
Are there any players on islands, such as aggregators, that facilitate the integration of solar PV consumers to the system? The facilitators of PV integration are normally the DSOs.
Which permits are needed for the installation of off-grid and distributed PV solutions? - Offgrid system: No permit is required for low power offgrid systems. For high power/voltage systems a notification to regulatory authority / DSO is needed - DG system: Permit is required from the connected system operator based on formal application.
Are there any constraints, in the regulatory field, for installing off-grid solar PV systems? The same as the connected, in terms of spatial frameworks (natura, traditional settlements etc)
Do islands have an appropriate network to meet applicable rules regarding safety and reliability for distributed solar PV? The non-interconnected islands have specific rules. All described in the relevant code https://www.deddie.gr/media/5507/kodikas-diachirisis-mdn-ekdosi3.pdf. The interconnected island are following the generic code for distribution
Are there any restrictions for connecting distributed generation solar PV plants to the grid? Yes, there are certain electrical standards for the equipment. There are limitations for non-interconnected islands regarding the maximum installed power. Different for each island complex. There are also cable limitations for some of the interconnected islands.
Are there any requirements for covering a minimum percentage of domestic hot water with solar thermal energy in renovated buildings? In all new or radically renovated buildings, it is mandatory to cover 60% of the needs in DHW from solar thermal systems or other system of RES, CHP, or high efficiency heat pumps. Failure to implement the above facilities must be documented

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Which are the regulatory laws that apply for waste-to-energy processes? Law 4042/2012 which is a Greek implementation of the 2008/98/EC
Which environmental specifications should be compiled in order to enable the construction of waste-to-energy facilities?
Who has the jurisdiction over generated and hazardous waste on islands? Who is responsible of its management? The management and responsibilities are described thoroughly in the Article 226 of the law 4555/2018 (with current amendments). In general, municipalities or municipal controlled (consortium) companies are responsible
Are there any permitting requirements for using vitrified slag for construction? We are not aware for special permitting requirements.
Is there any public scheme incentivizing the use public buses using hydrogen on islands? No, there isn't. In the majority of Greek islands it would be very difficult to develop hydrogen refueling stations
Are there any technical standards for the usage of "green gases" such as hydrogen or biogas? The main laws regarding Biofuels are: Law 3423/2005 and Law 4546/2018 (articles 32 and 33).
Which are the conditions of use and access of power-to-gas technologies to the network?
Is there any regulatory support to promote deployment of power-to-heat technologies? Heat Pumps are eligible selection for the Greek Residential Buildings Upgrade Program (Eksikonomo kat Oikon III)
Does the regulation allow decentralized resources to provide services to local grids? In non-interconnected Islands and for dispatchable RES active power reserved for frequency control and service for voltage regulation is offered. Non-dispatchable RES provide only voltage regulation. It is possible if its technical feasible to provide Active Power Reserves
Are there any policies or incentives to support innovative technologies (specify for each of the technologies described in the business models)? There are several target policies regarding energy related technologies. Apart from the mentioned action (Eksikonomo kat Oikon III), specific actions have been applied in order to promote electric vehicles (Cars, bicycles). Around 25 to 40% reduction on price. The public cars will be electric by a relative high share.
Which are the transmission access requirements for renewable energy plants? Are they different in the case of islands? For the non-interconnected islands the administrator is HEDNO and there is a specific code with all the details. (https://www.deddie.gr/media/5507/kodikas-diachirisis-mdn-ekdosi3.pdf) . For the mainland system and interconnected islands the transmission grid is administrated by IPTO (https://www.admie.gr/agora/rythmistiko-plaisio-agoras/methodologies-kai-tehnikes-apofaseis). Some interconnected islands are also administrated by HEDNO with the code of distribution networks (https://www.deddie.gr/media/1420/%CE%BA%CF%8E%CE%B4%CE%B9%CE%BA%CE%B1%CF%82-%CE%B4%CE%B9%CE%B1%CF%87%CE%B5%CE%AF%CF%81%CE%B9%CF%83%CE%B7%CF%82-%CF%84%CE%BF%CF%85-%CE%B5%CE%BB%CE%BB%CE%B7%CE%BD%CE%B9%CE%BA%CE%BF%CF%8D-%CE%B4%CE%B9%CE%BA%CF%84%CF%8D%CE%BF%CF%85-%CE%B4%CE%B9%CE%B1%CE%BD%CE%BF%CE%BC%CE%AE%CF%82-%CE%B7%CE%BB%CE%B5%CE%BA%CF%84%CF%81%CE%B9%CE%BA%CE%AE%CF%82-%CE%B5%CE%BD%CE%AD%CF%81%CE%B3%CE%B5%CE%B9%CE%B1%CF%82.pdf)
Are there any restrictions on sitting and construction of renewable energy plants? Yes there are important restrictions. Three are the most important: a) environmental, b) electrical network capability, c) domestic. Important Laws are: 4685/2020 and National Spatial Framework for RES (Ministerial Decision 49828/2008) which is going to be revised in the next year
Which are the investment limitations (according to regulation) regarding financial models? There is no formal limitation on the investment volume for each investor.
Are there any financing methods (such as grants, preferential loans, etc.) that incentivize the inversions in the energy efficiency sector? Yes, banks provide loans with low interest and favorable terms at the beneficiaries of Eksikonomo kat Oikon III for any additional funds are needed

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Are renewable energy sources demanded to meet balancing requirements? If its technical feasible then yes

A2.5 Italy

Is there any simplified bureaucracy process to become a prosumer? Generally speaking for grid injection you have to be authorized by GRID OPERATOR (from a technical point of view), GSE (energy services/regulator operator in Italy) and AGENZIA DELLE DOGANE (tax agency) to allow this type of market operation as prosumer. The only case that we found notice about is related to the "Simplified Procedure for the construction, connection and start-up of small PV systems on the roofs of buildings" started in November 2015 in Italy for small installation of PV systems. The bureaucratic process only requires the compilation and submission of a Single Application Form for both the construction and operation of generation plants using renewable energy sources as well as for the establishment of the connection cable. The capacity threshold for the application of the Single Authorization procedure for PV plants is above 20 kW and covers small plants installed on the roofs of houses, small businesses, small warehouses and apartment buildings. No fees or one-off costs are applied for the permit procedure.
Do you need any permission to start self-generation of electricity from solar energy? Any type of self-generation plant has to be authorized by GSE and AGENZIA DELLE DOGANE. Generally, as regards generation of electricity from solar energy, works for the installation, repair, replacement and renewal of solar and photovoltaic panels serving a building are exempt from approval by the Municipality, only if they are carried out outside cultural heritage areas. In case of cultural heritage areas, you will need to request authorization from a responsible body, such as the Municipality and / or the Superintendency for Architectural Heritage.
Are there any free available data about solar resource in a local/regional level so the prosumers can estimate the characteristics of their system? Yes, in Italy there are different free databases available on regional/state level (for example, the Italian atlas of solar radiation, developed by ENEA, representing a calculation model for the hourly forecast of solar radiation and electrical production of a photovoltaic system http://www.solaritaly.enea.it/Prodotti/ComESTo.php). On European scale, PVGIS provides free and open access to: -PV potential for different technologies and configurations of grid connected and stand-alone systems. -Solar radiation and temperature, as monthly averages or daily profiles. -Full time series of hourly values of both solar radiation and PV performance. -Typical Meteorological Year data for nine climatic variables. -Maps, by country or region, of solar resource and PV potential ready to print. -PVMAPS software includes all the estimation models used in PVGIS. https://ec.europa.eu/jrc/en/pvgis
Can the prosumer sell the electricity to the network? Yes, via particular processes called "ritiro dedicato" (GSE), even if "Ritiro dedicato" is more a "producer" scheme than a prosumer scheme, as production is discounted from the electric bill - generally speaking it works on a second "electric meter" - bidirectional electric meters are yet to be widespread in Italy
Can the prosumer obtain any economic benefit from selling the generated electricity? Yes, thanks to "ritiro dedicato" prosumers can benefit of the guaranteed minimum prices, allowing to guarantee a minimum remuneration, whatever the trend of the electricity market and to ensure the economic survival of smaller plants that exploit marginal or residual resources which, as such, could not otherwise be used.

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Is there any specific regulation for this initiative? Energy communities are not yet fully regulated, they mostly have to become "Energy cooperatives" (thus participating on the "LIBERO MERCATO" as an entity that "sells" energy to the users - this means that there is not a direct selling like in energy communities). Energy communities were first mentioned within the Italian legislation and regulatory framework by the Italian Energy Strategy in 2017 and, subsequently, by the National Energy and Climate Plan in 2018. However, they were both legislative framework documents which did not imply any concrete measure to support the implementation of community energy initiatives in the country. In 2018, the Piedmont region implemented a law on energy communities, which has mainly been a declaration of intent, although politically relevant, being the first legislative initiative explicitly dedicated to the Italian CE sector. A recent call for proposal launched by RSE (a public company devoted to research on the energy system) is also acting as showcase and test of pilot projects of energy communities, here intended as local, collective self-consumption initiatives. The conclusions of these pilot experiences are likely to provide the supporting evidence for the design of new incentive schemes currently under discussion. The national evolution of the regulatory framework for energy communities joint with the renewed national support to renewable energy, implemented in July 2019, will progressively shape the CE sector in Italy, which might be on the verge of a profound evolution. As of February 2020, only a first step has been taken by the national legislators (Law 8/2020), which enables small scale initiatives (below 200 kW). Which other CE implementation models that will be supported by the legislator will depend on the policy decisions that will be taken in the future steps of the EU Directive implementation process. Whether this will lead to a revival of local, small-scale experiences as those developed in the 2008–2013 period or will reinforce the national paradigm developed by the larger Italian CE initiatives (or a combination of both) is an open question worthy of analysis and discussion in the future.
Are there significant examples of energy communities in your local/regional area? When the energy cooperative is owing the distribution grid such local producer can be considered an energy community like in Sardegna (Berchidda) or in Trention valleys (EDYNA DSO)
Are public authorities in islands aware of the benefits of this initiative, especially in small or remote settlements or islands? And the population? Public Authorities in islands are aware of the benefits, often do not have the technical-administrative structure that can support even the simple bureaucratic process of access. Regarding the population, as a result, since the Public Administration is unable to initiate the procedures, even the informed population is unable to benefit from the advantages/support. In short, often the problem is related to lack of resources in terms of skills/men, rather than a mere economic issue.
Are there significant examples of district heating in your local/regional area? Bergamo, Milano, Brescia (A2A) Torino, Reggio Emilia, Parma, Genova and Piacenza (IREN) Savona, Venezia, Ospitaletto, Trieste, Sale Marasino
Are there examples of district heating in combination with renewable energy in your area? Savona, Venezia, Trieste, (Sea Water), Sale Marasino, Ospitaletto (Ground water)
Are the public authorities aware of this technology and its advantages? And the general population? Yes - but usually district heating is managed by ENERGY/HEATING utilities; Public authorities are aware of the advantages of district heating as most of the municipalities and public authorities decided to subscribe the Covenant of Majors. General population is less aware of district heating advantages.
Is this initiative legal in your country? Yes but only by "actors" recognized by GSE and AGENZIA DELLE DOGANE (no residential building, but power plants OK) - also Virtual Power Plant are moving first steps in this sense via the TERNA Unità Virtuali test cases (UVAM, UVAC, UVAP)
Are DSOs in your country/area interested in this initiative? Yes

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Is there any kind of platform, either private or driven by public authorities, that facilitates collection (donations) or allows investors to know the renewable energy projects that need financing through Crowdfunding? Not at our knowledge in Italy
Are there mechanisms for regulating the actions of the Crowdfunding? Are there further limits on the amounts of investment above those imposed by the EU (5 million euros)? For Lending there is no specific regulation, you have to rely on a single text of finance and banking and a provision of the Bank of Italy of 2016. For equity crowdfunding there is a specific regulation made in 2014. By the end of the year, a European regulation for equity and lending will enter into force, regulating the sector across Europe. In Italy, the date of adoption is uncertain.
As it is a virtual mechanism, in case of fraud, are there regulatory policies and guarantees backed by public authorities? For Lending there is no specific regulation, you have to rely on a single text of finance and banking and a provision of the Bank of Italy of 2016. For equity crowdfunding there is a specific regulation made in 2014. By the end of the year, a European regulation for equity and lending will enter into force, regulating the sector across Europe. In Italy, the date of adoption is uncertain.
Is there some kind of system in place or as a pilot project? Yes but at virtual level from H2020 project (e.g. FLEXIGRID, Berchidda municipality projects)
The population of the islands, that have photovoltaic installations in their homes, have access to information about P2P energy trading as a method of selling their stored surplus? The biggest constraint in Italy, at least at the moment, is the impossibility for customers to assume the real role of Prosumer, due to the extremely limited policies adopted by the Italian DSOs, which do not allow/sponsor this type of “innovative" services. It would be possible to promote such services where there is the possibility to have an open dialogue with DSOs. For example, in those rare cases where the Municipality has maintained the concession for the direct management of the electricity Grid ((or is directly involved - PPP), it is possible to promote services such as P2P.
Are there any agreements or regulatory policies with the traditional electricity market agents regarding the possible establishment of P2P Energy trading systems or planning to establish them? No
Is there a legal regulation on the responsibility of their actions (prosumers, consumers, network platform) or motivated by situations of fraud at the time of the return on investment agreed with? Not at our knowledge in Italy
Is there any kind of tax benefit for the renting modality? Not at our knowledge in Italy - Generally, the operating Leasing system makes it possible to " deduct" the cost of the periodic lease payment from the taxes.
Are there VAT tax deductions for the monthly expenditures fee? Don't know specifically - Generally, there is a " privileged" VAT rate (10%) for RES installations.
Is there any public programme in operation to promote energy efficiency systems? Yes - CREDITO D'IMPOSTA, NATIONAL FEED-IN like "Cogenerazione ad Alto Rendimento" and "Certificati Bianchi"
When an islander decides to replace household appliances or industrial machinery, in the case of industry, for more energy-efficient products, do they receive any financial or economic compensation (grants, discounts…)? Yes via "Certificati Bianchi" or "Credito d'Imposta"
Is there a district heating system in operation at a domestic level (residential/housing or office building) or at an industrial level on the islands? Not at our knowledge in Italy
For the construction of new infrastructures (buildings/offices) on the islands, the planning of centralized hot water or cooling systems is promoted as an energy efficiency measure? Yes, it is generally an action that a wise designer and/or Energy Manager proposes and promotes.

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Is there any programme, public or private, to promote the development of ESCOs? In Italy, we could consider the Conto Termico 2.0 (at least the part reserved for the Public Administration) something that comes very close to the concept of promotion. It is not an explicitly "ad hoc" action created , but the involvement of an ESCo, allows some interesting facilitations.
Are ESCO contracts legally regulated? Yes
Is there any technical standard that defines the general requirements of companies offering energy services? Yes
Is the population aware of the great advantages and small inconvenience that this initiative may cause? See above the big constraint in Italy, at least at the moment, about the real role of the Prosumer, basically due to the extremely limited policies adopted by the Italian DSOs.
Is the population open to install automatic demand-response devices in their houses? Yes, but they are "not directly controlled from grid operators" solutions but controlled "Only" by Building Energy Management System
Is the electric market willing to offer competitive tariffs or other incentives for customers in a demand-response scheme? Not yet defined in Italy except for "big Demand Response" Schemes for industrial loads
Is the population open to consciously modify their electricity consumption habits depending on the electricity rates? Yes
Is ISO 50001 certification a requirement for some companies? What is the criteria to demand this standard? Yes
Are there significant ISO 50001 certification companies in your country/area? Yes there are, the biggest companies are: RINA ACCREDIA (Italian National Accreditation Body) CERTvalue (https://www.certvalue.com/iso-50001-certification-in-italy/)
How do storage systems integrate into the ancillary service market? Not fully allowed yet to sell ancillary services to the grid - only "Special projects" for relevant ancillary services to Transmission lines
Which grid fees apply for energy storage? N/A
Which incentive schemes apply for prosumers who share the energy produced and stored to the grid? N/A (As previously presented - Storages can be coupled to local RES Plants and declared/permitted by Enegry permitting authorities GSE/Agenzia delle Dogane etc.)
In the case of big storage installations, such as pumped hydro storage, which are the licenses required to develop the projects? TSO permitting, in case of reserve capacity of the "whole national system" (Strategic plants) or on DSO level otherwise Pumped Hydro participates on the Electric market as a traditional power plant
Who is responsible of providing grid connection to offshore wind energy plants? The Plant developer
Which are grid regulation requirements for offshore wind energy plants (such as cost of access to the grid, duration of connection period, etc.)? In Italy, probably, the main problem is the lack of dialogue between DSO and TSO, which does not allow an effective exchange of information, allowing for a controlled, timely and uniform sizing and regulation/balancing of the national network. The biggest barrier is most likely related to landscape permits (VIA, VAS, Environmental Impact, ...), rather than technical permits.

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Are there any environmental permits that restrict the location of these installations? All pilots have to be authorized via a VIA (Valutazione Impatto Ambientale) taking care of both local marine environment and Natural Heritage constraints
Are there any effective ways of accessing to credit to finance offshore wind energy projects on islands? In Italy, the biggest barrier is most likely related to landscape permits (VIA, VAS, Environmental Impact, ...), rather than technical permits. Meeting with investors could be also a possibility.
Are there any players on islands, such as aggregators, that facilitate the integration of solar PV consumers to the system? Energy utilities and ESCOs
Which permits are needed for the installation of off-grid and distributed PV solutions? As all RES plants it has to be at least authorized by AGENZIA DELLE DOGANE and declared to GSE
Are there any constraints, in the regulatory field, for installing off-grid solar PV systems? As all RES plants it has to be at least authorized by AGENZIA DELLE DOGANE and declared to GSE
Do islands have an appropriate network to meet applicable rules regarding safety and reliability for distributed solar PV? In Italy electric grids in islands are quite old and usually at medium-low voltage (particularly in minor islands)
Are there any restrictions for connecting distributed generation solar PV plants to the grid? As all RES plants it has to be at least authorized by AGENZIA DELLE DOGANE and declared to GSE also requiring the local DSO permitting
Are there any requirements for covering a minimum percentage of domestic hot water with solar thermal energy in renovated buildings? No
Which are the regulatory laws that apply for waste-to-energy processes? N/A
Which environmental specifications should be compiled in order to enable the construction of waste-to-energy facilities? Permitting via a VIA + integration in local Waste management plan in accordance to Regional Waste Management Plan
Who has the jurisdiction over generated and hazardous waste on islands? Who is responsible of its management? Local Waste management company or public tender at national level, which assigns the service through a call for tenders
Are there any permitting requirements for using vitrified slag for construction? In Italy, it is necessary to verify competence on waste collection and disposal and/or landfill. That done, the other step is to pass the landscape permits (VIA, VAS, Environmental Impact, ...) and the verification of gas emissions limits into the atmosphere.
Is there any public scheme incentivizing the use public buses using hydrogen on islands? Not at our knowledge in Italy - Probably an important issue is the lack of a regulatory framework in this area, which threatens to block administrative/authorisation procedures.
Are there any technical standards for the usage of "green gases" such as hydrogen or biogas? Not at our knowledge in Italy
Which are the conditions of use and access of power-to-gas technologies to the network? Authorization by ARERA, GSE, Agenzia delle dogane and both gas and electricity grid owners/Managers in accordance to gas injection technical regulation
Is there any regulatory support to promote deployment of power-to-heat technologies? Not at our knowledge in Italy
Does the regulation allow decentralized resources to provide services to local grids? Yes, if properly registered on the Electric Market as power producer and grid actor

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Are there any policies or incentives to support innovative technologies (specify for each of the technologies described in the business models)? -Battery specific incentives: Feed-in tariffs, tender schemes, and premium tariffs and net-metering are available. There are also tax benefits for PV and wind energy plants. -Incentives for Solar PV (and other renewables such as onshore wind, hydroelectric and sewage gases) promoted by the FER 1 Decree 2019 -"Conto Termico" or thermal account supports the adoption of energy efficiency and solar technologies for individuals and public buildings and is dedicated to private and public users. It supports other renewable technologies: solar heating and cooling systems, installation of solar protection devices (including automation), heat pumps (including ground coupling) and biomass. Also innovative solutions, like solar cooling and ground coupled heat pumps, are funded within the scheme. This incentive is currently in a phase of changing (in particular for the simplification of the application process).
Which are the transmission access requirements for renewable energy plants? Are they different in the case of islands? The transmission access requirements for renewable plants are not different for islands, but it's important to get the allowance from the local grid manager who is different island by island (even in the same region and often different than Mainland one even in the same region)
Are there any restrictions on sitting and construction of renewable energy plants? Everything has to be approved by local authorities at Municipal, Regional, Province level as well as by local grid operators (plus any other type of stakeholders locally present that could interfere in the development of the demonstration)
Which are the investment limitations (according to regulation) regarding financial models? N/A
Are there any financing methods (such as grants, preferential loans, etc.) that incentivize the inversions in the energy efficiency sector? Yes, CREDITO D'IMPOSTA proposed by the decree "Legge di bilancio" that for example, throughout 2020, foresees to grant a tax credit to those who build a photovoltaic system to serve their activities (trade, industry, agriculture): 6% in 5 years (distributed in equal shares for each year).
Are renewable energy sources demanded to meet balancing requirements? Not yet from the electric market point of view even if PV/WIND plants are more and more required to be integrated with storage to be "more dispatchable" and more flexible in balancing the grid

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A2.6 Spain

Is there any simplified bureaucracy process to become a prosumer? There is simplified procedure put in place for installations of less than 100 kW (Real Decreto 244/2019), in which the prosumer has to present a project but does not need the DSO permission, just from the competent authorities.
Do you need any permission to start self-generation of electricity from solar energy? The prosumer needs permission from the DSO in case of installation of more than 100 kW that plan the sell energy to the grid. If there is a device to avoid the output of energy it is not needed.
Are there any free available data about solar resource in a local/regional level so the prosumers can estimate the characteristics of their system? IDAE, the agency in charge of these matters refers to use the Photovoltaic Geographical Information System (PVGIS) of the European Commission Joint Research Centre: https://ec.europa.eu/jrc/en/pvgis
Can the prosumer sell the electricity to the network? The prosumers can sell their excess energy either by signing a representation contract with an energy supplier or registering as an energy generator in the market (not recommended for small and medium installations).
Can the prosumer obtain any economic benefit from selling the generated electricity? In the simplified method for installations under 100 kW the prosumer obtains a discount in their energy bill from the energy poured into the grid. In the case of regular installations they can reach an agreement with a supplier that buys that energy at the price they agree.
Is there any specific regulation for this initiative? Not yet - the relevant legal framework derived from the Clean Energy Package is still under development and shall be provided until Jan 2021 at latest. The prosumer regulation allows for sharing electricity from a generation plant in a radius of 500 meters with a fixed coefficient distribution of the energy output.
Are there significant examples of energy communities in your local/regional area? There are small examples but it is not developed.
Are public authorities in islands aware of the benefits of this initiative, especially in small or remote settlements or islands? And the population? This question can only be seriously answered based on interviews conducted with such authorities. However, it can be assumed the public authorities are generally aware of the key features of the Clean Energy Package.
Are there significant examples of district heating in your local/regional area? According to ADHAC, a national association for district heating and cooling there are 402 district heating and cooling installations in Spain as of 2018. The Canary islands have 5 installations (2 MW total) and the Balearic islands have 8 (24 MW total).
Are there examples of district heating in combination with renewable energy in your area? According to ADHAC, 72% of these installations use biomass or other renewable energy sources.
Is this initiative legal in your country? There is currently no regulated flexibility market on DSO level. Flexibility on DSO level is currently procured by top-down measures such as feed-in management or switching of controllable loads.
Are DSOs in your country/area interested in this initiative? DSOs are basically interested in this initiative, however the commercial benefit need to be elaborated in comparison to current top-down flexibility measures.

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Is there any kind of platform, either private or driven by public authorities, that facilitates collection (donations) or allows investors to know the renewable energy projects that need financing through Crowdfunding? There is a Spanish Crowdfunding Association, funded in 2013, https://www.spaincrowdfunding.org. There are many private platforms of crowdfunding for sustainable projects, such as Fundeen which allows particulars to invest in renewable energy projects or eCrowd (crowdlending) which is the first platform of crowdlending for sustainable projects.
Are there mechanisms for regulating the actions of the Crowdfunding? Are there further limits on the amounts of investment above those imposed by the EU (5 million euros)? Ley 5/2015 del 27 de abril, de Fomento de la Financiación Empresarial. There are some requirements of authorization and registration in the CNMV. There are limits of the investment the project can obtain through a participative financing platform, 2,000,000 €, excepting if the project is addressed exclusively to accredited investors, in this case the maximum is 5 million euros. The maximum investment an no accredited investor can offer per project is 3,000 €. Limits to the maximum investment a no accredited investor can offer in the same platform during one year is 10,000 €.
As it is a virtual mechanism, in case of fraud, are there regulatory policies and guarantees backed by public authorities? Regarding its operational activity, the Law is based on the objective of ensuring the neutrality of participatory financing platforms in their relationship between investors and promoters. The Law merely recalls the prohibition on taking funds to make payments in their own name on behalf of clients, without having the required authorization from the payment institution. Basically what is intended is to minimize (not eliminate) the risk that investors and developers face in front of the platform. In this sense, the Law establishes protective measures aimed at least at mitigating and managing such risks.
Is there some kind of system in place or as a pilot project? In Spain, the Spanish start-up Klenergy has developed a platform, Pylon Network, to eliminate the figure of the intermediary and without being interconnected, in the buying and selling of electricity, in this case renewable energy. The transactions use a new payment method, the Pylon-Coin.
The population of the islands, that have photovoltaic installations in their homes, have access to information about P2P energy trading as a method of selling their stored surplus? This question can only be seriously answered based on interviews conducted with island population. However, it can be assumed that all relevant information is available online.
Are there any agreements or regulatory policies with the traditional electricity market agents regarding the possible establishment of P2P Energy trading systems or planning to establish them? The Enerchain joint project started in May 2017 and consists of the first trading platform for energy products with physical delivery with decentralized execution. The platform allows gas and electricity transactions to be carried out for any European area and for any delivery period, from the very short term to operations with annual base load. Some traditional electricity market agents are involved such as Endesa, Iberdrola, Enel or Vattenfall.
Is there a legal regulation on the responsibility of their actions (prosumers, consumers, network platform) or motivated by situations of fraud at the time of the return on investment agreed with?
Is there any kind of tax benefit for the renting modality? The taxation of the rent is highly favorable both for the self-employed workers and for the mercantile companies, since they can deduct the monthly rental fee in the Corporate Tax or the Personal Income Tax, always, It is a necessary expense for the development of their professional activity, with the only exception of professionals who are subject to the objective specification regime.

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Are there VAT tax deductions for the monthly expenditures fee? The taxation of the rent is highly favorable both for the self-employed workers and for the mercantile companies, since they can deduct the monthly rental fee in the Corporate Tax or the Personal Income Tax, always, It is a necessary expense for the development of their professional activity, with the only exception of professionals who are subject to the objective specification regime.
Is there any public programme in operation to promote energy efficiency systems? The E.P.E. Institute for the Diversification and Saving of Energy (IDAE), MP, is an organism attached to the Ministry for the Ecological Transition and the Demographic Challenge, through the Secretary of State for Energy, on which it organically depends. IDAE carries out dissemination and training actions, technical advice, development of specific programs and financing of technological innovation and replicable projects. Likewise, the Institute leads an intense international activity within the framework of different European programs and cooperation with third countries. https://www.idae.es/ At regional level, the local government might publish programs to foster the energy efficiency, but it depends on each case.
When an islander decides to replace household appliances or industrial machinery, in the case of industry, for more energy-efficient products, do they receive any financial or economic compensation (grants, discounts…)? The E.P.E. Institute for the Diversification and Saving of Energy (IDAE), MP, is an organism attached to the Ministry for the Ecological Transition and the Demographic Challenge, through the Secretary of State for Energy, on which it organically depends. IDAE carries out dissemination and training actions, technical advice, development of specific programs and financing of technological innovation and replicable projects. Likewise, the Institute leads an intense international activity within the framework of different European programs and cooperation with third countries. https://www.idae.es/ At regional level, the local government might publish programs to foster the energy efficiency, but it depends on each case.
Is there a district heating system in operation at a domestic level (residential/housing or office building) or at an industrial level on the islands? Yes, see answers for 'district heating'.
For the construction of new infrastructures (buildings/offices) on the islands, the planning of centralized hot water or cooling systems is promoted as an energy efficiency measure? It seems it is not any support for centralized hot water or cooling systems.
Is there any programme, public or private, to promote the development of ESCOs? It seems there is no any program to promote the development of ESCOS
Are ESCO contracts legally regulated? The form of ESCO contracts is based common legal requirements for contracts. The content of ESCO contracts is not legally regulated, although the contract shall not contradict to current legislation e.g. la Ley de Contratos del Sector Público (BOE-A-2017-12902)
Is there any technical standard that defines the general requirements of companies offering energy services? In the Spanish legal system, the definition of an energy services company is included in Article 19. Of Royal Decree-Law 6/2010, where the ESE is described as: “Natural or legal person that provides energy services or improves energy efficiency in a user's facilities or premises and faces a certain degree of economic risk in doing so. All this, provided that the payment of the services provided is based, either partially or totally, on obtaining energy savings by introducing energy efficiency improvements and on meeting the other agreed performance requirements.”
Is the population aware of the great advantages and small inconvenience that this initiative may cause? This question can only be seriously answered based on interviews conducted with island population. However, it can

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be assumed that all relevant information is available online but demand response as very technical term is not very well known in general.
Is the population open to install automatic demand-response devices in their houses? This question can only be seriously answered based on interviews conducted with island population.
Is the electric market willing to offer competitive tariffs or other incentives for customers in a demand-response scheme?
Is the population open to consciously modify their electricity consumption habits depending on the electricity rates? This question can only be seriously answered based on interviews conducted with island population.
Is ISO 50001 certification a requirement for some companies? What is the criteria to demand this standard? On Saturday February 13, 2016, the Ministry of Industry, Energy and Tourism published the long-awaited Royal Decree 56/2016, which establishes that large companies require a first energy audit within 9 months and in Thereafter every 4 years, or, implement and maintain an Energy Management System in accordance with the corresponding international regulations (ISO 50001: 2011).
Are there significant ISO 50001 certification companies in your country/area? There are actually 3 accredited certification companies in Spain offering ISO 50001 certification and audits, specifically: AENOR, BUREAU VERITAS IBERIA, S.L. and SGS.
How do storage systems integrate into the ancillary service market? The CNMC resolution of 19/12/19 opened the way for energy storage and demand to participate into balancing services, becoming operative last June (2020). This apply to all consumers (industries, SMEs, domestic consumers...). Currently, the minimum Programming Unit (UP) to participate is 1 MW, including offers from aggregation. However, Specific values might be stablished for storage and demand. In the case of the secondary control, the minimum is set with a Regulation Zone (ZR) minimum 200 MW. https://boe.es/boe/dias/2019/12/23/pdfs/BOE-A-2019-18423.pdf https://www.cnmc.es/sites/default/files/editor_contenidos/CNMC/Becas/20190719__DCOOR_DE_012_18_Documento_Explicativo_Condiciones_Balance.pdf
Which grid fees apply for energy storage? Not enough information to date. Access rate depends on contracted power. CNMC recently (24/01/20) published Circular 3/202 with new access rates to be apply from 2021 on.
Which incentive schemes apply for prosumers who share the energy produced and stored to the grid? There is no specific incentive scheme for this model. The National Strategy for Storage is under development, and might include specific incentives.
In the case of big storage installations, such as pumped hydro storage, which are the licenses required to develop the projects? Generally, the project developer must hold all technical and commercial capabilities according to the requisites established by the CNMC. Currently, a new regulation regarding the conditions for grid access and connection on generation facilities is being developed. Its draft establishes that in the case of having electrical energy accumulation elements, a description of these elements, including their storage capacity, must be provided.

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Who is responsible of providing grid connection to offshore wind energy plants? Any agent who wishes to connect a new generation, demand or distribution facility to the transmission grid, or modify the conditions of existing facilities, must request access and connection permits from the Spanish TSO, Red Electrical España (REE), who will manage them in accordance with current regulations.
Which are grid regulation requirements for offshore wind energy plants (such as cost of access to the grid, duration of connection period, etc.)? RD 1028/2007 is the national regulation for the authorization offshore wind plants. But the share of this RES is low compared with others. The Energy and Climate Integrated National Plan 2030-2050 (PNIEC) establishes ambitious targets for this technology (50 GW from wind power for 2030), that would result in the simplification of the 2007 regulation. The National Roadmap for the Development of Marine Wind Energy is under elaboration.
Are there any environmental permits that restrict the location of these installations? Yes, RD 1028/2007 establishes that the first step to get an authorization is the "Zone Reservation", that includes the Environmental Impact Evaluation of the project. To date, most projects have not overcome this step. Since 2009, the Spanish coasts have been classified as "suitable", "not suitable" and "suitable with conditions" from an environmental perspective. The current regulation does not differentiate between fixed and floating platforms, and geographically the Spanish continental platform makes impossible the development of the former. A differentiation should be addressed with new regulation.
Are there any effective ways of accessing to credit to finance offshore wind energy projects on islands? Not enough information to answer this. Currently, developments and projects are innovation-driven, not market-driven.
Are there any players on islands, such as aggregators, that facilitate the integration of solar PV consumers to the system? Energy Cooperatives, that are both RES generators and Energy Suppliers, also operate in islands. Consumers usually are part of a energy community as associates or as clients. Neither aggregation, nor aggregator are concepts conceived in the current regulation.
Which permits are needed for the installation of off-grid and distributed PV solutions? - Off grid system: RD 244/2019 establishes self-consumption, individual or collective, with or without surplus fed to the grid. Either modality should comply with the technical requirements of the Electric Sector Regulation. For installations below 10 KW, no permit is required. For installations below 100 KW, there is a simplified permit procedure that should be managed between the consumer and the supplier. Over 100 KW is not allowed for self-consumption. - DG system: not yet regulated.
Are there any constraints, in the regulatory field, for installing off-grid solar PV systems? RD 244/2019 opened the road for developments below 100 KW.
Do islands have an appropriate network to meet applicable rules regarding safety and reliability for distributed solar PV? Self-consumption regulation does not conceive differences towards island's systems. Although, the Canary Island electrical system has six electrically isolated systems, small in size. These conditions make these systems less stable and safe than the large interconnected systems. The Balearic system is inter-connected with mainland.
Are there any restrictions for connecting distributed generation solar PV plants to the grid? - DG system: not yet regulated.

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Are there any requirements for covering a minimum percentage of domestic hot water with solar thermal energy in renovated buildings? Retrofitted buildings with a consumption over 100 L/day of DHW must guarantee that 70% of the energy comes from RES. https://www.codigotecnico.org/images/stories/pdf/ahorroEnergia/DBHE.pdf
Which are the regulatory laws that apply for waste-to-energy processes? The Waste Sector regulation mention energy recovery, but this is poorly developed in Spain as prevention and recycling has been highly prioritised. A new Waste Law is under development. Current legislation is: - Law 22/2011 on waste and polluted soils - RD 815/2013 for industrial incineration https://www.miteco.gob.es/es/prensa/ultimas-noticias/arranca-la-tramitaci%C3%B3n-del-anteproyecto-de-ley-de-residuos-para-impulsar-una-econom%C3%ADa-circular-mejorar-la-gesti%C3%B3n-de-residuos-en-espa%C3%B1a-y-luchar/tcm:30-509531
Which environmental specifications should be compiled in order to enable the construction of waste-to-energy facilities?
Who has the jurisdiction over generated and hazardous waste on islands? Who is responsible of its management? Municipalities are responsible of waste management (collection, transport and treatment). National and regional authorities are responsible of its planning.
Are there any permitting requirements for using vitrified slag for construction? Since 2002, Spain has a Catalogue of Waste Usable in Construction. the technical sheet SLAG AND ASH FROM URBAN SOLID WASTE INCINERATOR (2012) establishes chemical and physical properties. The technical regulation this material must comply are UNE-EN 12620:2003, UNE-EN 13043:2003+A1:2009 and UNE-EN 13242:2003+A1:2008 http://www.cedexmateriales.es/catalogo-de-residuos/38/escorias-y-cenizas-de-incineradora-de-residuos-solidos-urbanos-(rsu)/301/referencias.html
Is there any public scheme incentivizing the use public buses using hydrogen on islands? Current public grants include the possibility to finance the acquisition of buses, but the focus is on electric vehicles. Both the National Roadmap for Renewable Hydrogen (from the Environment Ministry) and the Sectorial Agenda for Green Hydrogen (from the Industry Ministry) are under development. Incentives might be expected.
Are there any technical standards for the usage of "green gases" such as hydrogen or biogas? The technical committee CNT 181 - Hydrogen technologies - is in charge of standards related to the systems and devices for the production, storage, transport and distribution, measurement and use of hydrogen: - Hydrogen specifications; - Hydrogen production facilities and their associated devices; - Hydrogen storage facilities and their associated devices; - Hydrogen transport facilities and their associated devices; - Installations and devices that use hydrogen; - Hydrogen supply facilities; - Qualification of personnel involved in the construction, operation, maintenance and inspection of production, storage, transport, supply and use facilities for hydrogen as fuel. - Hydrogen measurement
Which are the conditions of use and access of power-to-gas technologies to the network? Conditions under development. For example, the Enagás regasification plant located in Cartagena (Murcia) is the first experience of hydrogen injection in a real gas network in Spain. Measure 18 of the Energy and Climate Strategic National Plan (PNIEC) conceives the promotion of renewable gases for electricity generation and thermal uses.

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Is there any regulatory support to promote deployment of power-to-heat technologies? Both the National Roadmap for Renewable Hydrogen (from the Environment Ministry) and the Sectorial Agenda for Green Hydrogen (from the Industry Ministry) are under development. Incentives might be expected.
Does the regulation allow decentralized resources to provide services to local grids?
Are there any policies or incentives to support innovative technologies (specify for each of the technologies described in the business models)? There are regional initiatives to support energy efficiency and renewable energy projects. In the case of applied R+D projects, the Centre for the industrial technological development (CDTi) has a funding line related to energy transition projects.
Which are the transmission access requirements for renewable energy plants? Are they different in the case of islands? Operating procedures 12.1 (P.O. 12.1 Solicitudes de acceso para la conexión de nuevas instalaciones a la red de transporte) and 12.2 (P.O. 12.2 Instalaciones conectadas a la red de transporte: requisitos mínimos de diseño, equipamiento, funcionamiento y seguridad y puesta en servicio) regulate the requirements for grid connected generations installations, with the latter adding considerations for extra peninsular territories.
Are there any restrictions on sitting and construction of renewable energy plants? Large renewable energy plants have to follow a specific planning procedure, incl. environmental impact assessment and connection request to TSO or DSO systems. They can only be erected in specific areas according to the land use and development plans or in case of offshore wind farm in specific cluster areas.
Which are the investment limitations (according to regulation) regarding financial models? For crowdfunding, a private investor has no funding limit if he provides information on his financial status which proves that the investor has freely available resources of at least 100 k€. Furthermore, the maximum amount of funding per project is stated at 2 million euros. In case of classic investment models (via banks, investment funds etc.), there is no formal limitation on the investment volume for each investor.
Are there any financing methods (such as grants, preferential loans, etc.) that incentivize the inversions in the energy efficiency sector? There are subsidies up to 30% of the investment through the Fondo Nacional de Eficiencia Energética.
Are renewable energy sources demanded to meet balancing requirements? The transmission grid operator may reduce electricity imports for the following reasons: grid stability or short-circuit power warnings, grid congestion, inadequate active or reactive power levels, production variations, balancing issues and minimum load. RES generators may be curtailed only after conventional generators have been curtailed wherever possible. In practice, wind farms are curtailed more often than other RES installations (Art. 56, 65, 52 –RD 1955/2000).

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