"Innovative Business Models for Market Uptake of Renewable Electricity unlocking the potential for flexibility in the Industrial Electricity Use"

Policy Recommendations

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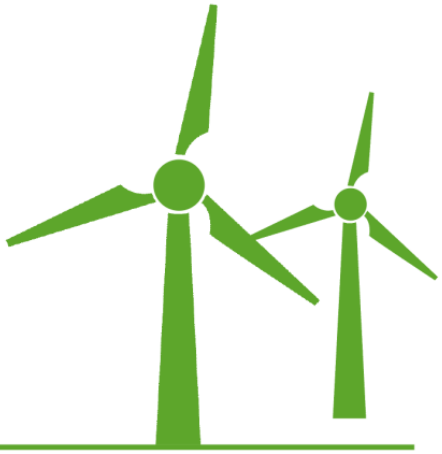

IndustRE

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This deliverable has been written by Lorenzo Simons, Tomás Gómez and Pablo Frías from the Institute for Research in Technology (IIT), of Universidad Pontificia Comillas.

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List of abbreviations and acronyms

aFRR	Automatic Frequency Restoration Reserves
BRP	Balance Responsible Party
BSP	Balancing Service Provider
DA	Day-ahead
DG	Distributed Generation
DNO	Distribution Network Operator
DSO	Distribution System Operator
EC	European Commission
EU	European Union
FCR	Frequency Containment Reserves
FFR	Firm Frequency Response
FID	Flexible Industrial Demand
FIT	Feed-in tariff
FRR	Frequency Restoration Reserves
mFRR	Manual Frequency Restoration Reserves
NRA	National Regulatory Authority
PV	Photovoltaic
RES	Renewable Energy Sources
RR	Replacement Reserves
SO	System Operator
TSO	Transmission System Operator
VRE	Variable Renewable Energy

Executive Summary

The IndustRE project has identified the flexibility potential of the largest and most energy intensive industrial electricity demand as an opportunity that, through innovative business models, could allow industrial consumers to reduce electricity costs while bringing significant benefits to the system, including further growth and integration of renewable energy in a cost-effective way.

In previous work packages, we have defined and described the most suitable **business models** for the exploitation of demand flexibility by industrial consumers, either on their own or involving certain interaction with Variable Renewable Energy (**VRE**) generation. This document starts from the definition of these business models and formulates some country-specific policy recommendations that are necessary for those business models to be implemented.

Business models

A **business model** can be understood in this project as a set of **flexibility business strategies** chosen by Flexible Industrial Demand (**FID**) in relation to its electricity consumption in order to generate economic benefits. These strategies could arise from combining a variety of **instruments** to obtain economic benefits from different **sources** of revenues and savings.

The main **sources of savings** in the energy bill are the reduced cost of the electric energy and the avoided or reduced payment of network and other regulated charges, while the main **source of revenues** is the remuneration obtained in return for the explicit provision of flexibility services. Three **tools** have been identified at the disposal of the FID to grasp benefits from these sources: its own **load flexibility** to adjust consumption schedules in time in response to the signals received, the establishment of **bilateral contracts with VRE generators** and the installation of **on-site VRE** generation.

Regulatory analysis

A regulatory analysis has been carried out with the aim of identifying the main regulatory barriers that could be impeding the implementation of these business models in a set of target countries: Belgium, France, Germany, Italy, Spain and United Kingdom.

This analysis showed that **model I** (which is based on the reaction to final electricity prices by shifting consumption from high to low price hours) is feasible and implemented in all target countries. Likewise, **model II (**provision of flexibility services to other system agents**)** is already implemented in most of the target countries except for Spain and Italy. The expectation is that after the upcoming reform in Italy, also this model becomes feasible which leaves Spain as the only country where this model remains infeasible.

Model III (the establishment of bilateral contracts between FID and a VRE generator for the supply of electricity) and **model V** (which involves the on-site installation of VRE generation by the industrial consumer) are both feasible, but inefficient tariff design and subsidies for energy produced by VRE generators have made that they are not yet implemented in any country.

Model IV, the establishment of long-term bilateral contracts between the FID and the VRE generators to minimize their imbalances is mostly hypothetical for the time being in all of the target countries. This is due to the fact that most countries have shifted to a single imbalance pricing system, aggregation is not everywhere allowed between demand and generation and VRE generators are not everywhere required to bear balance responsibility.

Policy recommendations at country level

This document provides some country-specific policy recommendations about which changes are necessary to adapt the current regulatory framework to attract more demand-side participation. We have categorized our policy recommendations in five categories: **Market Access and Energy Management**, **Revenues through provision of ancillary services, Tariffs, Bilateral Balancing** and **On-site Generation**. A summary of the main policy recommendations for each country is presented here.

Belgium

- In the future, also secondary reserves should be opened to the participation of the demand to become technology neutral.
- The regulatory framework should enable enhanced dynamic TSO-DSO interaction and coordination to optimize system management by the use of flexibility from different sources.
- The regulatory framework should provide clear rules for cost recognition at DSO-level (in relation to the benefits) of ancillary service provision coming from different sources (demand response, storage, flexible (distributed) generation, over different timeframes).

France

- Further develop the markets for the provision of all the ancillary services and open these markets for demand-side participation (direct or through independent aggregators).
- Split the provision of upward and downward FCR and aFRR, such that the requirement of symmetry is eliminated.
- Gradually require VRE generators to bear responsibility for their imbalances.

Germany

- Create a general framework (instead of the current bilateral agreements) for compensation payments between independent aggregators and retailers.
- The network tariff itself should also include a fixed component, a volumetric component and a peak-coincident component as opposed to the current purely volumetric + capacity tariff.
- Grid costs should be borne by all grid users. Exceptions for large industrial companies shall be removed if they are counterproductive for increasing flexibility.

Italy

- Regulated charges that are not directly related to the use of electricity networks, should be separated from the rest of charges, in such a way that they do not distort electricity market prices and cost-reflective network charges. Moreover, customers should have the adequate information to know on which basis (€/kW, €/kWh,…) these costs are charged.
- Adapt the existing load interruptibility and the capacity mechanism with the creation of more competitive and dynamic market instruments, in line with the standard procedures for the provision of reserve capacity and balancing services.
- Make VRE generators responsible for their imbalances to such an extent that they are subject to equal market conditions as non-intermittent renewable generation. It is necessary to adapt the regulatory framework to create these equal market conditions by shifting the gate-closure closer to real time. A second necessary condition is to allow aggregation so that VRE generation can reduce its imbalances, for example by contracting flexible demand.

Spain

- Wholesale participation: allow complex bids for demand in the day-ahead market
- Provision of reserves by the demand side: create asymmetric products and allow demand-side participation. Reduce the minimum bid size (e.g. 1 MW).
- Tariff design: make the tariffs cost-reflective; eliminate regulated charges that are not directly related to the use of electricity networks from the tariff. Make sure that tariffs incentivize and do not penalize demand-side participation.

UK

- The capacity remuneration mechanism in place should be on equal terms for both generation and demand.
- Bring the procurement of ancillary services closer to real time.
- Reduce minimum bid sizes for the participation in ancillary services.

Policy recommendations at European level

Based on the analysis of the different target countries, some European-wide policy recommendations were formulated, divided into six categories.

Market access

- Large consumers should have **access to** and participation in **wholesale electricity markets** (day-ahead and intraday markets), including through aggregation.
- Allow **participation of demand and storage in reserve and balancing markets**, including through aggregation.
- Guarantee **fair technical conditions** for demand into these markets.
- Allow and facilitate consumer **involvement in existing capacity remuneration** mechanisms.

Ancillary services

- Make **load interruptibility** mechanisms **competitive.**
- Promote an **active network management by DSOs** with provision of flexibility by industrial demand in local network services.

Tariff design

- **Cost-reflective network tariffs**: fixed charge (€) + peak-coincident capacity charge (€/kW).
- Other regulated costs that are not directly affected by changes in electricity consumption or injection should be **removed from the volumetric (€/kWh)** component of the tariff and charged in a way that minimizes distortions of cost-reflective prices and charges for electricity services.

Bilateral balancing

- Require **VRE** generators to bear **imbalance responsibility.**
- Move towards a single efficient imbalance pricing system.
- In the case of remaining in a dual imbalance pricing system, **allow aggregation** and imbalance compensation.

On-site generation

- **Abandon net-metering** policies and allow self-generation for on-site VRE.

EU Harmonization

- High-level principles-based **harmonization** of flexibility mechanisms across the EU.

1 Introduction

Electric power systems are currently facing new challenges to sustainably satisfy an increasing load with high peaks, which generally occur during a reduced number of hours per year, and to absorb a growing penetration of intermittent renewable energy sources. Load flexibility is widely recognized as a key resource to face these challenges, which would enable a more efficient operation of the available resources in electric power systems, thus facilitating the growth and integration of variable renewable energy more cost-effectively. Making electricity demand response happen is also an essential component of the European Union's (EU) strategy to increase economic efficiency in electric power systems across Europe, as reflected in numerous EU initiatives, including the third Energy Package, with Directive 2009/72/EC (EC 2009), the Network Codes and the Energy Efficiency Directive (EED) (EC 2012). More specifically, the EED urges National Regulatory Authorities (NRA) across Europe to take the responsibility of facilitating demand response for all consumers.

The IndustRE project has identified the flexibility potential of the largest and most energy intensive industrial electricity demand as an opportunity that, through innovative business models, could allow industrial consumers to reduce electricity costs while bringing significant benefits to the system, including further growth and integration of renewable energy in a cost-effective way. Partly due to a lack of sufficient experience and understanding of the power sector by these consumers, and also because of the inexistence of the appropriate regulatory and market frameworks in many countries, much of this potential flexibility has traditionally been locked for many of these consumers.

The overall objective of the IndustRE project is to use the potential for flexibility in energy intensive industries to facilitate further uptake of variable renewable electricity, through innovative business models and regulatory improvements. In this context, this document describes in section 2 the business models developed previously within the IndustRE project for the exploitation of demand flexibility by industrial consumers, either on their own or involving certain interaction with variable renewable energy generation.

In section 3, we highlight how regulatory and market frameworks affect the implementation of these business models, especially in the set of countries targeted by the IndustRE project (Belgium, France, Germany, Italy, Spain and UK, as indicated in Figure 1.1).

Based on these barriers, we have formulated some country specific policy recommendations for each of these target countries, which are provided in section 4, divided into five categories; Market Access and Energy Management, Revenues through provision of ancillary services, Tariffs, Bilateral Balancing and On-site Generation. This is the main focus of this work, while the evaluation of the economic viability of these business models in terms of costs and technical requirements for the industrial consumer is out of the scope of this report, as it has been addressed in previous work packages of the IndustRE project.

Figure 1.1 Scope of the project: IndustRE target countries

This document stems from work carried out in previous tasks of Work Package 2 of the IndustRE project, presented in the following working documents: the preliminary definition of the business models (T2.1), see (Papapetrou 2015), the screening of the regulatory and market frameworks of the target countries (T2.2), see (Vallés, Frías, and Gómez 2015), the stakeholder consultation process (T2.3), see (Jezdinsky and Nuño 2016) and Business models and market barriers (T2.4) , see (Vallés, Gómez, and Frías 2016).

2 Business models

A **business model** can be understood in this project as a set of **flexibility business strategies** chosen by Flexible Industrial Demand (**FID**) in relation to its electricity consumption in order to generate economic benefits. These strategies could arise from combining a variety of **instruments** to obtain economic benefits from different **sources** of revenues and savings.

The main **sources of savings** in the energy bill are the reduced cost of the electric energy and the avoided or reduced payment of network and other regulated charges, while the main **source of revenues** is the remuneration obtained in return for the explicit provision of flexibility services. Three **tools** have been identified at the disposal of the FID to grasp benefits from these sources: its own **load flexibility** to adjust consumption schedules in time in response to the signals received, the establishment of **bilateral contracts with VRE generators** and the installation of **on-site VRE** generation at its own premises.

A **business model** can then be regarded as the business opportunity that results from putting several of these strategies together into an actionable framework in a realistic and feasible way. As a result of this, as can be seen in Table 1, five different business models have been identified:

		Available tools		
Savings/Revenues sources		**Flexible demand only**	**+ Contract with VRE generator**	**+ On-site VRE generation**
Savings	Energy costs	I **Supplier price response** (react to time-varying prices from a supplier); **Market price response** (react to real time market prices)	III **Long-term electricity supply** (establish long-term energy contract with VRE)	**Long-term electricity supply** (through self-consumption) V
	Network and other regulated charges	**TOU network tariff response** (reduce peak demand in accordance with network tariff structure)		**Volumetric tariff response with on-site VRE** (reduce net demand)
Revenues	System services	II **Balancing service provision** (provide frequency control reserves and balancing services); **Other services provision** (capacity remuneration, load interruptibility, distribution network services)	IV **Bilateral balancing service provision** (establish flexibility contract to support VRE balance)	

Table 1: Categorization of business models (I-V) as combinations of flexibility business strategies for industrial consumers, which result from the different sources of savings and revenues and the available tools to capture them

I. **Electricity Bill Reduction**, with the use of the FID's own flexibility in reaction to the electricity price.

II. **System Service Provider**, with the possibility of providing almost any type of frequency control and balancing services to the system operator, and also other ancillary services to DSOs or participate in mechanisms of capacity remuneration and load interruptibility managed by TSOs. The optimization of load schedules in relation to the price of electricity (model I) is taken for granted in this model.

III. **Electricity Supply Contract with off-site VRE**, through the establishment of a long-term bilateral electricity supply contract with a (VRE) generator off-site the consumer's premises under more stable and predictable conditions than being exposed to the market.

IV. **Balancing Service Contract with off-site VRE**, through the establishment of a flexibility contract with a (VRE) generator off-site the consumer's premises for the provision of flexibility services to minimize imbalances, possibly including in this contract the supply of electricity (model III).

V. **Electricity Bill Reduction with on-site VRE**, from the avoided payment of network and other regulated volumetric (€/kWh) charges. In addition to this, the FID would avoid the risks of being exposed to the market price volatility regarding the volume of self-consumed electricity, just like in business model III, as the cost of this energy would only depend on the Levelised Cost of Electricity (LCOE) of this on-site VRE generation.

3 Regulatory analysis of the applicability of the business models

A regulatory analysis has been carried out in (Vallés, Frías, and Gómez 2015) with the aim of identifying the main regulatory barriers that could be impeding the implementation of these business models in the target countries: Belgium, France, Germany, Italy, Spain and United Kingdom. In this section, we present an updated brief summary of this regulatory analysis. The aim of this analysis is to point out where the current regulation in the target countries is putting up barriers for the presented models. This indicates in which fields policy recommendations can lead to an improvement such that the business models become more viable.

Business model	BE	FR	DE	IT	ES	UK
model I						
model II						
model III						
model IV						
model V						

	business case is viable in existing regulatory framework
	business case limited viability/restricted in current regulatory framework
	business case impossible in existing regulatory framework

Table 2: Overview of regulatory viability of the business models

In view of this analysis, it can be said that business **model I** is feasible and implemented in all target countries. FID may have direct access to the market or receive offers of time-varying retail prices from specialized retailers. Furthermore, network tariffs across the target countries generally present a cost-reflective structure. Given that the share of the energy cost in the final retail price prevails over regulated charges for large consumers, the interest of this model for FID would be primarily focused on the time-variation of the energy cost component of the retail price.

In contrast, the application of business **model II** presents more difficulties and regulatory barriers than model I. Overall, there is a growing trend in Europe of modifying the design of ancillary services and balancing energy markets and mechanisms to allow the participation of demand-side resources. While Belgium, France, Germany and UK provide regulatory frameworks that enable consumers to provide capacity reserves and balancing products, consumers are not legally allowed at all in balancing programs in Italy and Spain. Italy has taken some steps over the last months with the introduction of some pilot projects to allow aggregation and participation in ancillary services in the future. Capacity remuneration mechanisms are also being gradually introduced across Europe, with the aim of allowing

demand-side participation, e.g. in the UK, with on-going discussions about it in Italy and France. Moreover, load interruptibility programs managed by the SO are present in all target countries, in many of which they represent a significant source of income for industrial consumers. Remunerations are still regulated and not market-based, which make them costly for society.

The establishment of **bilateral contracts** between the industrial consumer and a VRE generator for the **supply of electricity** (**model III**) is still only hypothetical nowadays in the European context because of the existence of VRE support schemes in all countries. To the extent that VRE investments are guaranteed by regulatory subsidies, VRE generators will be less incentivized to be competitive and establish long-term bilateral contracts to secure their revenues and minimize risk-exposure. Nevertheless, the EU energy policy strategy foresees VRE progressive market integration with reduced support incentives, so this model would increasingly make more sense in the future.

Moreover, the establishment of **long-term bilateral contracts** for the provision of **balancing services** by the FID to assist VRE generators to minimize their imbalances (**model IV**) is also mostly hypothetical for the time being. In principle, VRE generators are increasingly required to bear some responsibility over their own generation imbalances in most countries so this business model is gaining interest from their perspective. Notwithstanding this, model IV is not generally possible or attractive in the target countries because of the design of imbalance settlement arrangements. Even though the level of aggregation of imbalances permits this model in Belgium, Germany and UK, the single imbalance pricing scheme provides little incentive to aggregation of consumption and generation units. In France aggregation between consumers and generators is not allowed, which makes the model not viable. On the other hand, a dual imbalance pricing system encourages aggregation of consumption and demand imbalances in Italy and Spain. Italy is planning to implement a single imbalance pricing system in the future and in both countries, imbalances are settled separately for generation, which makes this model also rather hypothetical.

Finally, business **model V**, which involves the **on-site** installation of **VRE** generation by the industrial consumer, could be an attractive decision for the FID, who could benefit from paying lower network tariffs and other regulated charges as long as these were charged through a volumetric rate (€/kWh) on net demand. Partial exemptions from paying certain regulated charges on self-generated energy remain in certain countries (France, Italy, Germany) while in others, these exemptions are gradually being cut down or eliminated (e.g. Spain and the Flemish region of Belgium) so the attractiveness of this model is progressively being reduced in these regions. In contrast, self-generation is strongly incentivized for industrial consumers in the UK and Belgium (except for the Flemish region), where prosumers are exempted from paying any network and system costs on self-generated electricity because tariffs are applied on net consumed electricity.

4 Policy recommendations

This section starts by pointing out in 4.1 some general principles. These principles are the starting point for the country-specific policy recommendations presented in sections 4.2 to 4.7. Then sections 4.8 and 4.9 provide a summary and conclusions.

4.1 Main principles

The main principles in this section are drawn from the policy recommendations described in (T2.4) and (Pérez-Arriaga et al. 2016).

1. Ensure that market design rules guarantee that large consumers have **direct access** to wholesale electricity markets, markets for ancillary services and balancing markets.
2. **Tariff design** should be based on cost-causality in order to encourage network users to employ their flexibility to make a more efficient use of the grid capacity.
3. **Technical conditions** should not impose unfair barriers for demand-side participation in the different electricity markets.
4. **Capacity remuneration** mechanisms need to be open for the participation of consumers.
5. Make **load interruptibility** mechanisms market based.
6. Adapt the regulatory framework of **distribution network operation** and implement the mechanisms that would allow DSOs to use active network management solutions.
7. Move towards a **single imbalance pricing system** and gradually require **VRE** generators to bear **responsibility** for their **imbalances**.
8. Progressively abandon **net-metering** policies and allow self-generation from on-site VRE.

These principles are the starting point for the policy recommendations that have been formulated individually for each of the six target countries.

4.2 Belgium

- In the future, the regulatory framework needs to ensure the opening of the market, specifically the spot market and the secondary reserves should be opened to the participation of demand and storage to become technology neutral.
- The regulatory framework should enable enhanced dynamic TSO-DSO interaction and coordination to optimize system management by the use of flexibility from different sources.
- The regulatory framework should provide clear rules for cost recognition (in relation to the benefits) of ancillary service provision coming from different sources (demand response, storage, flexible (distributed) generation, over different timeframes.

4.2.1 Market Access and Energy Management

- Ensure that market design rules make it possible that large and medium consumers have **direct access to** intraday markets and allow aggregators to participate in the **day-ahead and intraday** markets (Smart Energy Demand Coalition 2017). To facilitate the participation of aggregators, the regulatory framework should be adapted such that an aggregator does not need to ask for permission to the BRP of the industrial consumer. This could be done by following the approach of the transfer of energy concept. This concept formalizes the transfer (virtually) of the energy subjected to a demand response program from the BRP's basket to the basket of the aggregator. Another approach would be to follow the proposed method in the clean energy package to remove compensation payments, as they should only be used in exceptional cases[1].

4.2.2 Revenues through provision of ancillary services

- Primary (R1) and Tertiary reserve (R3) are already open for demand-side participation. In the future, the regulatory framework needs to ensure the opening of the other markets, specifically **secondary reserves** should be opened to the participation of demand to become technology neutral (Elia 2017).
- Further, bring the **procurement of ancillary services closer to real time**. Shift from monthly tenders to weekly/daily tenders (Elia 2016).
- Apply **marginal pricing** for contracting all balancing energy instead of pay-as-bid.
- Modify the following **technical conditions for the provision of ancillary services** to remove unfair barriers for demand-side participation (Elia 2016):
    - Split the provision of upward and downward balancing products (secondary and tertiary reserves) like has been done for primary reserve (R1), so that the requirement of symmetry is eliminated.
    - Reduce the availability requirements for primary and secondary reserve similarly to the mechanism that has already been implemented by the BidLadder in which service providers are allowed to provide their flexibility differently for every 15 minutes.

Up until June 2017, the offering of non-reserved power (free bids) was limited to large production units. Elia's ambition is to create as well the possibility for offering free bids on

[1]Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on common rules for the internal market in electricity, Article 17, 4º: "In order to ensure that balancing costs and benefits induced by aggregators are fairly assigned to market participants, Member States may exceptionally allow compensation payments between aggregators and balancing responsible parties. Such compensation payments must be limited to situations where one market participant induces imbalances to another market participant resulting in a financial cost. Such exceptional compensation payments shall be subject to approval by the national regulatory authorities and monitored by the Agency."

the balancing market from flexibility coming from grid users, aggregators and smaller production units. To achieve this, Elia created the pilot project BidLadder aiming to provide all market parties with a bidding platform by 30 June 2017, in a first stage for the delivery of flexibility to the balancing market from delivery points in the Elia grid, and later potentially – after deliberation with the DSOs - from delivery points connected to the distribution grid. The introduction of this mechanism is in line with our policy recommendations to bring the procurement of these reserves closer to real time and to remove unnecessary technical limitations.

4.2.3 Tariffs

- The current tariff design will be totally revised for the distribution grid tariffs. In general, the tariff design should be cost-reflective and provide the correct short term and long term signals to network users.
- Regulated charges ("kosten groene stroom", "kosten WKK", "Federale bijdrage", "Federale toeslag GSC" and "Bijdrage op de energie") and grid tariffs should be revised in order to ensure that they provide the right signals and incentives in terms of cost recovery for the grid, signals for cost efficient grid management, providing desired signals to the end user etc. The incorporation of non-energy/grid related costs in a way that might distort market signals, should be avoided as much as possible in regulated charges.

4.2.4 Bilateral balancing

- Gradually require **VRE** generators to bear full **responsibility** for their **imbalances** (EWEA 2015).

4.2.5 On-site generation

- Progressively **abandon** remaining **net-metering** policies (for RES < 10kW) and allow self-consumption from on-site VRE ensuring an adequate network tariff design. In this sense, network tariffs should provide end users with efficient and non-discriminatory economic signals that cover the underlying costs of the grid infrastructure and management, while respecting basic principles such as e.g. transparency, cost-reflectivity etc. For large consumers/prosumers with on-site generation, this could be obtained for instance by foreseeing grid tariffs based on net hourly consumption/injection, regardless of what is behind the meter, and on their contribution to the actual utilization of the grid (VREG 2016).

4.3 France

- Further develop the markets for the provision of all the ancillary services and open these markets for demand-side participation (direct or through independent aggregators).
- Split the provision of upward and downward FCR and aFRR, such that the requirement of symmetry is eliminated.
- Gradually require VRE generators to bear responsibility for their imbalances.

4.3.1 Market Access and Energy Management

- Allow the aggregation of both demand and generation within the same bid (Smart Energy Demand Coalition 2017).
- Currently conventional generation units are obliged to provide secondary reserve. For primary and tertiary reserves, organised markets exist which are only open for generators. To allow more competition and to exploit fully the flexibility of the demand side, these services should be open for demand-side participation. Moreover, an **organised market** should be created for all the **ancillary services** to make the prices more transparent, replacing the current bilateral secondary market.
- Adapt the regulatory framework of **distribution network operation** and implement the mechanisms that would allow DSOs to use active network management solutions that include the market procurement of local network services provided by FID, such as power reductions and reactive power and voltage control, for alleviating congestion and voltage problems, and in the long term possibly avoiding network reinforcements.

4.3.2 Revenues through provision of ancillary services

- Bring the **procurement of ancillary services** closer to real time. Shift from annual tenders (like the contracted capacity for "le mécanisme de ajustement") to weekly/daily tenders.
- Apply marginal pricing for contracting balancing energy instead of pay-as-bid
- Modify the following **technical conditions** for the procurement of ancillary services to remove unfair barriers for demand-side participation:
  - Split the provision of upward and downward FCR and aFRR, such that the requirement of symmetry is eliminated.
  - Lower the minimum capacity needed for interruptibility contracts.
  - Lower the minimum bid size for mFRR and RR (currently 10 MW).
  - Allow participation of consumers connected to the distribution grid.

4.3.3 Tariffs

The following table provides an overview of the regulated charges in France. The CSPE is a charge to finance the incentives for renewable energy, the islands and the tariff for vulnerable customers. The CTA is a charge that aims to finance the costs of the pensions for EDF-GDF employees. The TCFE includes the tax on the final consumption of electricity, while the TVA is the value added tax on the electricity bill.

Taxe	Taux	Proportion de la facture	Affectation
CSPE (Contribution au service public de l'électricité)	22,5€ /MWh	15% du prix du kWh	Finance le développement des énergies renouvelables, la péréquation tarifaire pour les DOM et les îles, et le tarif de première nécessité. Elle est reversée à l'état depuis 2016.
CTA (Contribution tarifaire d'acheminement)	27,04% de la partie fixe du TURPE	15% de l'abonnement	Reversée à la CNIEG, finance la retraite des agents EDF-GDF.
TCFE (Taxe sur la consommation finale d'électricité)	jusqu'à 9,5€ /MWh	6% du prix du kWh	Reversée aux communes et départements
TVA	20% sur le prix du kWh 5,5% sur l'abonnement	17% du prix du kWh	Reversée à l'Etat

Table 3: *Different regulated charges* ('Taxes Sur L'électricité' 2017)

- Introduce **peak-coincident pricing** (€/kW) reflecting the contribution to network peak utilization costs. (Bertoldi et al. 2016)
- Ensure that the **tariff design for network costs** is based on the cost-causality principle (i.e. each user must pay for the actual costs incurred), in order to encourage network users to employ their flexibility to make a more efficient use of the grid capacity ('Taxes Sur L'électricité' 2017).
- Separate the **regulated charges** (see table 1) from the network tariff and introduce them as a fixed charge instead of the current volumetric tariff.

4.3.4 Bilateral balancing

- Gradually require VRE generators to bear **responsibility for their imbalances** (EWEA 2015).

4.3.5 On-site generation

- As previously mentioned, industrial demand with on-site generation should not be considered as generation but should be treated on equal foot as demand without on-site generation.

4.4 Germany

- Create a general framework (instead of the current bilateral agreements) for compensation payments between independent aggregators and retailers.
- The network tariff itself should also include a fixed component, a volumetric component and a peak-coincident component as opposed to the current purely volumetric network tariff.
- Regulated costs should be charged based on the cost-causality principle by moving away from a purely kWh tariff. At the same time, exceptions for large consumers should be removed.

4.4.1 Market Access and Energy Management

- **Allow independent aggregators to participate directly** in the different markets without the permission of the consumer's BRP. Currently aggregators have to negotiate three different contracts (i.e. one with TSO, consumer, and consumers BRP) and a separate agreement with the DSO prior to offering a consumer's flexibility into the market. Therefore, it is necessary to create a general framework to facilitate this process between aggregators and retailers (Smart Energy Demand Coalition 2017). A possible solution could be the introduction of a concept similar to the "transfer of energy" as has been introduced in Belgium and France.
- Adapt the regulatory framework of **distribution network operation** to allow DSOs to use active network management solutions that include the market procurement of local network services provided by flexible industrial demand, such as power reductions and reactive power and voltage control, for alleviating congestion and voltage problems, and in the long term possibly avoiding network reinforcements (Smart Energy Demand Coalition 2017).

4.4.2 Revenues through provision of ancillary services

- Primary (FCR), Secondary (aFRR) and Minute (mFRR) reserves are all open for demand-side participation. However, to attract a higher rate of participation, the **technical requirements need to be adapted**. For secondary reserves some important changes are underway; proposals include to reduce the availability periods from 12 hours (60 hours during weekends) to blocks of 4 hours, to change the weekly tendering mechanism to daily auctions and to reduce the minimum bid to 1 MW (Smart Energy Demand Coalition 2017).
- **Apply marginal pricing instead of pay-as-bid** for contracting primary, secondary and minute reserves (availability and utilisation payments).
- Modify the following technical conditions for the provision of ancillary reserves to **remove unfair barriers for demand-side participation**:
  - Split the provision of upward and downward primary reserve so that the requirement of symmetry is eliminated.

- Lower the minimum-bid size for ancillary services to 1 MW (instead of 5 MW for secondary and minute reserve).
- Enable a centralized mechanism or standard procedures to facilitate financial adjustments between involved agents, especially between aggregators and BRPs/suppliers to adjust imbalances caused by demand response actions.

4.4.3 Tariffs

- **Regulated charges** (the renewable energy surcharge, the electricity tax, the concession levy, the levy for offshore liabilities, the surcharge for combined heat and power plants and the levy for industry rebate on grid fees) should charged in a way that they do not distort the behaviour of consumers. These charges are introduced to recover policy costs and do not depend on the consumption of electricity, nor on the usage of the network. Therefore, they should be charged in a way that they cannot be avoided ('What German Households Pay for Power' 2015).
- The network tariff itself should also include a fixed component, a volumetric component and a peak-coincident component as opposed to the current purely volumetric + capacity tariff. The problem with the current tariff is that consumers are incentivized to lower their individual peak with taken into account if they are actually lowering the overall network peak (Pérez-Arriaga et al. 2016). Moreover, the current tariff prioritises the high utilisation of existing grid infrastructure and thus incentivises consumers to maintain a standardised consumption profile. Specifically very large consumers are incentivised to have a flat profile (Smart Energy Demand Coalition 2017).

4.4.4 Bilateral balancing

- Make VRE generators **responsible for their imbalances** to such an extent that they are subjected to equal market conditions as none intermittent renewable generation (EWEA 2015).

4.4.5 On-site generation

- As most industrial consumers have separated metering for injection and withdrawal, there is no specific recommendation for Germany to adapt the regulatory framework.

4.5 Italy

- **Regulated charges** that are not directly related to the use of electricity networks, should be separated from the rest of charges, in such a way that they do not distort electricity market prices and cost-reflective network charges. Moreover, customers should have the adequate information to know on which basis (/kW, /kWh,…) these costs are charged.
- Adapt the existing **load interruptibility** and **the capacity mechanism** with the creation of **more competitive and dynamic** market instruments, in line with the standard procedures for the provision of reserve capacity and balancing services.
- Allow **VRE generators to be responsible for their imbalances** under equal market conditions as non-intermittent renewable generation. It is necessary to adapt the regulatory framework to create these equal market conditions by shifting the market gate-closure closer to real time. A second necessary condition is to allow aggregation so that VRE generation can reduce its imbalances, for example by contracting flexible demand.

4.5.1 Market access for energy management

- Ensure that market design rules guarantee that large consumers have direct and equal **access to wholesale electricity markets** and adapt the regulatory framework to allow for third-party aggregation (Smart Energy Demand Coalition 2017).
- Adapt the regulatory framework of **distribution network operation** and implement the mechanisms that would allow DSOs to use active network management solutions which are not yet in place in Italy. Distributed generation (DG) can only be curtailed by the TSO in emergency conditions. A Terna consultation on DG participation in ancillary services identified that that DSOs should be in charge in the future to validate the participation of DG units. The dispatch of these units is centrally managed by Terna.

4.5.2 Revenues through provision of ancillary services

- Open ancillary services for demand-side participation. Currently only a pilot project has been launched to evaluate the participation of demand in these services.
- To allow full participation of the demand, it is necessary to open up reserve capacity and balancing markets to the participation of the demand and make sure that **technical requirements for ancillary services** do not impose unfair barriers for participation on a level playing field. In this regard, the following recommendations are provided to facilitate the involvement of consumers in Italy:
  - Reduce minimum bid sizes from 5 MW to 1 MW, or lower.
  - Allow the participation of aggregated loads.
  - Split the provision of upward and downward balancing products, so that the requirement of symmetry is eliminated.

- Adapt the existing **load interruptibility and the capacity mechanism** with the creation of more competitive and dynamic market instruments, in line with the standard procedures for the provision of reserve capacity and balancing services. Therefore, both generators and (aggregated) demand should be allowed to compete in both mechanisms while at the same time removing the barriers for further demand-side participation. Pricing should be changed from administratively-set prices to market-based pricing with a separation between capacity and energy bids. Currently pilot projects are running to open the capacity market for demand-side participation and the regulator AEEGSI already announced the transformation of the current regulated load interruptibility mechanism into a market-based service (Smart Energy Demand Coalition 2017; Commission 2016).

4.5.3 Tariffs and Access

According with AEEGSI deliverable 657/2015/r/com, the present energy bill called "Bolletta 2.0" for the typical Italian customers includes the following main charges:

Spending item	Price description	Included components
Expense for energy	Price consists of • a fixed share (euro / year) • an energy share (euro / kWh), with price differentiated for time slots for users with energy electronic counter. It can be updated every quarter. For Domestic customers the price is the same for the quarter, while for the Non-domestic customers can vary from month to month.	It includes billed amounts for various activities carried out by the vendor to provide electricity to the final customer. The total price charged in the bill is given by the sum of prices for the following components: energy (PE), dispatching (PD), equalization (PPE), Marketing (PCV), component of Dispatching (DispBT).
Expense for transport and energy counter management	The rate may vary each quarter and consists of: • a fixed share (euro / year) • a power share (euro / kW / year) • an energy share (euro / kWh)	It includes billed amounts for various activities that allow sellers to deliver electricity to end customers. The total price includes the components of the transport, distribution and measurement tariff, and UC3 (balancing of costs for transporting and distributing electricity) e and UC6 (incentives for TSo and DSO for improving quality of service) tariff components.
Expense for system charges	Rates may vary according to the need to cover system charges; They usually are reviewed each quarter and are composed of: • an energy share (euro / kWh) • a fixed quota (euro / year). Fixed rate is not applied to residences of residence.	Includes billed amounts for cost coverage related to activities of general interest to the electric system, which are paid by all the end customers of the electric service. The total price includes components A2 (charges Nuclear and State's balance), A3 (incentives to renewable sources), A4 (Facilitations for the rail sector), A5 (Research for Electric System), AE (Facilitations to the energivore industries), As (Charges for electric bonus), UC4 (facilitations for minor electricity companies), UC7 (Energy Efficiency Promotion), MCT (Local bodies hosting nuclear facilities and State's balance).
Taxes	Includes items relating to consumption tax (excise duty) and value added tax (VAT).	Excise duty applies to the amount of energy consumed; domestic customers with power up to 3 kW enjoy facilitated rates for the supply in the residence. VAT is applicable on the total amount of the bill. At present, for households it is 10%; for Non-domestic households is currently equal to 22%; Some production activities enjoy a reduced VATrate of 10%.

Table 4: Elaboration of AEEGSI guidelines of energy bill "Bolletta 2.0". In the present energy bill, therefore, regulated charges are included in different voices and the main part is on "expense for system charges".

- **Network tariffs** are partially included in expense for energy and partially within expense for transport. Expense for transport consists of a volumetric part, a fixed component related to the grid connection and peak-coincident capacity component (€/kW) reflecting the contribution to network peak utilization. Therefore, it is recommended that the capacity charge which depends on the individual peak of the consumer is changed to a peak-coincident capacity component(Lapenna 2016)
- **Regulated charges** (see appendix 1) that are not directly related to the use of electricity networks, like costs of the subsidies for renewables, should be separated from the rest of charges, in such a way that they do not distort electricity market prices and cost-reflective network charges. Industrial consumers should not be exempted from certain costs (at the moment large energy-intensive industries can be exempted from type A components, see appendix 1 and (Vallés, Gómez, and Frías 2015)). A tariff that is based on cost-causality gives consumers the right incentives to activate their flexibility. Moreover, customers should have the adequate information to know on which basis (€/kW, €/kWh,…) these costs are charged.

4.5.4 Bilateral balancing

- Move towards a **full single imbalance pricing system**, such that imbalance prices reflect the actual imbalance costs and, as such provide the correct incentives to value flexibility, avoiding distortions to the real time signal sent to market participants. Currently, Italy has an imbalance pricing system that is slightly different from other European countries as it has a mixed system of single and dual pricing (European Commission 2016).
- Allow **VRE generators to be responsible for their imbalances** under equal market conditions as non-intermittent renewable generation. It is necessary to adapt the regulatory framework to create these equal market conditions by shifting the market gate-closure closer to real time. A second necessary condition is to allow aggregation so that VRE generation can reduce its imbalances, for example by contracting flexible demand (EWEA 2015).

4.5.5 On-site generation

- The promotion of self-consumption should be pursued through explicit forms of incentives aimed at the most efficient and sustainable configuration rather than by acting on network tariffs. This means that network tariffs should be cost-reflective and therefore self-generation cannot be completely exempted from network costs. A network tariff should be technology neutral and purely based on net hourly consumption/injection, regardless of what is behind the meter. Therefore, the tariff design should make sure that users are not over-incentivized, nor penalized for self-generation (Res-legal 2017).

4.6 Spain

- Wholesale participation: allow complex bids for demand in the day-ahead market
- Provision of reserves by the demand side: create asymmetric products and allow demand-side participation. Reduce the minimum bid size.
- Tariff design: make the tariffs cost-reflective; delete regulated charges that are not directly related to the use of electricity networks from the tariff. Make sure that tariffs reward and do not penalize demand-side participation.

4.6.1 Market Access and Energy Management

- Ensure that market design rules guarantee that large consumers have direct and equal access to wholesale electricity markets. In the case of Spain this means that **demand should be allowed to submit complex bids**, like the generation-side is allowed to do.
- Allow third party aggregation and ensure that demand response may participate in all markets (Smart Energy Demand Coalition 2017).
- Adapt the regulatory framework of **distribution network operation** and implement the mechanisms that would allow DSOs to use active network management solutions that include the market procurement of local network services provided by FID, such as power reductions and reactive power and voltage control, for alleviating congestion and voltage problems, and in the long term possibly avoiding network reinforcements.

4.6.2 Revenues through provision of ancillary services

- Adapt the existing **load interruptibility mechanism** with the creation of more competitive and dynamic market instruments, in line with the standard procedures for the provision of reserve capacity and balancing services. Therefore, also generators should be allowed to compete in this mechanism while at the same time the technical standards should be lowered to allow more consumers to participate in this mechanism.
- Open up **reserve capacity** and **balancing markets** to the participation of the demand and make sure that **technical conditions** do not impose unfair barriers for participation on a level playing field. In this regard, the following recommendations are provided to facilitate the involvement of consumers in Spain:
    - Reduce minimum bid sizes from 10 MW to 1 MW, or lower.
    - Allow the participation of aggregated loads.
    - Split the provision of upward and downward balancing products, such that the requirement of symmetry is eliminated.
- Open up **reserve capacity** and **balancing markets** to the participation of the demand and make sure that **technical conditions** do not impose unfair barriers for participation on a level playing field. In this regard, the following recommendations are provided to facilitate the involvement of consumers in Spain:

- Reduce minimum bid sizes from 10 MW to 1 MW or lower.
- Allow the participation of aggregated loads.
- Split the provision of upward and downward balancing products, such that the requirement of symmetry is eliminated.

4.6.3 Tariff Design

- In Spain, the secondary reserve is procured one day in advance and the costs are charged to the demand consuming at the relevant hours. These **costs for procurement of ancillary services** should not be charged to the ones who are consuming at those hours, but to the ones who cause these costs.
- **Network tariffs** should consist of a fixed component related to the grid connection and peak-coincident capacity component (€/kW) reflecting the contribution to network peak utilization. In Spain, industrial consumers are obliged to contract power for 6 different periods during the day. The lowest number p_1 refers to the pre-defined peak period, while p_6 is the period with the lowest expected demand. The contracted capacity should always be bigger in p_{t+1} than in p_t. This design should be changed to tariff in which consumers are charged a fixed component for being connected to the grid and an ex-post peak-coincident capacity component for their contribution to the local/total peak. Similarly to the triad charges in the UK, consumers should be informed ex-ante about possible peak periods.
- **Regulated charges** that are not directly related to the use of electricity networks, like the "peaje de respaldo" (a tax that owner of solar panels have to pay on the installed capacity and on the produced energy of these solar panels, see 4.6.5), the subsidies for renewables and the payments to recover the tariff deficit, should be separated from the rest of charges, in such a way that they do not distort electricity market prices and cost-reflective network charges.

4.6.4 Bilateral balancing

- In Spain, balancing capacity and energy resources are committed through different markets after the day-ahead market, up to 15 minutes ahead of real-time. Real-time deviations from an agent's declared schedule are penalized to recover the costs that occurred from the TSO's balancing actions. A dual pricing system penalizes any agent that deviates from his declared commitment. To make use of all the potential balancing energy, these markets should also be **opened for demand-side participation**. Additionally, the **introduction of a single imbalance** pricing system should reduce the overall balancing costs.

4.6.5 On-site generation

- Allow self-generation from on-site VRE ensuring an adequate **network tariff design** (as indicated in section 2). In this sense, the additional fees charged to self-generated

energy should be modified and tariffs should be based on net hourly consumption/injection, regardless of what is behind the meter, and on their contribution to the actual utilization of the grid.

4.7 UK

- The capacity remuneration mechanism in place should offer generation and demand a level playing field.
- Bring the procurement of ancillary services closer to real time.
- Reduce minimum bid sizes and temporal availability limits for the participation in ancillary services.

4.7.1 Market Access and Energy Management

- Ensure that market design rules guarantee that demand and aggregators have **direct access** to wholesale electricity markets. Allow third party aggregators to access the Balancing Mechanism or wholesale energy markets without the requirement of bilateral agreements with each customer's retailer (Smart Energy Demand Coalition 2017).
- Adapt the regulatory framework of **distribution network operation** and implement the mechanisms that would allow DNOs to use new solutions to solve network problems such as the market procurement of local network services provided by flexible industrial demand, such as power reductions and reactive power and voltage control, for alleviating congestion and voltage problems, and in the long term possibly avoid network reinforcements (Smart Energy Demand Coalition 2017). Fundamentally, regulatory frameworks and policy mechanisms should allow DNOs to be rewarded for pursuing '*smart*' solutions in contrast to traditional reinforcement options. It is also advisable that the DNO model as it is at this moment evolves towards a DSO model as in the other European countries.

4.7.2 Revenues through provision of ancillary services

- Apply **marginal pricing** contracting balancing energy instead of pay-as-bid (National Grid 2017).
- Bring the procurement of ancillary services **closer to real time**. Shift from monthly tenders to daily tenders (National Grid 2017).
- Considering the **technical requirements for ancillary services**, the following recommendations are provided to facilitate the involvement of consumers in these markets (National Grid 2017):
  - Reduce minimum bid sizes.
  - Reduce the temporal availability limits. Several ancillary services (e.g. STOR - 2 hours available at full capacity) require the providers to be available for an

unreasonable long period of time, introducing further barriers to demand providers who can provide balancing for shorter periods
- ❖ Separate the procurement of balancing capacity and balancing energy.
- ❖ Enable a centralized mechanism or standard procedures to facilitate financial adjustments between involved agents, especially between aggregators and BRPs/suppliers to adjust imbalances caused by demand response actions.

- The **capacity remuneration** mechanism in place should be on equal terms for both generation and demand. At this moment, the requirements to participate in the capacity mechanism are still more suitable for generation units than demand (Smart Energy Demand Coalition 2017).

4.7.3 Tariffs & Pricing

The follow table presents the relevant network tariff components in the UK. An updated tariff will be applicable from 01/04/2018 (UK Power Networks 2017).

Tariff component	Unit	Restrictions
One, two or three unit rates	€/kWh	No more than two unit rates for non half hourly settled demand.
Fixed charge	€/day	Not for unmetered supplies.
Capacity charge	€/kVA/day	Half hourly settled demand tariffs only.
Reactive power charge	€/kVArh	Half hourly settled tariffs only.

Table 5: List of tariff components and restrictions on their application

- Ensure that the **tariff design for network costs** (see table 2) is based on the cost-causality principle (i.e. each user must pay for the actual network costs incurred), in order to encourage network users to employ their flexibility to make a more efficient use of the grid capacity (EMA 2013).
- **Network tariffs** should consist of a fixed component related to the grid connection and a peak-coincident capacity component (€/kW) reflecting the contribution to network peak utilization. In contrast, flat and purely volumetric tariffs should be avoided (EMA 2013).
- **Regulated charges** (the renewable obligation, feed in tariff, climate change levy and the hydro benefit) should be separated in the short term from the other charges in such a way that they do not distort electricity market prices and cost-reflective network charges ('Climate Change Levy Rates - GOV.UK' 2017). In the long term, regulated costs to cover the subsidies given to renewables should be abolished to allow a full market-based playing field between the different generation technologies.
- Introduce **locational marginal pricing**, as the differences in locational conditions are expected to increase in the coming years. A more cost-reflective pricing will further incentivize local flexible units to provide their flexibility to the system.

4.7.4 Bilateral balancing

- As the UK already has implemented single imbalance pricing and

4.7.5 On-site generation

- Progressively abandon **net-metering** policies and allow self-generation from on-site VRE ensuring an adequate **network tariff design** (as indicated in section 2). In this sense, network tariffs should provide end users with efficient economic signals based on net hourly consumption/injection, regardless of what is behind the meter, and on their contribution to the actual utilization of the grid.

4.8 Conclusions

This section provides some country-specific policy recommendations about which changes are necessary to adapt the current regulatory framework to attract more demand-side participation. We have categorized our policy recommendations in five categories: **Market Access and Energy Management**, **Revenues through provision of ancillary services, Tariffs, Bilateral Balancing** and **On-site Generation**.

With respect to **market access and energy management**, we see that mainly Italy and Spain have not opened there markets yet to demand-side participation. The regulatory reform that is expected to happen in 2018 should start the change towards a market opening for demand response. Furthermore, we have found some barriers in France and Germany that make it difficult to fully exploit the potential of demand flexibility in practise. In all target countries, industrial consumers can reduce their electricity bill by actively doing energy arbitrage.

Concerning the participation in the **provision of ancillary services**, we find that demand faces some practical barriers in more or less all of the target countries. Also here, consumers in Spain and Italy face many barriers as there are the requirement of symmetrical products, transmission-grid connection and no transparency about the load interruptibility contracts. While in Spain most of the reserves are contracted on daily basis, the procurement in reserves in Belgium and the UK still happens on monthly or yearly basis. This limits the demand participation significantly, as they need to commit their availability several months/weeks ahead.

With respect to the **tariffs**, we see that in all six target countries, the tariffs are designed such that they created overall inefficiencies. All countries have some regulated costs included in their tariffs on kWh hour basis that can be avoided by reducing the (net-)metered consumption. Moreover, most of the countries also allow some exemptions for industrial consumers such that the real costs are not well reflected to them.

Most of the countries have already implemented a single balancing price and have made (at least partially) VRE balancing responsible. Regarding the **bilateral-balancing** business model,

there seem to be no market barriers anymore that prohibit the implementation of this model. However, other economic reasons might exist for not implementing this business model, which are not covered in this report.

The last category of policy recommendations is related to the on-site generation business model. In many countries, there are still net-metering policies in place, which cancel out the incentives to consume when cheap renewable energy is available.

5 Final policy recommendations

The final policy recommendations for a European-wide level are based on the country-specific policies that we have formulated in the previous section. Therefore, we provide the reader an overview of these recommendations followed by our general policy recommendations.

5.1 Summary of policy recommendations

The following table gives an overview of the policy recommendations for the six target countries. **Green** means that the current situation is adequate to create demand-side participation and that there is no urgent need to change the regulation on this aspect. **Orange** means that formally the regulation allows demand-side participation but in practise there is an obstacle created by the relevant regulation. A change is advisable but not necessary a significant barrier. **Red** means that there is a need to change the current regulation as the current regulation limits certain practises that could increase the countries' efficiency. In the most right column the relevant article of the Electricity Directive proposal[2] can be found if the recommendation is in line with one of the articles of the Directive.

Countries	BE	FR	DE	IT	ES	UK	Clean Energy Package
Market access							
Aggregation fully allowed							MARKET prop new dir. - Art 13
Direct access intraday/day-ahead markets							MARKET prop new dir. - Art 15,17
Reserves open for DR							
Ancillary services							
Procurement closer to real-time							
Symmetric Products							
Minimum-bid size							
Distribution connected demand can participate							MARKET prop new dir. - Art 32
load-interruptibility							
Tariffs							
Regulated charges in kWh							
Peak-coincident capacity component							
Extra charge for self-generation							RES prop new dir. - Art. 21
Balancing							
Single or Double pricing	S	S	S	S/D	D	S	
VRE balancing responsible party							
On-site generation							
net-metering							

Table 6: Overview of applicability of Policy Recommendations for the target countries

[2] Proposal for a Directive of the European Parliament and of the Council on common rules for the internal market in electricity

5.2 European wide policy recommendations

5.2.1 Market access

- Large consumers direct **access to** and participation in **wholesale electricity markets** (day-ahead and intraday markets), or alternatively through aggregation.
- Allow **participation of demand in all markets (reserve, balancing markets, and wholesale markets)**, directly or through aggregation.
- Guarantee **fair technical conditions** for demand into these markets.
- Allow and facilitate consumer and demand involvement in any existing and planned **capacity remuneration mechanisms**.
- **Aggregators** should **not face undue barriers** to market entry, and product definitions, gate closure times, and minimum bid sizes should recognise and encourage innovative and flexible distributed solutions (Smart Energy Demand Coalition 2017).

5.2.2 Ancillary services

- Make **load interruptibility** mechanisms **competitive.**
- Promote an **active network management by DSOs** with provision of flexibility by industrial demand in local network services.

5.2.3 Tariff design

- **Cost-reflective network tariffs**: fixed charge (€) + peak-coincident capacity charge (€/kW)
- Other regulated costs that are not directly affected by changes in electricity consumption or injection **should be removed from the volumetric (€/kWh)** component of the tariff and charged in a way that minimizes distortions of cost-reflective prices and charges for electricity services.
- An appropriate regulatory mechanisms should be in place to incentivize network operators to pursue non-traditional solutions. Traditionally, most DSOs receive a remuneration based on new network investments (i.e. reinforcements) which constitutes a barrier in recognising the reinforcement deferral / avoidance benefit brought by demand flexibility.

5.2.4 Bilateral balancing

- Require **VRE** generators to bear **imbalance responsibility.**
- Move towards a marginal efficient imbalance pricing system.
- In the case of remaining in a dual imbalance pricing system, **allow aggregation** and imbalance compensation.
- Ensure regulation promotes a standard approach, or model, in order to **avoid** a need for **bilateral contracts between aggregators and suppliers** on a case-by-case basis.

5.2.5 On-site generation

- **Abandon net-metering** policies and allow self-generation for on-site VRE

5.2.6 EU Harmonization

- High-level principles-based **harmonization** of flexibility mechanisms across the EU
- Suitable arrangements should be established for cross-border trading of both energy and ancillary services. This would enable an integrated market for energy and ancillary services, which in theory should lead to more efficient system operation and market pricing.

6 References

Bertoldi, Paolo, Paolo Zancanella, Benigna Boza-Kiss, European Commission, Joint Research Centre, and Institute for Energy and Transport. 2016. *Demand Response Status in EU Member States.* Luxembourg: Publications Office. http://dx.publications.europa.eu/10.2790/962868.

'Climate Change Levy Rates - GOV.UK'. 2017. Accessed June 26. https://www.gov.uk/government/publications/rates-and-allowances-climate-change-levy/climate-change-levy-rates.

Commission, European. 2016. 'Final Report of the Sector Inquiry on Capacity Mechanisms'.

EC. 2009. 'Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 Concerning Common Rules for the Internal Market in Electricity and Repealing Directive 2003/54/EC'. Official Journal of the European Union. http://eur-lex.europa.eu.

EC. 2012. 'Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on Energy Efficiency, Amending Directives 2009/125/EC and 2010/30/EU and Repealing Directives 2004/8/EC and 2006/32/EC'. Official Journal of the European Union. http://eur-lex.europa.eu.

Elia. 2016. 'Ancillary Services'. http://www.elia.be/en/suppliers/purchasing-categories/energy-purchases/Ancillary-services.

Elia. 2017. 'ARP Workshop'. Brussels, March 16.

EMA. 2013. 'EMA Guide To... Electricity Pass through Charges'. http://www.theema.org.uk/wp-content/uploads/2013/05/Martin-Hills-Supplier-Pass-Through-Charges.pdf.

European Commission. 2016. 'METIS Technical Note T4: Overview of European Electricity Markets'.

EWEA. 2015. 'Balancing Responsibility and Costs of Wind Power Plants'.

Jezdinsky, Tomas, and Fernando Nuño. 2016. 'Stakeholder Consultation Process'. Deliverable 2.3. IndustRE Project, European Union's Horizon 2020 Grant agreement no. 646191, Work Package 2: Innovative Business Models.

Lapenna, Daniele. 2016. 'Il Ventunesimo Secolo - Blog d' Informazione Di Lapenna Daniele: Come Leggere La Bolletta dell'Enel? Ecco Una Spiegazione Semplice Su Ogni Sua Parte. Con La Nuova Bolletta Ci Sono Stati Aumenti'. *Il Ventunesimo Secolo - Blog d' Informazione Di Lapenna Daniele*. April 3. http://ilventunesimosecolo.blogspot.com.es/2016/04/come-leggere-la-bolletta-dellenel-ecco.html.

National Grid. 2017. 'Balancing Services'. http://www2.nationalgrid.com/uk/services/balancing-services/.

Papapetrou, Michael. 2015. 'Main Variations of Business Models for Flexible Industrial Demand Combined with Variable Renewable Energy'. Deliverable 2.1. IndustRE

Project, European Union's Horizon 2020 Grant agreement no. 646191, Work Package 2: Innovative Business Models.

Pérez-Arriaga, Ignacio, Tomás Gómez, Carlos Battle, Jose Pablo Chaves Avila, and John Deutch. 2016. 'UTILITY OF THE FUTURE'. http://www.abrapch.org.br/admin/arquivos/arquivos/3/utility-of-the-future-full-report-661.pdf.

Res-legal. 2017. 'Net-Metering'. February 24. http://www.res-legal.eu/search-by-country/italy/single/s/res-e/t/promotion/aid/net-metering-scambio-sul-posto/lastp/151/.

Smart Energy Demand Coalition. 2017. 'Mapping Demand Response in Europe Today'. *Tracking Compliance with Article* 15.

'Taxes Sur L'électricité'. 2017. *Prix-Elec by Selectra*. Accessed June 26. https://prix-elec.com/taxes.

UK Power Networks. 2017. 'London Power Networks Plc Use of System Charging Statement'.

Vallés, Mercedes, Pablo Frías, and Tomás Gómez. 2015. 'Regulatory and Market Framework Analysis: A Working Document Assessing the Impact of the Regulatory and Market Framework on the IndustRE Business Models'. Deliverable 2.2. IndustRE Project, European Union's Horizon 2020 Grant agreement no. 646191, Work Package 2: Innovative Business Models.

Vallés, Mercedes, Tomás Gómez, and Pablo Frías. 2015. 'Regulatory and Market Framework Analysis: A Working Document Assessing the Impact of the Regulatory and Market Framework on the IndustRE Business Models'. http://www.industre.eu.

Vallés, Mercedes, Tomás Gómez, and Pablo Frías. 2016. 'Business Models and Market Barriers'. http://www.industre.eu.

VREG. 2016. 'Tariefmethodologie Voor de Reguleringsperiode 2017-2020'.

'What German Households Pay for Power'. 2015. *Clean Energy Wire*. January 23. https://www.cleanenergywire.org/factsheets/what-german-households-pay-power.

7 Revision history

Table 7.1. Revision history

Version	Date	Revised by
V1	29/08/17	Lorenzo Simons
V1.1	08/09/17	Tomás Gómez
V2	13/09/17	Lorenzo Simons
V3	22/09/17	Lorenzo Simons
V3.1	25/09/17	Lorenzo Simons
V3.2	27/09/17	Pablo Frías
V3.3	29/09/17	Lorenzo Simons

Appendix 1

The list with different components that can be included in the as regulated charges:

- A2 *Oneri per il finanziamento delle attività nucleari residue* (charges for maintenance and decommissioning of old nuclear plants)
- A3 *Fonti rinnovabili e assimilate* (incentives for renewable energy production)
- A4 *Regimi tariffari speciali ferrovie* (supporting tariffs for railways)
- A5 *Finanziamento della ricerca* (supporting research on electricity system)
- A6 Stranded Costs
- AE *Agevolazioni imprese energi*vore (benefits for energy-intensive industries)
- AS *Bonus sociale* (supporting social tariffs)
- UC4 *Imprese elettriche minori* (supporting small local utilities, for example in the islands)
- MCT *Misure di compensazione territoriale* (local compensations, usually where large generation plants/infrastructures are built)
- UC3: balancing costs on transmission and distribution
- UC6: balancing quality costs
- UC7 *Efficienza energetica negli usi finali* (supporting energy efficiency)