Output Factsheet

Output title:
Output 3.1: Strategy to influence regulatory framework

Summary of the output (max. 2500 characters)

The output contains identified regulatory framework barriers and their overcome suggestions, with corresponding action plan, for integrated real-time grid-building Energy Management System adoption in the Danube region including demand response. The first part of the document is the introduction about demand response and requirements of flexibility service. The second part is about the recognized barriers for flexibility services in each country of the Danube region and third part are the proposals for removing barriers, with action plan.

The main proposals for removing barriers are:

- Recognition of short-term rising costs in the implementation of intelligent energy systems and the associated IT services,
- Legal clarification of the new roles and IT services and a guideline provided by the regulator which existing actors will (or can) take which part in the new energy system,
- Promotion and dissemination of the new business models for a better recognition of the new market structures,
- Financial incentives by government for the implementation of EMS and IT-service platforms,
- Legislative anchoring of battery storage systems as storage asset for distribution grid operators,
- Enable distribution grid owners to own storage assets as an integral part of their grid infrastructure and to operate them in support of the grid,
- Definition of an expanded framework for designing the grid tariff model and grid compensation system for feeding energy into and withdrawing it from storage systems in connection with billing for the provision of storage capacity at respective grid levels,
- Development and recommendation of funding schemes for the installation of distributed generation systems combined with storage assets for the optimisation of local generation and consumption,
- A wider smart meter roll-out to get a real market penetration,
- A favourable regulatory and legal framework on a national scale for EMS as well as financial support for the necessary infrastructure for a wide implementation of EMS and smart systems.

Action plan for the strategy to remove the regulatory framework barriers inherits the conclusions and recommendations for different Danube region countries provided in the preceding strategy, and then orders the recommended measures in a sequence of steps needed to enable participation of prosumers in flexibility provision.

Contribution to the project and Programme objectives (max. 1500 characters)
The main objective of 3Smart is to provide a technological and legislative setup for cross-spanning energy management of buildings, energy grids and major city infrastructures in the DR. Into the main objective converge both technical developments in defining the energy management platform and its compatible modules on the building and the grid side, demonstrated viability of the energy management platform and its durable functioning in different pilot setups, as well as strategy for removing identified barriers in the current regulatory setup to enable the platform functioning in outside-the-pilot environment from the energy regulatory side. For the latter this output provides the key contribution. As the DTP major objective is to harmonize policies across different countries in the Danube region in crucial priority fields, one of them being also energy, the strategy contributes to it by identifying regulatory barriers and suggesting solutions to resolve them for harmonizing policies that enable introduction of integrated grid-building energy management with demand response in the Danube region.
Transnational impact (max. 1500 characters)
The results of this deliverable can function as a basis for the regulatory framework development in all Danube region countries. Action plan for the strategy is created in that sense, to identify steps that need to be went through regarding regulatory and technology issues, for the whole Danube region.
Contribution to EUSDR actions and/or targets (max. 1500 characters)
The output contributes to Priority Area 2 (PA2) "To encourage more sustainable energy" of the EUSDR within which the following actions are required: „To explore the possibility to have an increased energy production originating from local renewable energy sources to increase the energy autonomy", „To promote energy efficiency and use of renewable energy in buildings and heating systems", „To facilitate networking and cooperation between national authorities in order to promote awareness and increase the use of renewable energies". Wide-scale grid-building energy management and demand response is crucial for enabling decarbonization of the energy system and different listed EUSDR PA2 targets. From the regulatory side steps needed for enabling grid-building energy management and demand response are listed in this strategy.
Performed testing, if applicable (max. 1000 characters)
The findings of the strategy were presented to national energy regulators gathered within Energy Regulators Regional Association (ERRA) on its meeting in Skopje, North Macedonia, in April 2019. The project has got the full attention of regulators where the technology developed and the regulatory suggestions were presented in a 1,5 hour time slot, followed by discussions. The major findings and suggestions were well accepted by the regulators. The conclusions are also presented in a project booklet which is disseminated widely across the Danube region.

Integration and use of the output by the target group (max. 2000 characters)
The key target group addressed by this strategy are national authorities in the field of energy and regulatory agencies. Each country was separately analyzed in the strategy derivation part in order to address the country specifics and provide suggestion for removing regulatory barriers. Then at the end the action plan has shown the key steps that should be followed in adapting the regulatory setup throughout the Danube region. The findings are assessed on sound technical basis stemming from the developed energy management tool and verification of its operation in various pilots. For that reason it will be hopefully considered seriously by the regulators.
Geographical coverage and transferability (max. 1500 characters)
The strategy is performed by identifying regulatory barriers and deriving solutions in 12 countries of the Danube region: Germany, Austria, Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Romania, Bulgaria, Serbia, Bosnia and Herzegovina, Montenegro. This makes the strategy well applicable in the entire Danube region, but also broader. Common action plan derived at the end identifies the necessary steps on a common path to introduction of integrated grid-building energy management procedures and demand response functionality.
Durability (max. 1500 characters)
The strategy can be used to improve regulatory framework in the Danube region for introduction of demand response. Considering the different pace of countries changing their legislation regarding this topic during the coming years, the strategy remains relevant for all those countries going through the path of regulatory change identified by the strategy and the action plan provided.
Synergies with other projects/ initiatives and / or alignment with current EU policies/ directives/ regulations, if applicable (max. 1500 characters)
The strategy has a synergy effect with Clean Energy for all Europeans package – it shows how the regulatory framework should change to transpose the package directives in the area of demand response.
Output integration in the current political/ economic/ social/ technological/ environmental/ legal/ regulatory framework (max. 2000 characters)
The output is integrated in the current EU regulatory framework for real-time grid-building Energy Management System including demand response and flexibility service.

Project Deliverable Report

Smart Building – Smart Grid – Smart City

http://www.interreg-danube.eu/3smart

DELIVERABLE D3.4.1.

Strategy to remove the regulatory framework barriers for Energy Management System adoption in the Danube region

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Table of Contents

Executive summary

This document addresses regulatory framework barriers and their overcome suggestions for integrated real-time grid-building Energy Management System adoption in the Danube region, including demand response. The first part of the document is the introduction about demand response and requirements of flexibility service. The second part is about the recognized barriers for flexibility services in each country of the Danube region and third part are the proposals for removing barriers.

The most important barriers for flexibility services are:

- Electricity spot market is not fully established,
- Low intensity of spreading smart meter technologies, technological and data standards,
- Missing market place for flexibility trading transactions,
- No ancillary services and balancing markets.

The main proposals for removing barriers are:

- Recognition of short-term rising costs in the implementation of intelligent energy systems and the associated IT services,
- Legal clarification of the new roles and IT services and a guideline provided by the regulator which existing actors will (or can) take which part in the new energy system,
- Promotion and dissemination of the new business models for a better recognition of the new market structures,
- Financial incentives by government for the implementation of EMS and IT-service platforms,
- Legislative anchoring of battery storage systems as storage asset for distribution grid operators,
- Enable distribution grid owners to own storage assets as an integral part of their grid infrastructure and to operate them in support of the grid,
- Definition of an expanded framework for designing the grid tariff model and grid compensation system for feeding energy into and withdrawing it from storage systems in connection with billing for the provision of storage capacity at respective grid levels,
- Development and recommendation of funding schemes for the installation of distributed generation systems combined with storage assets for the optimisation of local generation and consumption,
- A wider smart meter roll-out to get a real market penetration,

- A favourable regulatory and legal framework on a national scale for EMS as well as financial support for the necessary infrastructure for a wide implementation of EMS and smart systems,
- Creation of a long-term vision and strategy regarding the national energy system, with ambitious goals, well-targeted policies and generation of public support for energy transition.

1. Introduction

The goal of the Work Package 3 (WP3) within the 3Smart project is to provide regulatory and technology framework for successful integration and active role of flexible distributed sources and prosumers in low carbon energy system. The focus of this project is on demand response, however we aim to provide a wider and more comprehensive proposal to national regulatory agencies, by including all active participants at the distribution level (generation, storage, demand response, etc) at an aerly stage.
One part of WP3 is the creation of strategy to remove the regulatory framework barriers for real-time Energy Management Systems (EMSs) adoption in the Danube region (DR). This deliverable includes description of Demand Response, requirements of flexibility services, regulatory requirements – EU regulatory framework, current situation in EU regarding the implementation of Demand Response, as well as other barriers for flexibility services and recommendations pointed out specifically for the Danube region countries.

The most important conclusions in the preceding Activity 3.2 (current regulatory state assessment) are the following:

1. There are huge differences in the levels of energy market liberalization, market competitiveness and independency of the energy regulators in the analysed countries. One of the main obstacles for residential consumers to become prosumers are the fixed, low residential energy prices which do not reflect market prices.
2. There are no identified barriers for dynamic pricing related to bilateral contracts and trading. Market participants in all countries can enter this market without any special requirement.
3. Dynamic pricing for end customers reflecting wholesale prices of power exchange is not yet offered as a service by the suppliers/retailers. Furthermore, since power exchange has not yet been established in Bosnia and Herzegovina and Montenegro, there are additional steps required to make this available as an option in the future. In all other countries power exchanges exist and operate with the expected preconditions and features.
4. There are different participants in cross-border trading. The participants may differ from one country to another, but the common interest of the participants to move forward to market coupling in every country can be assessed. Within the cross-border trading topic there is no identified barrier for dynamic pricing.
5. The majority of Danube region countries still does not have developed ancillary services markets, meaning that renewable generators, even if they were not subsidized by feed-in-tariffs, cannot participate in the ancillary services market. With the exception of Germany and Austria, aggregators of renewable energy are

very rare in the Danube region, although there are some indications they will be present in the near future.

6. Market access and integration has to be strengthened. Intraday markets have to be introduced where they are still missing. Procurement of reserves through auctions should be more promoted in the South Eastern European region.
7. Renewable energy and load (demand side management) participation in ancillary services and in balancing needs to be improved in all countries.
8. The end-users in the Danube region countries are not encouraged by dynamic electricity prices or network tariffs to perform flexible response, either depending on conditions on wholesales market (dynamic electricity tariffs) or network technical aspects (network tariffs as one way of doing this).
9. There is no general obstacle to include flexible end-users, distributed generators, storage devices etc. as equal market participants providing different services increasing the power system flexibility.
10. Smart meter roll-out is quite diverse in the Danube region: in certain countries it is carried out, in others it is not yet decided. There are no legislative barriers for the roll-out.
11. Technical specifications for smart meters do not cover the possibility of communication with the building energy management system.
12. Cooperation and information exchange between TSOs and DSOs in the context of flexibility-based services is still limited and further steps are necessary.
13. There are relatively few available regulations or strategies in the Danube region countries in the context of Energy Performance in Buildings Directive which concern also usage of advanced building energy management systems.

The following recommendations are also important:

1. Remove priority dispatch for existing RES,
2. Avoid net metering and ensure fair cost allocation,
3. Clear distinction between incentives for DSOs and network users,
4. Maintain a flexible approach to smart meter roll-out,
5. EU-wide smart meter minimum specification (metering frequency per minute, techical minimum criteria),
6. Facilitate but avoid mandating dynamic prices,
7. Interoperability is key for data format,
8. DSO as Neutral Market Facilitator,
9. Better network planning and coordination,
10. Holistic approach to support market flexibility is needed,
11. Flexibility to support ditribution network operation,
12. Renewable self-consumers and Energy Communities.

2. Stucture of Energy Management System technology/regulation within 3Smart project

Objectives of the 3Smart WP3 are:

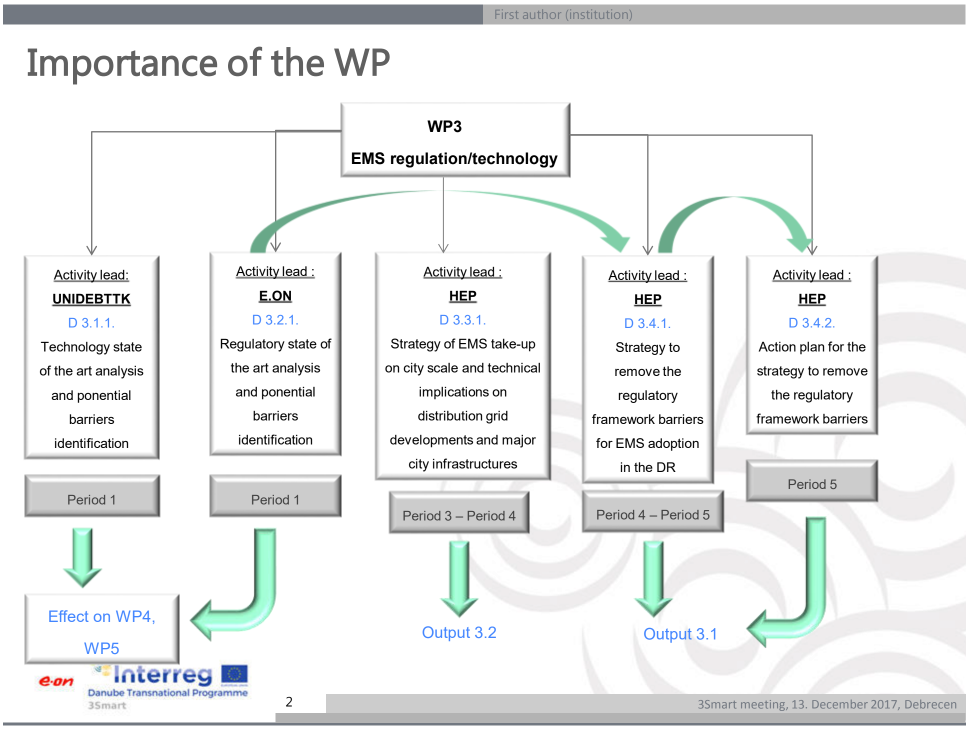
(1) Facilitate the technical developments on the project by assesing current technical and regulatory state with respect to cros-spanning building-grid energy management across buildings, energy grids and infrastructure.

(2) Derive the local/regional up-scaling paths for the developed EMS

(3) Assess a plan to overcome identified regulatory barriers

The following figure presents the WP3 structure on EMS regulation/technology.:

- Technology state-of-the-art analysis and potential barriers identification (D3.1.1),
- Strategy of EMS take-up (D3.3.1) and
- Regulatory state-of-the-art analysis, overcome strategy and action plan (D3.2.1, D3.4.1 and D3.4.2).



3. Demand Response

Demand Response is a critical resource for achieving a low carbon, efficient electricity system at a reasonable cost [1,2].

In **Explicit Demand Response schemes** (sometimes called "incentive-based") the aggregated demand side resources are traded in the wholesale, balancing, and capacity markets. Consumers receive direct payments to change their consumption (or generation) patterns upon request (consuming more or less), triggered by, for example, activation of balancing energy, differences in electricity prices or a constraint on the network.

Consumers can earn flexibility from their consumption individually or by contracting with an aggregator who could be either a third party aggregator or the customer's supplier itself. Hence it is 'only' the regulatory framework at EU and national level, which currently determines whether Explicit Demand Response services are available to consumers or not.

Implicit Demand Response (also sometimes called "price-based") refers to consumers choosing to be exposed to time-varying electricity prices or time-varying network grid tariffs (or both) that reflect the value and cost of electricity and/or transportation in different time periods. They respond to wholesale market price variations or in some cases dynamic grid fees. Introducing the right to flexible prices for consumers (provided by the electricity supplier) does not require the role of the aggregator.

The role of aggregation and the need for regulatory clarity: Explicit Demand Response requires the coordinated participation of the full energy value chain. The players involved include the Transmission System Operator (TSO) in balancing markets, the DSO, the supplier, the Balance Responsible Party (BRP) and the aggregation service provider. Most consumers do not have the means and the know-how to trade directly in the energy markets. In order to engage, consumers therefore require a clearly defined offer, which is both simple to use and contains clear benefits. They need to organize flexilbility services by a new market player (aggregator) and the market models are still undr examination.

To enable the participation of independent aggregation service providers in a safe manner, the relationship between the supplier, Balancing Responsible Party (BRP) and the aggregator must be predefined. Standardised processes for information exchange, transfer of energy, and financial settlement between these parties are a critical requirement in order to facilitate the smooth functioning of the markets and ensure consumer protection.

A wide range of enablers can be implemented to encourage/facilitate participation in the market for flexibility services:

- Information and communications technology (ICT): includes broadband information exchange, home automation, etc.

- Grid access rules & tariffs: interruptible contracts etc.
- Retail market arrangements: energy access contracts, e.g. time of use tariffs etc., data provision etc.
- Smart Meter: the use of smart meter data is an important enabler, but even without metering and settlement the use for the increase of system efficiency is still possible
- Wholesale market arrangements: roles and responsibilities, product requirements, metering and settlement, aggregation, data exchange, etc.

4. Requirements of flexibility services

The flexibility services are required by the different actors in the value chain - Balancing Responsible Parties, Transmission System Operator and Distribution System Operator, while the services can be provided by industrial and commercial customers, domestic and distributed generators, possibly supported by aggregators.

For this project the following explanations are presented for DSO and providers (industrial and distributed generation).

Distribution System Operator requires flexibility for the following:

<u>Long-term congestion management</u>: Currently, DSOs provide grid capacity (guaranteed access) that may not be fully used due to, for example, consumer behaviour or local consumption/injection of electricity produced by Distributed Generation (DG). With the rise in DER, the system cannot be designed to cater for all contingencies without significant investment in basic network infrastructure. Different levels of grid access and real-time flexibility can reduce or postpone investment needs.

<u>Short-term security congestion management</u>: DSOs should have the ability to obtain flexibility from DGs, energy storages and demand in order to keep local balance, optimise network availability or to manage network conditions in the most economic manner. Network reinforcement could be deferred until it becomes more cost-effective than the on-going cost of procuring flexibility services. DG owners should be informed in advance about expectations of curtailment.

<u>Voltage control/reactive power management</u>: Injection of active power leads to voltage profile modifications. Voltage increase (overvoltage) is the most common issue with the connection of DG units. Reversed power flows (flows from distribution to transmission) occur when DG production exceeds local load. If the DG is properly coordinated with the available voltage and reactive power equipment, a proper voltage regulation can still be maintained in the presence of that DG. In some situations DG will have to be curtailed to prevent voltages from rising above statutory limits, either actively by the DSO, or automatically by interconnection protections.

Network losses (NL): At local level, DGs could reduce the amount of energy lost in distributed electricity up to a saturation point when renewable generation is so high that it flows to Medium Voltage network and thus increases DSO network loss.

Other benefits for DSOs are avoidance/deferral of distribution network investments costs, reduced curtailment of distributed generation and reduced outage times, and outage/fault management.

Whilst demand response can be an effective tool for DSOs to relieve network congestions, activation of demand response located in the distribution network may lead to network constraints and affect security of supply or quality of service. Adequate procedures allowing DSOs to maintain operational security in their networks and the market to function efficiently need to be set up.

Furthermore, a robust and efficient IT framework is required to ensure the necessary exchange of information. The cost of such a framework will have an impact on aggregators' business model and should not be hidden or carried by other market parties.

(Aggregated) industrial and commercial users can operate as a group (through aggregation) or individually.

When an industrial or commercial user offers flexibility (automated or manually) activated in response to a market signal, such flexibility will be remunerated by a BRP/supplier/aggregator or TSO/DSO. The means and type of remuneration depends on national market rules.

A consumer/generator contracted by a third-party aggregator for its flexibility would have a separate contract with its third-party aggregator in addition to its contract with the supplier. How energy is allocated depends on the market model. The contract agreement will determine the remuneration of the provider of flexibility services. Suppliers or third party aggregators may then have a contract with the DSO or TSO for providing it with peak shifting or demand adjustment services. Curtailment of distributed generation can be both an individual and an aggregated response action.

(Aggregated) distributed generation

There are many different forms of distributed energy resources, for instance cogeneration or combined heat and power (CHP), wind farms, photovoltaic systems, etc. along with biogas in the gas system.

Aggregating DG depends on the controllability of the generation unit. Energy storage, CHP or back-up generators are more controllable than wind farms or photovoltaic systems. The more generation can be controlled, the easier the aggregation of such units becomes, and if storage (where economically feasible) participates in the aggregation, aggregation will become even more controllable.

5. Regulatory requirements for enabling Demand Response – European regulatory framework

The European policy makers have demonstrated strong support for Demand Response. This is reflected in several important legislative texts elaborated in the sequel.

The Electricity Directive – 2009/72/EC

The Electricity Directive of the Third Energy Package defines the concept of "energy efficiency/demand-side management", acknowledging the positive impact on environment, on security of supply, on reducing primary energy consumption and peak loads. The Art. 25.7 requires network operators to consider Demand Response and energy efficiency measures when planning system upgrades. Art. 3.2 also states "*In relation to security of supply, energy efficiency/ demand-side management and for the fulfilment of environmental goals and goals for energy from renewable sources, [...] Member States may introduce the implementation of long-term planning, taking into account the possibility of third parties seeking access to the system*". This language was strengthened further within the Energy Efficiency Directive (EED).

The Energy Efficiency Directive (EED) – 2012/27/EU

The Energy Efficiency Directive (2012/27/EU) constitutes a major step towards the development of Demand Response in Europe.

According to its Art. 15.2, Member States were required to undertake an assessment of the energy efficiency potentials of their gas and electricity infrastructure, in particular regarding transmission, distribution, load management and interoperability and identify concrete measures and investments for the introduction of cost-effective energy efficiency improvements in the network infrastructure, by 30 June 2015.

Furthermore, Art. 15. 4 requires Member States to:

- *"Ensure the removal of those incentives in transmission and distribution tariffs that are detrimental to the overall efficiency (including energy efficiency) of the generation, transmission, distribution and supply of electricity or those that might hamper participation of Demand Response, in balancing markets and ancillary services procurement*".
- *"Ensure that network operators are incentivised to improve efficiency in infrastructure design and operation, and, within the framework of Directive 2009/72/EC, that tariffs allow suppliers to improve consumer participation in system efficiency, including Demand Response, depending on national circumstances".*

Of outmost importance is Art. 15.8 of the Directive, which establishes consumer access to the energy markets, either individually or through aggregation. In detail the Article states:

- *"Member States shall ensure that national regulatory authorities encourage demand side resources, such as Demand Response, to participate alongside supply in wholesale and retail markets."*
- "*Subject to technical constraints inherent in managing networks, Member States shall ensure that transmission system operators and distribution system operators, in meeting requirements for balancing and ancillary services, treat demand response providers, including aggregators, in a non-discriminatory manner, on the basis of their technical capabilities.*"
- *"Member States shall promote access to and participation of Demand Response in balancing, reserves and other system services markets, inter alia by requiring national regulatory authorities […] in close cooperation with demand service providers and consumers, to define technical modalities for participation in these markets on the basis of the technical requirements of these markets and the capabilities of Demand Response. Such specifications shall include the participation of aggregators."*

The Network Codes

The codes are a set of rules drafted by European Network of Transmission System Operators for Electricity (ENTSO-E), with guidance from the Agency for the Cooperation of Energy Regulators (ACER), to facilitate the harmonisation, integration and efficiency of the European electricity market.

The Network Codes will create the foundation for the realisation of the provisions of two aforementioned Directives on Demand Response. Some of the Codes that are expected to be finalised and adopted in the coming months, such as the **Demand Connection Code**, the **Electricity Balancing Code** and the **Emergency & Restoration Code**, will be critical for the development of Demand Response, because they describe the terms and conditions under which Demand-side flexibility providers will be able to participate in the electricity markets.

ACER's recommendation for the Network Code Electricity Balancing includes article 31, which specifically deals with enabling independent provision of demand-side response. In this article, the Draft Network Code describes which processes should be standardised, including the adjustment of energy volumes and financial settlement. Creating these standards and making aggregators independent of the consent of the consumer's energy supplier are crucial steps in creating competition to procure explicit Demand Response services from consumers. However, in its current form, this provision is optional for member states. If the European Commission does not make it mandatory, this could result in further fragmentation of the Demand Response landscape in Europe.

Directive 2018/2002/EU amending The Energy Efficiency Directive (EED) – 2012/27/EU

Directive 2018/2002/EU is the legislation in the Clean Energy for All Europeans package and it has been published in the EU Official Journal on 21st December 2018 and is entered into force on 24 December 2018.

In relation to the above mentioned provisions in Directive 2012/27/EU, there are no changes in Article 15.2, 15.4 and 15.8.

Additionally, it is important to emphasize changes in Article 9, relating the metering for gas and electricity and for heating, cooling and domestic hot water. These regulations relate to the installations of competitively priced individual meters that accurately reflect actual energy consumption, together with sub-metering and cost allocation and remote reading requirement.

Directive 2018/844/EU amending The Directive on the Energy Performance of Buildings (EPBD) – 2010/31/EU

Article 2 is amended with definitons about:

- *"technical building system - means technical equipment for space heating, space cooling, ventilation, domestic hot water, built-in lighting, building automation and control, on-site electricity generation, or a combination thereof, including those systems using energy from renewable sources, of a building or building unit"*
- *"building automation and control system - means a system comprising all products, software and engineering services that can support energy efficient, economical and safe operation of technical building systems through automatic controls and by facilitating the manual management of those technical building systems"*

Article 8 is amended with the regulations about technical building systems and smart readiness indicator:

> *„1. Member States shall, for the purpose of optimising the energy use of technical building systems, set system requirements in respect of the overall energy performance, the proper installation, and the appropriate dimensioning, adjustment and control of the technical building systems which are installed in existing buildings. Member States may also apply these system requirements to new buildings.*
>
> *System requirements shall be set for new, replacement and upgrading of technical building systems and shall be applied in so far as they are technically, economically and functionally feasible.*

Member States shall require new buildings, where technically and economically feasible, to be equipped with self- regulating devices for the separate regulation of the temperature in each room or, where justified, in a designated heated zone of the building unit. In existing buildings, the installation of such self-regulating devices shall be required when heat generators are replaced, where technically and economically feasible.“

Article 14 in point 4 about the inspection of heating systems is amended:

„4. Member States shall lay down requirements to ensure that, where technically and economically feasible, non - residential buildings with an effective rated output for heating systems or systems for combined space heating and ventilation of over 290 kW are equipped with building automation and control systems by 2025.

The building automation and control systems shall be capable of:

(a) continuously monitoring, logging, analysing and allowing for adjusting energy use;
(b) benchmarking the building's energy efficiency, detecting losses in efficiency of technical building systems, and informing the person responsible for the facilities or technical building management about opportunities for energy efficiency improvement; and
(c) allowing communication with connected technical building systems and other appliances inside the building, and being interoperable with technical building systems across different types of proprietary technologies, devices and manufacturers.“

The same is amended for Article 15 in pount 4 about the inspection of air-conditioning systems.

6. Current situation in EU regarding the implementation of Demand Response and regulatory barriers

Belgium, Finland, France, Ireland and Switzerland have reached a level where Demand Response is a commercially viable product. This is the case also in the United Kingdom due to its highly competitive energy markets, and open balancing markets, but the future of Demand Response in the country has become more difficult due to the launching of the UK Capacity Market. The market, thus far, is providing £1 billion income stream annually mainly to nuclear and fossil fuel generation resources, but does not create a level playing field for demand-side resources to participate. Finland and Belgium have positive programme and payment structures, which enable consumer engagement, though neither country has integrated independent aggregators fully into their systems yet. France and Switzerland have restructured their programme requirements and defined roles and responsibilities of market participants specifically to allow for independent aggregation. Belgium is carrying out a similar review.

In Sweden, the Netherlands, Austria and Norway, while Demand Response companies are being established, significant regulatory barriers remain an issue and hinder market growth. This is usually due to programme participation requirements, which are not yet adjusted for both generation and demand-side resources. For example in Austria a consumer may be required to install a secured and dedicated telephone line to participate in the balancing market. In Norway, TSO signals are still delivered over the telephone, and therefore the minimum bid-size remains high. Rules such as these block the participation of all but the very largest industrial consumers. A lack of clarity around roles and responsibilities may also block new entrants.

In the remaining of European Member States aggregated Demand Response is either not allowed or its development is seriously hindered for all market participants – except large industrial sites, suppliers or independent aggregators - due to regulatory barriers.

Overall main **regulatory barriers** found repeatedly across the Member States include:

1. **Demand Response may not be accepted as a resource**: Many Member States have wholesale, balancing, or capacity markets where aggregated flexibility in demand is not accepted as a resource (in direct contradiction to the Energy Efficiency Directive, Article 15.8).
2. **Inadequate and/or non-standardised baselines**: It is important that consumers' demand-side flexibility is accurately measured. Many Member States lack standardised measurement and baseline assessment methodologies, or have methodologies, which are designed for generators and therefore do not accurately measure consumption changes possibility. This may entirely block a market, as consumers will not receive adequate payments for the services they deliver.

3. **Technology-biased programme requirements**: Consumers may be blocked by historical programme participation requirements, which were designed for the convenience of the national generation fleet only, and have not yet been updated to include the capabilities of demand side resources.
4. **Aggregation services are not fully enabled**: Prequalification, registration and measurement may still conducted at the individual consumer level rather than on the pooled load collected by the aggregator, blocking participation by placing heavy administrative and legal burdens on the individual consumer.
5. **Lack of standardised processes between the BRP and the Aggregator**: As previously stated, without these processes in place, consumers cannot freely choose their service provider, and market competition around consumer services are severely impeded. It is important that standardised processes protect the customer-aggregator relationship, provide a direct path to market and include a standardised process for bidirectional payment of sourcing costs between the BRP and aggregator.

The EU Demand Response market is still in the early development phase and fragmentation is a result. At the national level, Member States have widely varying regulations, while a single Member State will contain between 4 to 9 separate electricity markets (forward, capacity, day-ahead, intraday, and a set of balancing markets) and each of these markets will have their own participation rules. Worse, in Member States with more than one TSO, each TSO may have different participation rules. Over and above this, even within this already severely fragmented market (28 countries, 4-9 electricity markets per country, individual rules per TSO), it is often impossible or illegal to aggregate customers across balancing responsible parties.

There is a critical need for standardised regulation at the European level, including clarified roles and responsibilities. The European Network Codes and the up-coming Market Design Initiative could unify and standardise the regulation across national markets. The Network Codes for example, do not yet provide detailed guidance concerning appropriate programme requirements, baseline methodologies or standardised national processes between market participants. Further guidance is required by European institutions, in particular the European Commission.

<u>Acceptance of demand side resources in the markets</u>

Step one to enable demand side flexibility to participate in energy markets is to accept flexibility as a resource in the full range of markets – including capacity, forward, day ahead, intraday and all balancing markets. This requires as a basis the proper national transposition of the Third Energy Package, the Energy Efficiency Directive as well as the Network Codes, which have the potential to pave the way for demand response and set rules that allow all flexibility providers to compete on a level playing field. Furthermore, any framework regulating demand response for TSOs should take care not to hinder the development of flexibility services for DSOs and, likewise, any framework for DSOs should take care not to hinder agreements in contracts between suppliers and balance service providers (BSPs) under normal circumstances.

Recognition of aggregation service providers

All aggregation service providers must be able to compete on a level playing field: aggregated load should be legal, facilitated and enabled in all markets. Aggregators and suppliers should have the same ability to extract the value of flexibility services on behalf of their consumers. Demand side flexibility needs to be treated on an equal footing with generation on the basis of the volumes effectively delivered (whether in the form of electricity generated at customer site or demand variations) and accepted on all markets.

Consumer participation requirements and offerings

In order to engage consumers, an offer must be reliable, affordable and simple or there should be a technology interface available that routinely deals with it. The benefits must be clear and measurable, and it will be important to provide comprehensive general information as well as tools for comparing flexibility offers. This implies a need for data access and dynamic pricing for domestic consumers and requirements for consumer participation within the balancing and ancillary services markets.

Other requirements for consumers are:

1. Consumers within the retail markets (domestic and commercial consumers)

To be fully empowered to manage their energy resources, all consumers, but particularly domestic and commercial, require two basic enablers:

- Data on consumption, self-production and pricing, with sufficient detail consistent with the flexibility market, and with respect of privacy requirements.
- Pricing options, meaning a price structure that allows savings from shifting demand.

2. Consumer access to organized electricity markets

When a customer signs a contract with a third party aggregator, the consumer gets access to whichever organized electricity markets in that Member State (day ahead, intra-day, balancing, capacity, etc.). Through this contract, the customer can sell the value of its consumption flexibility and/or injection to the third party aggregator, who can bid it into the market. Within the market, the injection or shifted or curtailed consumption is treated as a MWh of electricity (energy). Meanwhile, the consumer is also served by a supplier, a BRP and DSO.

3. Treatment of aggregated consumer load – single resource

   Aggregation is only beneficial to consumers if the aggregator is able to transform multiple small chunks of flexibility resources into a product that is tradable on the market. For this purpose, the aggregator must be able to fulfil registration, prequalification (if relevant), metering and communication required in these markets, as if they were a single power plant in the place of the individual consumers. In order for aggregation to be effective, the aggregated pool of load and finally flexibility must be treated as a single resource. Pre-qualification, verification and other administratively intensive activities should wherever possible be performed at this pooled level.

Measurement and verification requirements

Well defined and appropriate measurement and verification protocols are needed to realise cost-effective market coordination. Smart meters are necessary to allow the amounts to be allocated to the BRP and then settled in the settlement process if aggregated flexibilities want to participate in the markets.

Contractual arrangements

If contractual arrangements are necessary between market parties, they should be streamlined and simple, and reflect the respective costs and risks for all parties.

Contractual arrangements should allow consumers to access any service provider of their choosing without previous permission of the BRP or supplier. Consumers existing contracts with suppliers are continued and respected, as well as property rights of suppliers and necessary market procedures, e.g. for the balancing and transfer of energy.

Financial adjustment mechanism

A financial adjustment mechanism is required in order to enable competition allowing customer participation. This is particularly relevant between aggregators and BRPs/supplier in the case of a demand response action initiated by third party aggregators.

This mechanism should ensure that all the electricity sourced on the market and consumed by end-customers is paid to the actor who sourced it; and at the same time avoiding the BRP from having unfair costs incurred through the fulfilment of its balancing requirements.

Telecommunications aspects

The development of smart grids, smart meters and smart markets presumes the combination of telecoms infrastructure and the electricity infrastructure. Telecoms should be considered as a main infrastructural asset for the development of smart grids and, hence, also of flexibility. There are many different telecom services and many different ways to organize them. Some services are already available and are managed well, are secure both at physical and at application layers and are able to integrate and manage the data related with the operation of smart grids. Others may need to be developed specifically for smart grid services.

7. Other barriers for flexibility services

I. Identified barriers and solutions in case of Germany

Timing and technology of the smart meter roll-out, grid-building interface standardization

In case of Germany the Smart meter technology , installation and meter reading procedure are described below which embraces both the current and future approach.

Current model: DSO-centred decentralised data storage and access*

Future model: Same model, with added selective roll out of smart meters and smart meter gateway will distribute data*

Metering Frequency, Process and Storage

	NO	IT	DE	DK	NL	ES	GB	BE
Manual / automatic metering	Manual (Automatic)*	Automatic for smart meters, Manual for metering points without smart meters	SLP: Manual** RLM: Automatic***	Automatic	Manual, Automatic with smart meter*	Manual (Automatic)*	Manual (Automatic)*	Manual
Data is reported to	DSO (DSO and Elhub)*	DSO (SII)*	DSO	DataHub, owned by TSO	Supplier, DSO with smart meter	DSO	Supplier (DCC)*	DSO
Frequency of meter data reporting	Minimum yearly (Daily)*	For electricity: monthly (1st generation of meters) and daily (in case of 2nd generation	SLP: yearly** RLM: daily***	Daily, but can vary	Yearly, two-monthly up to daily with smart meter	Monthly	Various (Monthly /daily/half hourly with smart meter)*	Monthly, daily with Smart meter
		of meters); for gas: various frequencies depending on consumption						
Granularity of meter data	Monthly (Hourly)*	Various****	SLP: yearly** RLM: 15 minutes***	Hourly, but can vary	Various: Yearly, 15 minutes with smart meter	Daily (Hourly)*	Various (daily/half hourly with smart meter)*	Yearly
Entity storing data	DSO (Elhub)*	DSO	DSO	DataHub	Collected by DSO, and passed to supplier	TSO and DSO	Customer/data user (DSO, DCC)	DSO

*Future model (in brackets). ** Standard load profile (SLP). *** Registered consumption metering (RLM). **** For electricity (1s generation of meters): 3 time bands for small customers (< 55kW rated capacity), 15 minutes for mid-size customers (> 55kW for the future, in case of 2nd generation of smart meters: 15 minutes for all customer; for gas: daily with smart meter >= G10

Description of Current model

The current model has decentralised data storage and access. DSOs receive the data from the customer and check for plausibility. After the correction of data, if necessary, the DSOs distribute the data to other stakeholders according to the market communication procedures as defined by the natonal regulator (BnetzA). With the exception of the DSO, only those stakeholders that need data to fulfil their market functions get access to the necessary data. Metering values are read on-site and reported manually on a yearly basis for Standard load profile (SLP) customers, and automatically on a monthly basis (if remote control is possible) for Registered Consumption Metering (RLM) customers to the DSOs. The granularity from RLM-customers is 15 minutes, whereas the annual consumption is scaled via load shape for SLP-customers. Metering values and customer data are stored by the DSO.

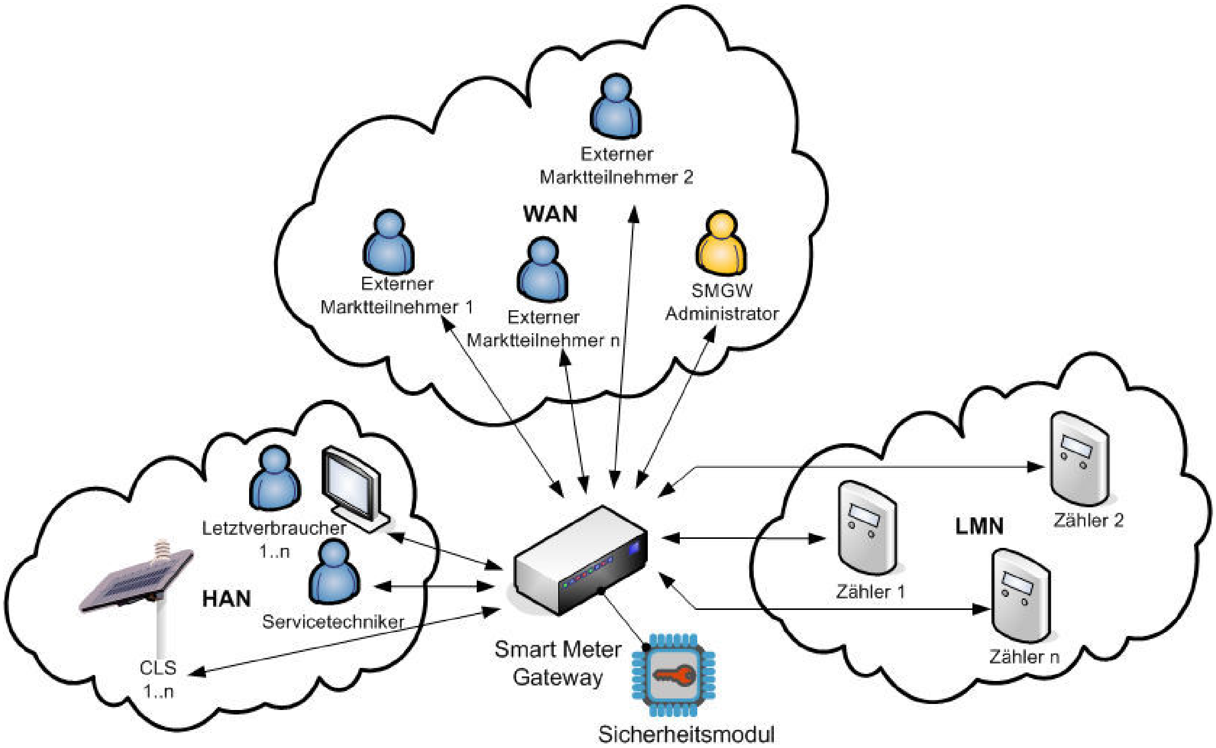
According to the metering point operation law (MsbG), the local DSO is responsible for the meter operation by default, also in charge for the smart meter gateway operation. The local DSO can contract a regulated third party as meter operator in case he is not able to perform this task.

Description of Future model

The future data management model will only change in a few small aspects. The basic idea of the German model stays the same as before. Stakeholders, who must get the data in order to fulfil their market functions, are defined by metering point operation law and have the authority to access data. Because of the new technological aspects of smart meters and smart meter gateways, the distributor of the data will change. The result of the German cost-benefit analysis is that Germany will not have a 100% roll-out of smart meters. The meter operators are only obliged to provide smart meters to customers consuming more than 6 000 kWh annually and suppliers (prosumers/producers who feed into the grid) with an installed capacity above 7 kW, where technically and economically feasable. For other customers the meter operator has the choice to install a smart meter. The customers and suppliers for which the smart meters are not obligatory will get a modern measuring system (an electronic meter without smart metering functionalities) in case of a new construction or major renovation. The modern measuring system is not able to send data to the different stakeholders automatically, but has to be able to be connected to a communication system if necessary. In this case the operator of the measuring system will distribute the data to eligible parties as legally required by market communication procedures or as defined by the customer under the GDPR framework. The metering values for smart meters will have a granularity of at least 15 minutes, and will, together with customer data, be stored at the Smart Meter Gateway or in the meantime, until 2019, with the eligible parties who need the data for their function. The data distributor for customers or suppliers with a smart meter will be the smart meter gateway (administrator).

In accordance to the future model E.ON has started to install such system which already contains the above mentioned gateway:

The gateway is the communication unit in the smart metering system. It is responsible for transmitting meter data wirelessly. The new technology is expected to be installed across the entire E.ON network area from mid-2018. Legislation provides for the installation of intelligent metering systems (smart meters) for private and business customers with an annual consumption of more than 6,000 kilowatt hours. Similarly, plant capacity of more than seven kilowatts will have a smart meter installed in their meter cabinet.



Data management model assessement by National Regulatory Authority

Regulators' Self-Assessed Strength of Data Management Model

Question to National Regulatory Authoritys: Which are the most important strengths of the planned (or current) model with regards to (a) customer empowerment and (b) lowering barriers to entry? What conditions are needed for these strengths to be realized?

Considers customer access to data and full control over who gets to access data crucial for empowerment. Generally highlights strict unbundling, standardisation of business processes, technical requirements and strong customer protection as important principles.

Regulation of Data Management Models

The National Regulatory Authority and the Federal Commissioner for Data Protection are responsible for monitoring compliance.

Customer data management is regulated in the Federal Data Protection Act and in sections 49 and 66 – 70 metering point operation law (MsbG).

Role of the NRA in Data Management

The legislative authority develops new regulations and gives the National Regulatory Authority the competence to define specific determinations on selected subjects.

Other Roles in Data Management

The Federal Office for Information Security (BSI) is commissioned by the German government with the development of security and interoperability requirements for German Smart Meter Gateways, additional components and services.

Privacy requirements by the Federal Commissioner for Data Protection and Freedom of Information (BfDI) are directly integrated in technical specifications (protection profiles and technical guidelines).

Possible barriers which should be removed:

- There is no full roll-out of smart meters, CBA analysis did not underpin the full roll-out,
- So called Smart meter Gateway is a „common“ point for DSO and other market players for accessing to meter and beyond the meter, the interaction of these market players not yet clear.

Limited access to DA and ID markets for all electricity market participants

The German spot power market is divided into three sub-markets: the day-ahead market (DAM), the 15-minute intraday auction, and the continuous intraday market (IDM). The DAM is a uniform price auction that occurs every day at 12 am. The contracts exchanged on the DAM are hourly contracts for the next day. The intraday period starts right after the DAM. The 15-minute auction is a uniform price auction that occurs every day at 3 pm in Germany. The traded contracts are 15-minute products for the next day. The market for the continous trading of the hourly contract starts at 3pm for the 24 products of the next day and closes 5 minutes before delivery. The duration of the trading session for a contract is between 9 and 32 hours.[1]

[1] Clara Balardy: An empirical analysis of the bid-ask spread in the german power continous market http://www.ceem-dauphine.org/assets/wp/pdf/0918-CEEM_Working_Paper_35_Clara_BALARDY.pdf

Among the members of the EPEX SPOT market there are utilities, municipal and regional suppliers, trading companies, banks and financial service providers, as also some energy intensive industries and Transmission Systems Operators.

The preconditions for admission are the following:

- Proof of personal reliability and professional qualifications of the person/s holding management authority
- Liable equity of at least € 50,000
- Admission of at least one trader who has proven personal reliability and who has provided proof of the required professional qualification (e.g. through the EEX trader examination)
- Technical connection to the trading systems
- Recognition as a trading participant by the clearing house of EEX, European Commodity Clearing AG (ECC).[2]

As third-party trading is permitted on EPEX SPOT's markets, several members also trade on behalf of smaller companies. Some companies also specialize in pooling small assets. Such small entities might be decentralised renewable producers (wind and solar in Germany), demand response aggregators, or other very small suppliers.[3]

Considering the preconditions, access to all market participants is not granted equally on the German ID and DA market. Although third-party trading is permitted as described above and it could be a solution or substitution for individual access, even the Exchange itself states that trading small quantities of electricity on the Exchange independently might not always be the most efficient solution for such producers, considering the costs and efforts involved in directly accessing the exchange. [4]

Possible barriers which should be removed:

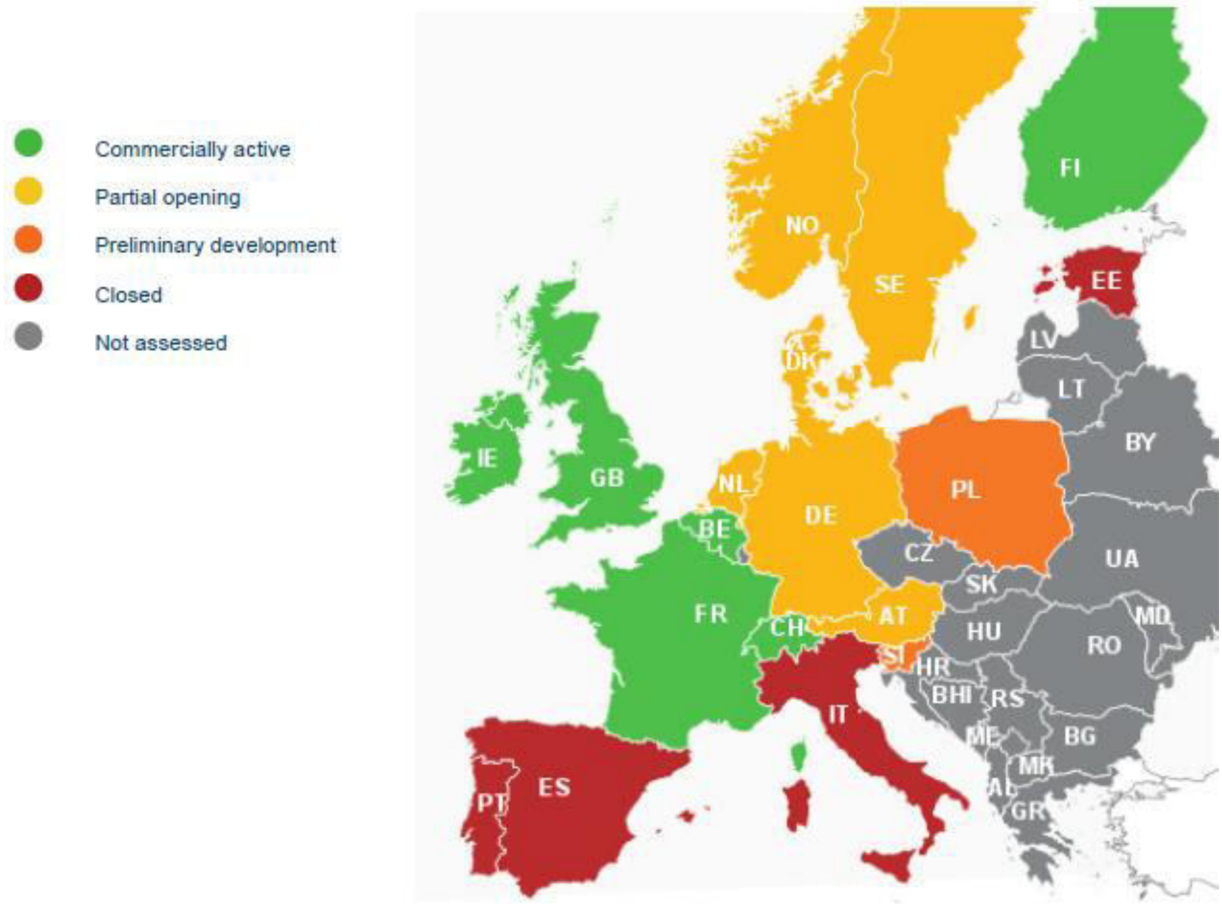
- For Smaller entities there are administrative and financial barriers to enter into DA and ID market,
- The smaller entities who could provide fleixibility have not yet enough capability to create a flexibility service procedure which could be marketable.

Missing market place for flexibility trading transactions, clearing the role in using flexibility between the market participants

General view about DSM in EU

Map of Explicit Demand Response development in Europe (2017) based on Explicit Demand Response in Europe- Mapping the Markets 2017

[2] https://www.eex.com/en/access/admission/admission-process
[3] http://www.epexspot.com/en/membership/who_are_our_members
[4] http://www.epexspot.com/en/membership/who_are_our_members



Austria, Denmark, Germany, Netherlands, Norway, and Sweden are marked yellow as regulatory barriers remain an issue and hinder market growth. Although several markets in these countries are open to Demand Response in principle, programme requirements continue to exist which are not adjusted to enable demand-side participation. Furthermore, a lack of clarity remains around roles and responsibilities of the different actors and their ability to participate in the markets.

One of the notable differences in 2017 was that Germany has moved from orange status in 2015 to yellow in 2017. This is primarily due to the fact that product definitions have been updated or are about to be updated, and balancing reserve markets are about to be opened for independent aggregation.

Local System Services are not yet commercially tradeable in European countries:

With the exception of Great Britain, incentive structures for Distribution System Operators in Europe do not encourage the use of market-based flexibility resources today. Despite pilot projects, no effective market structures have been implemented in any of the analysed countries for DSOs to be able to source flexibility, including from Demand Response, for optimised local system operations.

DSM analysis in general in Germany

Today, there are important barriers that prevent the full potential of demand-side flexibility in Germany from being realised.

With the plan to achieve 35% of renewable electricity supply by 2020 and the phasing out of nuclear power by 2022 announced in 2016, the German energy system has started to integrate more and more decentralised energy generation (wind, solar, biomass and biogas) and has increased its needs in de-centralised flexibility. Situations in which variable generation from wind and solar plants supply a large majority of total demand in the grid are expected to happen more frequently in the coming years.

Currently, the German market regulation creates significant barriers to most forms of Demand Response programme types, including both those provided by retailers and independent aggregators. However, the German Federal Ministry for Economic Affairs and Energy (the BMWi) is aware of the current barriers and is addressing then by running a broad discussion forum and consultation on the policy conditions for the future of generation and supply of electricity, its use in heating, transport and industry, and the transport of electricity across the grids. This process is supposed to help inform policy decisions of the new government which was elected in Sept 2017.

The current list of barriers includes (in general):

- A number of markets are closed for Demand Response, either because legislation does not allow DR (e.g. network grid reserve), or by being closed in practice due to highly generation-based product design (e.g. proposed design for a capacity reserve),
- The lack of a framework and incentives for DSOs to procure distributed flexibility as a service instead of investing in expansion/reinforcement of expanding their networks
- Pre-qualification requirements for balancing reserves are at the asset level (rather than exclusively at a pooled level),
- Network fees that are designed to incentivise a flat consumption pattern, and hence penalise those who provide flexibility to the system,
- The lack of a standardised role for third-party aggregators within the market model – requiring a multitude of contractual relationships between BRPs, Retailers and the third-party aggregators,
- The high share of taxes, network tariffs as well as other fees and levies included in the retail prices (50%-80%), which dilute the price signals of the wholesale market significantly.

Market and DSM in Germany

Wholesale Market and DSM

In Germany, electricity is traded at the European Energy Exchange EEX in Leipzig (forward market, only financial futures) and the EPEX SPOT in Paris (day ahead and intraday market) and OTC (forward and day-ahead). The Day Ahead & Intraday Wholesale markets are not explicitly closed to Demand Response in Germany – i.e., there is no specific regulation prohibiting Demand Response from participating. However, there are several other reasons which prevent Demand Response from being active in the wholesale markets, for instance lack of standardized processes, network tariff design that discourages consumers from participating. Theoretically, there is possibility for the participation of loads through independent third-party aggregators but there is no available experiences in place regardingthe interactions with the energy retailer and other market parties. Independent aggregation of distributed generation assets, like wind, biomass and biogas is however a viable business model, as the distributed renewable energy unit chooses a Balancing Responsible Party to market its generation.

Distribution network services and DSM

Demand-side flexibility could offer an important tool for local congestion management. As in most European countries however, the possibility for DSOs to invest in the ability to use Demand Response is very limited. Currently there are no market-based programmes operating on the distribution level. This is partly due to the fact that the incentive regulation favours CAPEX over OPEX, hence it is better from a DSO perspective to expand or enforce its network (and thus increase its capital base) than to contract with a Demand Response provider.

There are, however, traditional Demand Side Management (DSM) measures in place in Germany. These stem from the pre-liberalization era and for the most part, cover domestic heating appliances (e.g. heat pumps or electric night-storage-heaters which are often quite load intensive). However, the current technical framework as well as the incentive scheme are both highly price-inelastic and thus, are not adequate to respond to the future system needs with high shares of renewable energy. These traditional schemes essentially need to be re-designed to work in a more flexible manner (e.g. allowing for the use of flexibility during day time). Today, substantial network fee reductions steer the consumption patterns of these installations into the night hours (that traditionally used to have a low load profile). The steering mechanism (i.e., management based on ripple control) nowadays only works in relation to fixed restrictions given by the DSOs.

In terms of exploring mechanisms for DSOs to buy demand-side flexibility there has been a lot of discussion in Germany. Different trade associations have proposed different mechanisms, but nothing has yet been implemented. For instance, some of the newly installed SINTEG projects (funded by BMWi) have started to explore this possibility. BMWi is also in the process of launching a regulatory proposal that would change and substantiate the current section 14 (a) of the Energy Industry Act. These changes would propose a re-design of the mechanism to work in a more flexible manner.

Possible barriers which should be removed:

- Local (DSO) and global interests can be contradictory in case of flexibility usage which can have an effect on both DSO network and system balance,
- The future roles of players in case of felxibility (DSO, TSO, possible Aggregator, Supplyer, etc.) are still vague,
- There is no procedure for flexibility procurement,
- There is no explicit market place for flexibility (only for balancing market exist which of coirse can be further developed to serve the future needs in term of flexibility usage).

II. Identified barriers and solutions in case of Bosnia and Herzegovina

Electricity spot market is not fully established

At the 2015 Vienna Summit of the Western Balkan 6 Initiative, the WB6 Contracting Parties (Albania, Bosnia and Herzegovina, former Yugoslav Republic of Macedonia, Montenegro, Kosovo and Serbia) reasserted their commitment towards establishing a regional electricity market. They agreed to implement so-called “energy soft measures” that will remove existing legislative and regulatory barriers and enhance the institutional structures necessary for the functioning of this market in line with the Energy Community Treaty and relevant EU acquis. The 2016 Paris Summit re-emphasized the need for a closer cooperation on a regional level and integration of the markets of the Western Balkan 6 into the pan-European one.

In April 2016, this commitment was given a solid operating framework with the signature of the Memorandum of Understanding, by the representatives of the WB6 countries. The MoU sets out the general principles of cooperation as well as concrete actions to develop the regional electricity market. The importance of the initiative in terms of driving regional day-ahead market coupling between the Energy Community Contracting Parties and neighbouring EU Member States has been recognised by EU stakeholders. Stakeholders from all EU Member States that neighbour the WB6 countries have joined the initiative by signing the Memorandum of Understanding.

The process was further strengthened by the conclusion of a Grant Contract between the European Commission and the Energy Community Secretariat for provision of technical assistance to support the development of a regional energy market in the Western Balkans. The concrete project activities as set out in the work programme are expected to result in the establishment and operation of a regional electricity market.

To reach this goal, the WB6 energy connectivity initiative aims at spot market development, by establishing an organised day-ahead market in each Western Balkan country and their market coupling; cross-border balancing; regional capacity allocation; introduction of a coordinated capacity calculation process for the allocation of day-ahead capacities through the establishment of a regionally coordinated calculator; and cross-cutting measures of a horizontal dimension.

Technical assistance to support identifying a viable solution for the establishment of an organised day-ahead market in Bosnia and Herzegovina was provided under the WB6 regional energy market connectivity programme. According to its findings, an optimal solution would be to establish an entity responsible for organising a day-ahead market in Bosnia and Herzegovina. The current legal framework does not define competences for establishing such an entity, which blocks the process of setting up a day-ahead market in Bosnia and Herzegovina.

According to the WB6 Electricity Monitoring Report [L3], Bosnia and Herzegovina remains the only WB6 party where primary legislation necessary to reform and integrate the electricity market is still missing.

According to the plans, day-ahead markets in Albania, Bosnia and Herzegovina, former Yugoslav Republic of Macedonia and Montenegro are expected to become operational and ready for coupling with neighbouring markets by July 2019.

The main regulatory obstacle in Bosnia and Herzegovina for integration of dayahead and intraday electricity market and as well as to connect with the electricity markets in the region is the State Law on Regulator, Transmission and Power Market and the complementary law on establishment of a transmission system operator.

Supporting the functioning of the day-ahead markets, VAT law is also needed to prevent and combat VAT fraud in cross-border trade. Opening of national retail and wholesale markets and their regional and pan-European integration requires a level playing field for all participants, including also harmonization of public procurement rules, in particular procurement of energy by contracting authorities and procurement procedures applicable to energy undertakings.

Coupling of organised day-ahead electricity markets with at least one neighbouring country is neccecary for the organization of electricity market and power exchange. Along with the establishment of the national day-ahead market, implementation of market coupling of Bosnia and Herzegovina with Croatia, Montenegro and Serbia is envisaged under the roadmap for regional day-ahead market integration in Western Balkans. The Croatian day-ahead market operator CROPEX expressed its interest in receiving technical assistance for implementation of day-ahead market coupling between Croatia and Bosnia and Herzegovina under the WB6 regional energy market connectivity programme.

It is necessary to create a legislative and regulatory framework for the establishment of electricity market with possibility of establishing power exchange which should be a legal entity responsible for the establishment and management of organized trading of electricity for physical delivery. To reach this it would we necessary to change primarily regulation at the state level.

Bosnia and Herzegovina is preparing a new VAT Law to transpose the relevant provisions enabling cross-border trade and market coupling, compliant with EU practice.

Low intensity of spreading smart meter technologies

Smart meter technologies and advanced network solutions are crucial for the smart grid concept because smart meter is the key factor for demand response. The aim is to increase the number of smart metering devices in distribution networks which will provide more possibilities for distribution system operators and for the end users.

At the level of Bosnia and Hercegovina, there are different approaches regarding the implementation of smart metering devices in distribution network. Implementation of new smart metering devices is a strategic goal for each of the three power utilities in Bosnia and Hercegovina because the monthly readings of electricity consumption are an obligation.

JP Elektroprivreda Hrvatske zajednice Herceg Bosne d.d. Mostar has installed electronic smart meter on every MW/LV substation (AMR system) and in the next few years will probably have more than 50% of all customers equipped with new smart meter.

JP Elektroprivreda BiH d.d. Sarajevo is also oriented on implementation of new smart metering devices in MV/LV substations (AMR system) and at the costumers (AMM system).

MH Elektroprivreda Republike Srpske matično preduzeće a.d. Trebinje RS is also oriented on impelementaion of AMR and AMM system.

Theoretically there are no obstacles in the regulation for the installation of smart meters in Bosnia and Herzegovina. In the regulation currently it is not mandated that the entity performing the metering of energy exchange between the grid and the customer should allow read access to real-time data from the meter of the customer. This is a necessary condition for enabling demand response on the customer side where not all loads of the customer are controllable.

Ensuring adequate infrastructure in distribution network is the first and the basic prerequisite for building a quality, efficient and especially „cost-effective "EMS system.

This opens the door and enables the introduction of active network requirements such as „supply demand“ and „load balancing“.

An obstacle can be the lack of unique technical specifications of smart metering devices which usually are not adequate to provide real time data exchange between consumer and grid.

Another obstacle is the low electricity prices and the consequent poor development of electricity market in Bosnia and Herzegovina, which also gives poor development preconditions for Demand Response.

In practice, large consumers can request access to smart meter via impulse outputs which they can use in theirs EMS systems. Maybe this should be enabled on larger scale, but currently this is not defined in the legislation.

Renewable energy sources and ancillary services and balancing markets

Renewable energy production in Bosnia and Herzegovina is subsidized through a guaranteed purchase price of electricity (FiT) for privileged producers and the reference price of electricity (20% higher than the market price) for qualified producers and these producers are not encouraged to balance their own production or to, for example, participate in the demand response.

Currently the legislation in Bosnia and Herzegovina does not anticipate participation of RES in ancillary services.

Summary of identified barriers in case of Bosnia and Herzegovina:

- Legislative barriers for integration of dayahead and intraday electricity markets,
- Low intensity of spreading smart meter technologies,
- Low electricity prices and the consequent poor development of electricity market in Bosnia and Herzegovina,
- Legislative framework does not anticipate participation of renewables in ancillary services.

III. Identified barriers and solutions in case of Serbia

Low intensity of spreading smart meter technologies, technological and data standards

In Serbia, the smart meter technologies are not applied on a large scale, which is along with the lack of law and regulations one of the main problems which would need to be tackled in the near future.

At the moment, the Ministry of Mining and Energy of Serbia is concluding the work on the drafting of the law on rational use of energy, which will be done for the production sector, energy consumption, part of the utilities, building energy sector, and traffic. The draft regulation is to be done in order to implement more smart meters, especially related to the transition to a new method of paying heat energy, not amymore by a square meter, but according to the delivered amount of heat that would be measured by the calorimeters. So, from the regulatory point of view, there will be no obstacles for smart meter technologies implementation, starting with 2020.

There should be more initiative to build a reliable infrastructure for the implementation of the new metering technologies. The infrastructure is the first milestone for the smart distribution network implementation. This opens the door and enables the introduction of active network requirements such as „supply demand“ and „load balancing“.

In order for active network requirements to be possible, in ideally real-time dynamic, and their response and feedback as fast and quality as possible, network information provided by the above mentioned adequate infrastructure must be available in as much quantity and resolution and available for use with EMS system.

In accordance with the aforementioned and primarily related to active network requirements, the basis for introduction of much more transparent, and for all involved stakeholders, a much more flexible and therefore more favorable electricity market is created.

Republic of Serbia has adopted of new incentive measures for the production of energy from the RES in June 2016, which will be valid at least by the end of 2019 and has created a good framework for the rapid development of new biogas plants in Serbia, but that new measures should be considered in time. The goal is to produce 27 percent of electricity from renewable energy by 2020. The focus is on production the electricity from the wind and biomass.

To encourage energy service providers to offer contracts and services built around spot market prices (such as dynamic pricing), consumers should have the right to request and receive metering at a frequency corresponding to the national balancing settlement regime. Smart metering systems with a reading interval for the customer corresponding to at least one tenth of the settlement time period and a reading interval for the grid corresponding to the settlement time period are a technical prerequisite for participation in flexibility markets.

Accurate consumption information and accurate billing based on actual consumption are critical enablers of demand side flexibility.

Quality IT support (platform) for the implementation of EMS, which includes all entities (DSO, TSO, aggregators, network users)

The development of smart grids, smart meters and smart markets presumes the combination of telecom infrastructure and the electricity infrastructure and proper hardware and software both on grid and end-customers side.

Simple payment arrangements between all entities are a key to facilitate consumer participation.

Highly advanced controls and communications capabilities of integrated communications architecture that enable dynamic management of the system (building) as a whole, using also smart end-use devices, smart distributed energy resources and advanced whole-building control systems, is a part of dynamic EMS to addresses permanent energy savings, permanent demand reductions and temporary peak load reductions. The components build upon each other and interact with one another to contribute to an infrastructure that is dynamic, fully-integrated, highly energy-efficient, automated, and capable of learning. These components work in unison to optimize the operation of the integrated system based on consumer requirements, utility constraints, available incentives, and other variables such as weather and building occupancy.

The IT sector is one of the fastes growing in the Republic of Serbia, and therefore is the subject of constant changes, which includes the regulatory framework changes, as well. Effort needs to be done to make one cohesive, robust and reliable regulatory framework for the implementation of the grid-side and building-side EMS solutions.

Renewable energy sources and ancillary services&balancing markets

A sustainable energy future in Serbia is based on three key pillars: improvement of fossil fuel technology so as to reduce the impact of these fuels on the environment and society; the greater exploitation of renewable energy technologies; and the introduction of energy efficient measures in the field of energy saving, its distribution and consumption.Renewable energy production in Serbia is subsidized using guaranteed buyoff prices (FiT support scheme), and these producers are not encouraged to balance their own production or to, for example, participate in the demand response. On the other side, the ancillary services markets are not developed such that RES cannot participate in the ancillary services market.

It would be necessary to develope the ancillary services and balancing markets. Currently these markets are not yet fully operational and are not centrally regulated.

The current subsidy system will need to be oriented towards electricity markets (supporting RES and CHP electricity production via market premium contracts obtained through a bidding process), encouraging competitive RES to participate in the market (e.g. tenders). This can be achieved by change of the Law on Renewable Energy Sources and High-efficiency Cogeneration and its appropriate rules (secondary legislation).

In the Republic of Serbia there have been identified several barriers regarding the project implementation and realisation:

- Acceptance of the new technology within the citizens,
- The low share of renewable sources for energy production,
- The technical infrastructure need to be modified to accommodate new technologies, such as smart grid,
- Better collaboration between governmental bodies and IT service providers is needed in the near future,
- Energy efficiency in the energy sector of Republic of Serbia must be improved to the significantly higher level,
- Governmental subventions are needed to attract more prosumers to the grid.

IV. Identified barriers and solutions in case of Croatia

Low intensity of spreading smart meter technologies, technological and data standards

The low level of the 'Smart technology' implementation in the Croatian distribution network, both of smart meter technologies and of advanced network solutions as well as a lack of a more precise regulatory framework are the main reason why there is no encouragement for a more intensive use of these technologies in Croatia.

The Energy Act and the Energy Efficiency Act defined the framework of the smart meter roll-out project and of the building of the smart meter networking system by which the model of the smart meter roll-out has been transposed into Croatian legislation. In addition, the legally prescribed General Conditions for the Use of Network and Electricity Supply adopted in 2015 set mandatory time periods for equipping billing meters with remote read meters for individual customer categories. The following obligations were prescribed under said General Terms and Conditions:

1. *The Distribution System Operator shall, within five years from the effective date of these Terms and Conditions and at the Operator's own expense and pursuant to the distribution system grid code, equip all end-customers' billing metering points which connection capacity exceeds 20 kW with remote read meters facilitating capacity and reactive power readings.*
2. *The Distribution System Operator shall, within 10 years from the effective date of these General Terms and Conditions and at the Operator's own expense and pursuant to the*

distribution system grid code, equip commercial end-customers' billing metering points which capacity does not exceed 20 kW with remote read meters facilitating reactive power readings.

3. *The Distribution System Operator shall, within 15 years from the effective date of these Terms and Conditions and at the Operator's own expense and pursuant to the distribution system grid code, equip household category end-customers' billing metering points with remote read meters.*
4. *The Distribution System Operator shall, within one year from the effective date of these General Terms and Conditions, pass the implementation plan for the replacement of a minimum of 95% of the existing meters by remote read meters according to the replacement time periods set under paragraphs 2 and 3 herein.*

Basicaly there are no huge obstacles in the regulation for the installation of smart metering devices in Croatia. The cost-benefit analysis (CBA) has been carried out by the regulator, and its result is positive, but still there is no decision on the smart meters roll-out. According to the existing Energy Act, the Minister of Energy makes a decision on the plan and program of measures for the introduction of advanced metering devices for end customers (roll-out) based on the results of the aforementioned cost-benefit analysis.

Furthermore in regulation currently it is not mandated that the entity performing the metering of energy exchange between the grid and the customer should allow read access to real-time data from the meter of the customer. This is a necessary precondition for enabling demand response on the customer side where not all loads of the customer are controllable. Additionaly, relatively low retail electricity prices and the consequent poor development of electricity market in Croatia, are the reasons for relatively poor development of Demand Side Management system.

In accordance with the aforementioned and primarily related to active network requirements, the basic framework for introduction of much more transparent, and for all involved stakeholders, a much more flexible and therefore more favorable electricity market has been created.

In view of the aforementioned regulatory requirements, obligations pursuant to the provisions of the Energy Act (OG 120/2012), metering requirements which have to be met under the Metrology Act (OG 74/2014), Directives 2009/72/CE and 2012/27/EU and the Recommendation 2012/148/EU of the European Commission, the synthesis of HEP DSO obligations emerge pursuant to legal and regulatory frameworks of the Republic of Croatia as well as to the legislative framework of the European Union.

In line with the aforementioned obligations, in 2016 HEP DSO adopted the Implementation Plan for the Replacement of the Existing Meters with Remote Read Meters in the period 2016 - 2030, which content provides the explanation as to the method by the means of which said synthesis of obligations was achieved. In 2017, HERA (Regulator) developed and submitted to HEP DSO the study titled the *Basis for the development of the cost-benefit analysis and the smart meter roll-out as well as for the smart meter networking system at electricity end customers.*

In line with its developed Implementation Plan, HEP DSO started with the grand-scale smart meter roll-out in 2018. The installation of about 85,000 smart meters is expected until end 2018, and of 120,000 more until end quarter of 2019.

This first step will serve as a basis for getting acquainted with some new as well as advanced existing steps and business processes regarding the smart meter roll-out and the building of the smart metering infrastructure. This primarily concerns all HEP DSO employees included in all the processes of the smart meter roll-out and the building of the smart metering infrastructure.

Following the implementation of the first step (first 120,000 smart meters), the installation of smart meters at all metering billing points is to be expected until 2027 in phases of an average of 225,000 smart meters per year.

The completion of HEP DSO's smart metering infrastructure is also expected in the aforementioned period, which individual units will include adequate metering infrastructure in distribution network points as well as process application systems for quality, timely and reliable management of collected billing and other metering data, which will finally be put on the electricity market via business application systems and by means of market data exchange.

To encourage energy service providers to offer contracts and services built around spot market prices (such as dynamic pricing), consumers should have the right to request and receive metering at a frequency corresponding to the national balancing settlement regime. Smart metering systems with a reading interval for the customer corresponding to at least one tenth of the settlement time period and a reading interval for the grid corresponding to the settlement time period are a technical prerequisite for participation in flexibility markets. Accurate consumption information and accurate billing based on actual consumption are critical enablers of demand side flexibility.

Quality IT support (platform) for the implementation of EMS, which includes all entities (DSO, TSO, aggregators, network users)

The development of smart grids, smart meters and smart markets presumes the combination of telecom infrastructure and the electricity infrastructure and proper hardware and software both on grid and end-customers side. Simple payment arrangements between all entities are a key to facilitate consumer participation.

Highly advanced controls and communications capabilities of integrated communications architecture that enable dynamic management of the system (building) as a whole, using also smart end-use devices, smart distributed energy resources and advanced whole-building control systems, is a part of dynamic EMS to addresses permanent energy savings, permanent demand reductions and temporary peak load reductions. The components build upon each other and interact with one another to contribute to an infrastructure that is dynamic, fully-integrated, highly energy-efficient, automated, and capable of learning. These components work in unison to optimize operation of the integrated system based on consumer requirements, utility constraints, available incentives, and other variables such as weather and building occupancy.

There are about 2.4 million billing metering points encompassed by the HEP DSO network, of which the household category accounts for 91%. In order to test technical characteristics, review usage possibilities and the cost of smart meter and smart meter network system roll-out, minor pilot projects were conducted in 2016 and 2017 acounting for 0.1% of the overall billing metering points.

As part of said pilot projects, a total of 2,343 meters was installed as well as two different systems for their networking built and tested.

In 2016, the *Smart Network Roll-Out Pilot Project* feasibility study was developed. As part of it, the Smart Metering Infrastructure sub-project was analysed. One of the objectives of said sub-project is testing of smart metering technology on a sample of 1% of the overall number of billing metering points of distribution network users or a total of 24,000 meters. This project will be responsible for equiping 6,125 MV/LV substations metered aggregately, and for the provision of data needed for the accurate calculation of the MV energy loss and the accurate calculation of the LV losses for the section of the network included in the pilot project. Said study was aimed at the testing of: the development and optimization of the conventional network, the automation of the distribution network. Values of the specific goal indicators were defined as follows: decreasing total distribution network losses from 8.7% to 7.6%, the number of additional smart grid-connected users of 24,000. The project also brings additional benefits for HEP DSO such as: the increase of electricity supply reliability, improvement of distributed sources network integration conditions. From the socio-economic analysis point of view, numerous additional benefits are achieved under the project resulting in potential savings for end-customers as well as in a reduction of greenhouse gas emissions and the pollutants for the benefit of the entire society. Project deliverables also justify its eligibility for EU co-funding.

Ensuring adequate infrastructure in distribution network is the first and the basic prerequisite for building a quality, efficient and especially ‘cost-effective’ EMS system.

This opens the door and enables the introduction of active network requirements such as ‘supply demand’ and ‘load balancing’.

In order for active network requirements to be possible, in ideally real-time dynamic, and their response and feedback as fast and quality as possible, network information provided by the above mentioned adequate infrastructure must be available in as much quantity and resolution and available for use with EMS system.

Renewable energy sources and ancillary services&balancing markets

Renewable energy production in Croatia has been subsidized using guaranteed feed-in tariff (FiT support scheme) from 2007 until 2016. They still have priority dispach rights and haven't been responsible for imbalances i.e. do not bear the balancing costs of power system, so these producers are not encouraged to balance their own production or, for example, to participate in demand response. On the other side, the ancillary services markets are still not developed enough so RES cannot participate in the ancillary services market yet.

The revised Act on Renewable Energy Sources and Highly-Efficient Cogeneration was passed by the Parliament in December and is in force from 1st January 2019. It aims for the efficient use of energy and the reduction of the impact of fossil fuels on the environment. It represents comprehensive codification of provisions concerning the planning and the promotion of renewable energy sources. It defines a support scheme for RES-electricity producers in the form of a premium tariff and a guaranteed feed-in tariff (for installations smaller than 500 kW). In order to qualify for government support, all renewable energy projects must win a bid in a public tender. The law also prescribes the foundation for sub-statutory regulations and decrees (by-laws/secondary legislation), which should be adopted within six months from the date of entry into force of the law which will define a quota for different RES technologies and prescribes public tendering procedure, as well as the rules on 'EKO balancing group' as balancing responsible party (for all existing RES producers who are automatically entering EKO BRP) and regulation on putting the part of RES production (30%) on the market instead of guaranted buyout. But priority dispatch rights are still in place, as well as net metering which disable fair cost allocation and further development of primary electricity market (intra day) and balancing market too. The current subsidy system will need to be more oriented towards market/competitive principles (supporting RES and CHP electricity production via market premium contracts obtained through a bidding process), encouraging RES to participate in the electricity market (e.g. tenders).

In general, there are just few obstacles/restrictions in the existing regulation as the Energy Act prescribes the posibility to open (develop) the ancillary services and balancing markets, with certain pre conditions regarding an official decision on opening these markets which should be issued by the regulator. Currently these markets are not yet operational and are still under-regulated by secondary legislation; there is a dominant ancillary service provider (HEP Proizvodnja d.o.o.) on high-voltage/transmission level of the power system so far, while on distribution level additional regulation is still missing and should be accordingly adopted. The TSO uses for demand response in tertiary regulation just two large industrial facilities where the activation is so far being done over the phone (reaction needs to begin within 15 minutes after te call). If energy suppliers would opt to extend their tariffs with demand response part for end-customers with production units, then according to the current law it would be needed to assess whether the tariff system with demand response included constitutes a better offer for the customer compared to the law minimum. There is so far no formula how this should be assessed.

For the conclusion, the new 'Clean energy package' will provide a guideline for future EU energy and climate development by 2030, and will pave the way for faster and better development of smart technologies and solutions in energy, construction and transport sector. At the national level, this framework will be rounded up with a new 'Strategy for energy development 2030 with 2050 vision' and 'Zagreb smart city strategy'. It will be a good basis for future development of smart specialization and digitalization projects. It will also enable creation of a new market design with different business models and opportunities.

In the context of described obstacles and barriers for the case of Croatia we could summarise these in:

- The low level of the smart technology implementation in the Croatian distribution network and advanced network solutions as well as a lack of a more precise regulatory framework are the main reason why there is no encouragement for a more intensive use of these technologies in Croatia,
- Currently the ancillary services and balancing markets are not yet operational and are still under-regulated by secondary legislation,
- The ancillary services markets are still not developed enough so RES cannot participate in the ancillary services market yet,
- There is a dominant ancillary service provider (HEP Proizvodnja d.o.o.) on high-voltage/transmission level of the power system so far,
- On distribution level additional regulation is still missing and should be accordingly adopted.

V. Identified barriers and solutions in case of Slovenia

Low intensity of spreading smart meter technologies, technological and data standards

Slovenia is making a big effort in installing as much as smart meters that have or give a possibility of development of all kinds of services that could help to develop the electricity market. In Slovenia there is a plan to install approximately 70.000 smart meters annually and goal is that all consumers have smart meters installed until 2022.

A problem is also the smart meters supporting (collecting) technologies. These reflect in frequency or granulation of collected data. Today technology allows to collect only day ahead data on daily basis. But the new technology is tested that will allow to collect data on hourly basis.

Metering data on medium voltage network

The problem or obstacle that is present also in Slovenia is that many of the transform stations on 20 kV network are not equipped with smart meters for the real time measurement of the network parameters (congestions, voltage regulations …).

Support of the state Energy Agency and Eco Fund, Slovenian Environmental Public Fund

Support of the Energy Agency and Eco fund that have resources that support the investments in energy efficiency of the final consumers of energy.

Eco Fund's main purpose is to promote development in the field of environmental protection. It is the only specialised institution in Slovenia that provides financial supports for environmental projects. The financial assistance is offered mainly through soft loans from revolving funds and since the year 2008 through grants. In comparison with commercial banks, Eco Fund’s principal advantages in the market for environmental financing are that it provides soft loans at lower interest rates than prevailing commercial market rates and it is able to lend for significantly longer periods than commercial banks. Recent evaluations of the effective interest rates of Eco Fund’s loans on the one hand, and those of commercial banks, on the other, have shown that a total of 15% of the cost of an investments can be saved when opting for Eco Fund’s loan.

Eco Fund’s subsidies have had a positive effect on tax revenues, diminishing of grey economy, new green jobs, sustainable development of the construction planning and business, as well as on the development of the use of strategic resources, such as wood. These effects which simultaneously contribute to the fight against the environmental crisis, on the one hand, and to the fight against the economic crisis, on the other, point to a positive role of Eco Fund in the process of green growth and development achievement which can be further enhanced with the growth in the range of assets and tasks given to Eco Fund, if so decided by the government.

Activities
To fulfil its mission Eco Fund made use of the following loan or grant financing programmes:

Loans to legal entities (municipalities and/or providers of public utility services, enterprises and other legal entities) and sole traders for investments in environmental infrastructure, environmentally sound technologies and products, energy efficiency, energy saving investments, and use of renewable energy sources;

Loans to individuals (households) for conversion from fossil fuels to renewable energy sources, energy saving investments, investments in water consumption reduction, connections to sewage system, small waste water treatment plants, replacement of asbestos roofs;

Grants to individuals (households) for investments in electric cars and for investments in residential buildings (energy efficiency and use of renewable energy sources);

Grants to legal entities (municipalities and/or providers of public utility services, enterprises and other legal entities) for investments in electric cars and buses for public transport on compressed natural gas or biogas;

Grants to municipalities for investments in buildings where public education takes place (schools, kindergartens, libraries etc.), newly constructed as low energy and passive buildings or renovated in passive standard.

Energy Agency shall, acting under public authorisation, carry out the administrative and other tasks specified in the Energy Act, EU regulations, which determine the competences of the national energy regulators, or in general act of the agency adopted on the basis of the energy legislation. The tasks can be summarized in the following areas:

- Regulation of the network activities, which covers economic regulation of all electricity and gas system operators and the regulation of the network with respect to issuing consents to the general acts,
- Regulation of the supply of heat and other energy gases,
- Ensuring a reliable supply of natural gas,
- Promoting the production of electricity from renewable sources and cogeneration
- Promoting efficient use of energy,
- Monitoring of electricity and natural gas market,
- Supervising the providers of energy operators' activities,
- Protecting the rights of consumers.

The Energy Agency must, at least once a year by 30 June for the preceding year, submit a report on the state of the energy sector to the Government and the National Assembly of the Republic of Slovenia. The report shall include among other information also the data on activities and measures carried out by the agency with regard to the fulfilment of its tasks.

The Energy Agency in performing its task establishes conditions that encourage regulated companies to improve performance and investments. It supervises and monitors the implementation of regulated activities by determining the right balance between the quality of supply and prices for regulated services and promotes the efficient use of existing infrastructure. It ensures the transparency and openness of the regulatory process. It cooperates in the preparation and amending of the rules and general acts regulating market operation, and promotes transparency and non-discrimination.

The Energy Agency is continuously improving the regulation of the energy market in accordance with the best professional practice. It participates in the creation of the internal energy market at regional level.

In our case the Agency could accelerate the procedure that distribution system operator could faster introduce the dynamic tariffs for the net fee. Till today the exception with dynamic tariffs was made only for test pilot projects.

In the context of described obstacles and barriers for the case of Slovenia we could summarise these in:

- Low intensity of spreading smart meter technologies, technological and data standards,
- Lack of Metering data on medium voltage network,
- Support of the state Energy Agency and Eco Fund, Slovenian Environmental Public Fund.

VI. Identified barriers and solutions in case of Slovakia

Low intensity of spreading smart meter technologies, technological and data standards

Slovakia has set a detailed smart metering plan to fulfil the EU requirements in the area of energy efficiency by 2020. The country`s goal is to install around one million smart meters that will enable utilities to perform demand response and allow consumers to better manage their energy consumption. Distribution system operators have already started the process of exchanging electromechanical meters with smart technology.

It seems that there are no regulatory obstacles on EU-level or national level regarding the roll-out of smart meters. Slovakia is in the second half time of the installation of smart meters. In two years, all electricity consumers with the annual consumption over 4 MWh are expected to have a smart meter instead of the old meters. All three distribution companies responsible for the installation of smart meters claim that everything advances as planned and in line with legislation.

However, apart from the physical roll-out of smart meters, Slovakia still lacks dynamic tariff systems and a more liberal framework for electricity distributors to respond to the potential of smart meters they have.

In Slovakia the CBAs for a large-scale smart metering rollout by 2020 were negative or inconclusive. In this sense, smart metering is proceeding for particular groups of customers only (annual consumption above 4 MWh), with 23% market penetration projected by 2020.

There are no special incentives available, neither of regulatory character nor financial incentives.

For a real market penetration, the smart meter roll-out needs to be expanded on more electricity consumers, not only on consumers with more than 4 MWh annual consumption.

Quality IT support (platform) for the implementation of EMS, which includes all entities (DSO, TSO, aggregators, network users)

The provision of the basic infrastructure and services for EMS is essential in addressing the current and future challenges in electric and thermal grids. The aim is to create boundary conditions for a significant market uptake of smart assets and EMS in the energy system in Slovakia. These components will optimize the operation of integrated systems regarding energy savings, peak load reductions and permanent demand reductions.

Regulatory obstacles are to be found mainly on national level, as the legal framework of the EU already allows for EMS systems, associated services and infrastructure to be implemented.

The main obstacles, beside regulatory issues, are of technical kind, and also market structures need to be developed. As there is no significant market penetration of smart meters expected in the following years (<30% of consumers in electricity grids by 2020), it can be concluded that the relevant players (DSO, TSO, aggregators, network users) are not prepared for big data acquisition and processing and implementation of EMS in large scale.

Regarding the financial incentives for EMS and the associated services there could be no detailed information obtained on the current status in Slovakia. However, there are some subsidies for the (residential) building sector, also addressing energy efficiency issues – basically, it is a dual system grant program from the Ministry of Transport, Construction and Regional Development for eliminating the most severe systemic defects of the buildings and the loan program from the State Housing Development Fund focusing on eliminating the rest of the systemic defects with the combination of energy efficient interventions. Having said that, it seems that the focus with energy efficiency measures may not cover smart systems or EMS, but more "basic" efficiency measures.

Modifications and incentives are necessary on all levels – a favourable and ambitious regulatory background is needed as well as financial support for the necessary infrastructure for a wide implementation of EMS and smart systems.

Renewable energy sources and ancillary services&balancing markets

Slovakia generates electricity in nuclear power stations, hydro-power stations, natural gas and coal-fired power stations as well as from renewable energy sources. In 2016, Slovakia generated roughly 27,000 GWh of electricity while the total consumption amounted to 30,000 GWh. Thus the country needed to import about 9 percent of its electricity consumption. Slovakia needs to import electricity since it closed down two nuclear power station units in Jaslovské Bohunice in 2006 and 2008. The country is expected to again become self-sufficient after the third and four nuclear power station units in Mochovce are put into operation. Their construction is dragging out while the latest plan for their completion is planning their launch in 2019. Nuclear power stations kept generating the highest share of electricity in Slovakia – 53.8 percent in 2016. Fossil fuels made up 19.4 percent, hydropower 17.65 percent and the rest (about 9 percent) other RES (biomass, biogas, solar power). The target is 27 percent of final energy consumption from RES by 2030.

The main problems regarding regulatory and political obstacles are to be found on a national level. For example, the government still subsidizes coal power plants in order to protect jobs in vulnerable regions. As a result, current policies and price regulation lead to the highest electricity prices for industry in the region. So far, Slovak energy policy developments have been reactive to either geopolitical threats or pressure from EU legislation. Low hanging fruits have been collected. One of the biggest hurdles in the liberalization of the Slovak electricity sector is the dominant role of nuclear power.

Most of the major energy companies are publicly owned, as it is the case of the dominant gas market player Slovak Gas Company (SPP), which was re-nationalized in 2014 and is now fully state controlled. Energy security is still one of the major concerns, and the country continues to focus on gas imports and further development of its nuclear power, which has received unprecedented political support across the whole political spectrum.

In Slovakia, green electricity is supported by a scheme of feed-in tariffs, which however, has resulted in higher electrical prices for end-consumers. Now the government is going to modernise the support scheme and emphasise market principles more. The revision will change the support for producers of electricity from RES. While existing producers will keep the so-far granted feed-in tariffs, new producers with an installed capacity of more than 500 kW will sell produced electricity to the state via auctions.

As a whole, Slovakia has not managed to exploit its full renewable energy potential. In debates, renewables have been associated with instability, high costs and intermittancy. One other major problem is related to the capacity of the electricity transmission lines.

Slovakia needs a combination of well-targeted policies that are reasonably using EU funds together with private investments. Last but not least, public support needs to be raised for energy transition policies.

In the context of described obstacles and barriers for the case of Slovakia we could summarise these in:

Low intensity of spreading smart meter technologies, technological and data standards

- Slovakia has already set a detailed smart metering plan to fulfil the EU requirements in the area of energy efficiency by 2020,

- Slovakia is in the second half time of the smart-meter rollout and the plan for the next 2 years is the replacement of smart meters at particular consumer groups,
- Slovakia still lacks dynamic tariff systems.

Quality IT support (platform) for the implementation of EMS, which includes all entities (DSO, TSO, aggregators, network users)

- There are still regulatory obstacles on national level regarding the market uptake of smart assets, associated services and infrastructure,
- Technical obstacles are based on the fact, that there is no significant market penetration of smart meters and also not expected in the upcoming years,
- Relevant players (DSO, TSO, aggregators, network users) are not prepared for big data acquisition and processing and implementation of EMS in large scale,
- Actual no financial incentives for EMS and associated services, with exception of some subsidies for the (residential) building sector.

Renewable energy sources and ancillary services & balancing markets

- Slovakia generates electricity in nuclear power stations, hydro-power stations, natural gas and coal-fired power stations and a small share also derives from renewable energy sources,
- Main obstacles on regulatory and political side can be found on national level, as Slovakia still invests in nuclear power stations and subsidizes coal power plants in order to protect jobs in vulnerable regions,
- Energy policy in Slovakia is prone to ideological and politically strategic considerations rather than market-oriented ones, which is a major obstacle for the further development of renewables.

VII. Identified barriers and solutions in case of Romania

Low intensity of spreading smart meter technologies, technological and data standards

Smart metering is expected to help address these challenges for Romania. Additionally, it is expected that smart metering will help distribution system operators as well as other players along the chain in facing these increasing challenges by leveraging their operational capabilities and enhancing efficiency of day to day operations.

Although in many cases there is strong motivation to install smart meters, a number of barriers can hinder both the speed and effectiveness of the implementation. The following should be considered when putting smart metering into operation:

- Consumer resistance is one of the key barriers to implementation. It is driven by data security and privacy issues, as collected data allow for very detailed conclusions to be made regarding a household's behavior. The impact of this barrier can be observed in some key markets, where the potential for smart metering is high, but the installation process has not progressed because of high customer resistance.

- Cost is another key barrier. In most countries, the cost of smart meter roll out can be recovered either through regulated network tariffs or through customers' bills. The United States, Canada, Sweden, the United Kingdom, and France are examples of where grid operators (DSOs or, in the case of the United Kingdom, suppliers) have the right to recovery costs for relevant and cost-efficient investments, such as smart metering, by adding those costs into the taxes. Cost recovery systems can be thought of in different ways. In Italy, for instance, the laws allow cost recovery through taxes based on revenues from the different types and quantities of meters installed (including the decreased allowed revenues for DSOs that fail to meet interim targets for deployment), whereas in other countries (Victoria state in Australia is a good example) everyone gets charged, regardless of when the smart meter is installed. A further example comes from First Utility in the United Kingdom, which charged a oneoff installation fee.
- Cost issues are even more problematic as tangible benefits, especially for customers, are expected after a certain period of time from the start of the implementation, whereas investment expenditures are incurred at the beginning. In other words, consumer benefits are delayed compared to costs.
- Economic constraints also pose a problem when it comes to the speed of a roll out, as there is the risk of a biased distribution of benefits. Costs can be easily assessed, while benefits remain uncertain. Benefits can also be distributed among market participants, so that investors are not accurately awarded. With high investment costs, market parties become hesitant. The United Kingdom has seen a great deal of debate around the topic of just how accurate many of the studies are that prove the benefits of smart meters. For example, an important benefit for consumers, such as the decrease or modification of energy consumption, is only possible with installation of in-house displays, which in some studies have not been taken into account, while in others, they were considered.
- There are also technical restrictions, resulting mainly from the lack of standardization and the rapid development and advancement of technologies. Together, they often result in the technologies not interacting when trying to integrate products from different suppliers. This is due, in part, to proprietary solutions. In Spain, for example, two open standards of communication protocol have been put in place to ensure that multiple vendors can access the market. Setting such standards through the regulatory framework, however, needs to be done carefully. In Canada, for instance, technology vendors failed to meet the stated specifications, which resulted in DSOs teaming up in a joint request for proposal.
- Stranded costs may be an important implementation aspect also when considering the business case from the DSO's point of view. If speed of implementation is not

accurately accounted for and the pace is too fast, replacing assets that are not fully depreciated, negatively impact accounting results of the companies replacing meters.

- Regulatory environment can, ultimately, be both a driver and a barrier. In liberalized markets, role of regulators in promoting smart metering may be limited. In addition, the regulator‘s responsibility may stretch further, protecting consumers against undue price increases and protecting consumers‘ privacy.

Energy (Electricity) Law (Law 13/2007) of Romania states the obligation of existence of one meter for each electricity consumption point in order to measure its consumption. Meters are in the ownership of distribution system operators and operation and maintenance of meters are their responsibility, even if this activity is sometimes outsourced. Reading is to be done at least once a year (as required by the Regulator; however, DSOs usually read meters once every three months). In between, customers are offered the possibility of own reading, case in which invoice is based either on self-read consumption or estimated consumption.

Energy Law does not impose any requirements regarding metering systems or meters functionalities, either for electricity or for gas or heat meters, the only requirement being measurement of consumption.

The information below is gathered during meetings with different market stakeholders in Romania (DSOs in this case). Several pilot projects have already started or are planned to start.

Main barriers perceived by market stakeholders are:

- High initial investments and lack of funds and budgets,
- High risk of error rates from the new systems due to incompatibilities,
- No standardized rules for basic functionalities,
- Alignment with future perspective of smart grids - avoid investing now in something that will become obsolete in the future,
- Supplier dependency needs to be avoided,
- Communication support: volumes, security levels, filters necessities,
- Managing the new higher volumes of data,
- Metrology legislation (legalization period) needs to be aligned with the new life-time of the smart meters,
- Technological issues: e.g.: current switchers positioned along the grid at almost all exchange points could hinder a good communication,
- Low levels of consumption (15% of the EU level); many customers with very low invoices (1-2 EUR per month),
- Remote disconnections not allowed for electricity; remote reconnections not allowed for gas, by current regulatory framework,

- Dependency on technology providers and on the IT systems (especially with regards to errors in reading data),
- Consumer resistance.

Quality IT support (platform) for the implementation of EMS, which includes all entities (DSO, TSO, aggregators, network users)

The main obstacles, beside regulatory issues, are of technical kind, and also market structures need to be developed. One of the main challenges is to adopt certain legislatives and regulations in the IT sector, which is one of the fastes developing in the Republic of Romania, and thus allowing the efficient implementation of EMS. The effort needs to be done to make one cohesive, robust and reliable regulatory framework.

On the other hand, the possible barriers that can be recognized are related to the network users. There, the promotion of the usage of the IT systems by final users and equipping the users with sufficient knowledge should be the priorities. That would allow for securing the reliable infrastructure for the implementation of the new metering technologies.

Renewable energy sources and ancillary services&balancing markets

Romania ranks 7th among the European Union member states in terms of electricity generation from renewable sources, with a share of 42.7 percent of total production in 2016, according to Eurostat. Romania's electricity consumption will increase and so will the local installed capacities and production of renewable energy. In 2030, Romania will thus surpass the renewable energy target set by the European Commission, according to a Deloitte study.

In 2020, the share of electricity from renewable sources will reach 26.8% of Romania's power consumption, over the European Commission's 20% target in the EU. In 2030, renewable energy will reach 35.5% of the domestic consumption, also over the European target of 32% for that year.

The local electricity production will reach 73.1 TWh in 2030, 24% of which will be produced in hydropower plants, 23% in wind parks, 22% will be nuclear power and 10% will come from photovoltaic parks. The total installed capacity of local power plants should reach 26.6 GW, with shares of 26% for hydro and wind and 18% for solar.

The electricity consumption per capita in Romania will also grow until 2030, to reach 54% of the EU average, up from 45% in 2020. The increase will come from higher electricity use for transport and household heating/cooling. About 500,000 electric cars are expected to be in use in Romania in 2030.

For both electricity and gas markets in Romania, the regulator (ANRE - Romanian Authority for Energy Regulation) is approving tariffs for electricity and gas utilities. The tariff methodology for electric energy contains indications on electricity price composition for various consumer categories, composition covering entire value chain from production to final supply. Romania implemented a support system for renewable energy based on green certificates (GCs) granted free of charge to producers of electricity from certain renewable energy sources (hydropower <10 MW, wind, solar, biomass, landfill gas and sewage treatment plants), and an obligation imposed on electricity suppliers to acquire a certain number of GCs.

Recognizing the stringent need to reform the legislation to avoid the collapse of the renewable energy sector, while still maintaining a balance between the level of affordability of the consumers and the financial effort of the producers in keeping their renewable energy production facilities operational, the GCs support scheme was heavily revised through the Emergency Governance Ordinance No. 24/2017 (EGO 24/2017) amending the Renewable Energy Law No. 220/2008.

On 26 June 2018, the draft Law for the approval of EGO 24/2017 (Draft Approval Law 2018) was approved by the Chamber of Deputies. The Draft Approval Law 2018 contai ns a series of amendments to the recently revised GCs support scheme.

The Draft Approval Law 2018 introduces the possibility for 2 or more renewable energy producers to participate on the centralised electricity market together, as a single aggregated entity, regardless of the technology used, in order to enhance financial and production performance. ANRE will issue specific regulation on this matter within 6 months as of entry into force of the Draft Approval Law 2018. This amendment acknowledges that renewable energy is unpredictable and strongly dependent on weather, therefore, through aggregation of 2 or more producers, the unbalances created in the system are reduced and the producers will be able to submit sale offers on the centralized market more efficiently.

From the regulatory point of view, there will be no obstacles for smart meter technologies implementation. It would be possible to develope the ancillary services and balancing markets. Currently these markets are not yet fully operational and are not centrally regulated.

The Romanian energy market will face a series of challenges in years to come that need to be addressed. These can be summarized in the following areas:

- Increase of energy efficiency.
- Increase of share of renewable sources. As part of the EU target, Romania has to ensure an achievement of 24 percent of renewable sources in total energy consumption by 2020. Through the National Energy Efficiency Action Plan however there is an even more ambitious target of 38 percent of all electricity production in renewable sources. This target is set high also because this year the regulator estimates 30 percent of internal consumption came from renewable sources (in 2010

the share was even higher, 35 percent, as it was a rainy year). The target for heating and cooling from renewable sources of 22 percent also poses a major challenge.

- Improvement of technical infrastructure. The capacity of Romania power grid poses a challenge, as well as increasing age of the current network. This poses a serious challenge to achieving the targets for energy efficiency and increased share of renewables.
- Liberalization of the electricity and gas markets and increasing prices. The national regulator, ANRE, has set up calendars for full-market liberalization for both electricity and gas, which next to the additional needed investments to modernize the grids, are expected to lead to increasing prices for energy.
- Growing demand. As purchasing power of Romanians is expected to grow in the next years and as the economic crisis flushes away, so the energy consumption is expected to grow. This has to be seen in parallel with the increasing energy prices, as a trade-off between the two might also be possible. The key challenge for Romania will be actually to optimize the consumption as a result of implementing energy efficiency measures such as smart metering and demand response solutions.
- High grid losses. It is generally acknowledged that in Romania, as it is the situation in many Central and Eastern European countries, energy theft is on increased levels, as well as technical losses primarily due to aging network and poor monitoring of assets. Again, separately from needed investments to upgrade the grid infrastructure, the challenge consists in adopting measures that can help in identification of places of commercial and technical losses.

VIII. Identified barriers and solutions in case of Bulgaria

Low intensity of spreading smart meter technologies, technological and data standards

The legal framework for demand response is not fully admissive, and demand response does not take place. Bulgaria is working on harmonizing the energy policy with EU Directives, and is especially lagging behind with the implementation of the Energy Efficiency Directive. The Bulgarian electricity markets do not include demand response yet, but a progress towards real liberalization foresees its development in the near future. Transactions in electricity may be concluded at prices regulated by the Energa and Water Regulatory Commission (EWRC), or at prices freely negotiated between the parties, or on the power exchange market, as well as on balancing market. The Bulgarian market is still small, but Bulgaria has committed to resolve the problem by offering certain volumes of electricity on an independently-operated day-ahead market on a recently created power exchange in Bulgaria. The amendments to the Energy Act (EA) as of 1 Jan 2018 stipulate that all electricity generators with total installed capacity over 5 MW are obliged to offer their generated power on the organized exchange, which is a step towards increasing the electricity market liquidity. However, demand response is not dealt with existing policy, although some requirements in Article 14 and Article 15 of the Energy efficiency directive are transposed with the revised Energy Act which introduce an obligation for the assessment of the energy efficiency potential of gas and electricity infrastructure and for the formulation of concrete measures, investments and implementation schedules to improve their energy efficiency. Such studies could form the basis for the admission of Demand Response and the technical background. The existing voluntary agreements can serve as a basis for Demand Response actions. Voluntary agreements may be concluded between the Sustainable Energy Development Agency (SEDA) and the energy sales companies or the owners of industrial systems. According to the NEEAP, the legislation substantiates the introduction of dynamic tariffs as a measure for the final clients to optimize their electricity use by means of:

1. tariffs that take into account the period in which energy is used;
2. tariffs for the critical peak-load periods;
3. pricing in real time;
4. discounts for reducing the use of energy during peak-load periods, but still cannot be envisaged when exactly it will be applied.

Quality IT support (platform) for the implementation of EMS, which includes all entities (DSO, TSO, aggregators, network users)

Bulgaria does not plan a mandatory rollout, but the country's DSOs are gradually deploying smart meters to selected customers. Bulgaria's transmission lines run on great distances, causing large energy losses. In order to accommodate new entrants, i.e. new generation facilities to the grid, Bulgaria has to increase the transmission system capacity. Demand response integration may be a way forward.

Bulgaria has started with a few projects to enable a smart grid. In 2009 CEZ installed more than 18,000 smart meters, which are now purely used for remote metering, but will be available for more efficient use of energy by adapting consumers' supplies to changing daily demand patterns and enabling consumers to feed unused electricity back into the grid. A prerequisite for this is the full liberalization. Technically, the grid and the consumers (smart meters) are underdeveloped. Although there have been a few independent (mostly supplier financed) smart meter installations, the possibility to extensive Demand Response is limited technically.

Renewable energy sources and ancillary services & balancing markets

The feed-in-tariff (FIT) system and long-term Power Purchase Agreement (PPAs) have been the main incentives for investment in renewable sources, following the start of the transposition of the Third Energy Package. The FIT is fixed for the term of the PPA (12 years for wind and 20 years for PV). However, following unforeseen policy changes, including the significant reduction in the FIT for wind and solar production, retroactive measures, such as introduction of access fees, a new 20% fee on production as well as imposition of financial responsibility for imbalances have deteriorated investors interests in new projects and led to the cancellation of a number of RES projects. In addition, in 2015, retroactive fee of 5% was imposed on all electricity producers. Currently, the challenge is to regain investors' confidence. The incentives for small hydro and biomass installations are still intact under the recent changes but investors interest remains low.

There are changes that open the market for an easier access even by consumers, however, the traditionally regulated market seems to be slow in taking up even new producers. Bulgaria is lagging behind with implementing the Third Energy Package.

Policy uncertainty and retroactive changes in the Renewables market, extrapolate to a general investment feeling. Furthermore, the reduced development in renewables, and the limited grid capacity have been considered as a major obstacle for the inclusion of Demand Response.

In the context of described obstacles and barriers for the case of Bulgaria we could summarise these in:

- The legal framework for demand response is not fully admissive, and demand response does not take place,
- Bulgaria does not plan a mandatory rollout,
- Although there have been a few independent (mostly supplier financed) smart meter installations, the possibility to extensive Demand Response is limited technically,
- Bulgaria is lagging behind with implementing the Third Energy Package,
- Policy uncertainty and retroactive changes in the Renewables market, extrapolate to a general investment feeling.

IX. Identified barriers and solutions in case of Czech Republic

Low intensity of spreading smart meter technologies, technological and data standards

Czech Republic still has not got a clear target or plan for the smart meter installation and with this purpose connected all other issues.

Because the Czech Republic does not have any detailed target that defines the exact strategy with the date and percentage of installation of smart meters in all segment of points of interest we do not see any technical obstacle for the installation of smart meter technologies.

Theoretically there are no obstacles for the installation of smart meters. However, the current regulatory environment is based on the use of traditional measuring instruments, but it also enables the use of SMART meters.

We also detect that the reason of non implementing the smart meters is also the cost-benefit analysis (CBA) which is negative with current price level and smart metering costs for small consumers, especially for households.

Limited access to DA and ID markets for all electricity market participants

In general, the DA nad ID market in Czech stock exchange on Power Exchange Central Europe, a.s. already exists and it is publicly accessible on https://www.pxe.cz/On-Line/Indexy/. However, stock exchange trade has several administrative requirements and it goes with significant financial costs and economy of scale. The main problem is in financial nature (financial deposit for financial guarantees) and numbers of costumers that are in each balance group. The power exchange is still organized that allows only to the big players to trade in the segments of DA and ID market of the power exchange.

In summary it can be said that based on scale economy standpoints, administrative and financial barriers, when we will be facing with the emergence and spread of aggregators that can offer substantive support and organize, on the customer level, wholesale markets. However, for the spread of these the active and efficient role of EU level incentives and local regulation authorities are indispensable.

Missing market place for flexibility trading transactions, clearing the role in using flexibility between the market participants

Beside the problem of the so called small consumer of the acces to the DA and ID market is the missing platform or place for the flexibility trading platform and all other roles of the operation of the flexibility market. The most important is that TSO and DSO provide the data in smooth and effective way (on time and accessible way).

Besides, as the technology and platform of exchange data are given, there are no barriers in the law to contract the DSO or TSO and the consumer or aggregator bilaterally in order to use flexibility.

Missing smart metering technological standards and data standards and their aim and importance

There are no regulatory obstacles; however, there are ongoing discussions on data privacy issues which are related to GDPR.

Because of no future plans for implementing the smart meter technologies we do not detect the exact smart metering thecnologies that 0will be implemented in the future. And the same is in the field of data standards. But for the future development of the energy market sector we are sure these documents must be defined as soon as possible. This standarts must be implemented by the Regulator.

Generally speaking, the smart metering uniformed technological standards and specifications are also missing or are in an early state in terms of application details. But this statement is a bit exaggerated. Because each manufacturer has its own tools, programmes, protocols this is one of the biggest dangers for compability of the market. Standardization, on EU level, between meter manufacturers has already been started, but it's not at all complete, and meter processors emerged especially to meters, and the meter manufacturers have to adapt to this. This technological advancement, namely the convergence of the usage of the processors also points to a kind of standardization, of course not imposed by any regulator, it is "governed" by the market.

In the context of described obstacles and barriers for the case of Czech Republic we could summarise these in:

- Limited access to DA and ID markets for all electricity market participants,
- Missing marketplace for flexibility trading transactions, clearing the role in using flexibility between the market participants.

X. Identified barriers and solutions in case of Austria

Low intensity of spreading smart meter technologies, technological and data standards

For the first time, smart meters give consumers better cost control over their energy consumption. Currently, households only receive information about their consumption once a year - when they receive their annual statements. Energy consumers have the right to know how much electricity they use at which time and what they have to pay for it. This is possible with smart meters.

Already in 2009, all EU member states decided together that so-called Smart Meters will be introduced throughout Europe by 2020. In Austria, in December 2017, the Minister of Economic Affairs amended the Intelligent Meter Implementing Regulation (IME-VO) from 2012. Now at least 80% (until the end of 2020) or 95% respectively (until the end of 2022) of all Austrian electricity customers must be equipped with an intelligent measuring device.

There are no considerable obstacles regarding the regulation in Austria. The E-Control, as responsible regulation agency in Austria, has received some regulatory authorizations from the government and the relevant ministries, respectively. For example, the nature and scope of the functional requirements, the data content or the information to the customer is regulated by the E-Control by a governmental decree. For this purpose, E-Control has issued two regulations. One that sets the minimum technical requirements of the equipment and a second, which regulates in what form and in which time periods consumers must have access to the measured data.

Issues like data protection and data management are not exactly obstacles for the implementation of smart meters, but they are still important aspects in the public discussion. The collection of measured data by a smart meter, like any other data application, is subject to the provisions of the Data Protection Act. However, security risks associated with the intrusion of unauthorized third parties, e.g. into the network control systems of the network operator already exist partly today. Safety must be ensured by the network operator when switching to smart meters.

The biggest (financial and administrative) effort is naturally in the physical replacement of the meter technologies. Meter replacement is not associated with any additional costs for the customers, in this sense there are also no incentives available (or necessary). The conversion is paid for by the measuring charge and the network tariffs, which are charged as usual. The network tariffs are set by the regulatory authority E-Control by decree and maximum prices for the metering fees are determined.

Regarding the spreading of smart meter technologies, it seems that there are no further regulatory modifications or financial incentives necessary, as the status in Austria is rather advanced already. Many regions have already started with the “Roll-Out” of Smart Meter implementation (e.g. Burgenland, Carynthia, Vienna, Upper Austria) the rest will start during the course of the year 2019.

Quality IT support (platform) for the implementation of EMS, which includes all entities (DSO, TSO, aggregators, network users)

An intelligent energy management is the basis for maximum benefit for the actors in electrical networks. Both the production and consumption of renewable energy consists of different components and consumers. A good control makes you independent, is fit for the future, relieves the power grids and increases self-consumption.

The digital age has long begun with electrical networks, as a prerequisite for the further development of energy management systems: the main feature of this era is an enormous increase in data, which in the future in the energy sector through developments such as smart meters, smart grids or virtual power plants will be particularly intense. However, data alone does not add value. It requires the targeted analysis of the available data in order to obtain an improved understanding of the customer. The status quo of the Austrian energy industry reveals a great catching-up potential in the use of data, which is a prerequisite for the effective implementation of EMS. In addition, a survey has recently been carried out - one third of the electricity suppliers interviewed state that the storage of data for analysis purposes is still not provided for in their own company. Nearly a quarter already stores data for analysis. After all, another third of the electricity suppliers intend to follow suit in the next three years. The Austrian network operators have already dealt more with digitization: About every second network operator already stores data for analysis purposes. Another 30% of network operators want to introduce targeted data storage over the next five years. Never before has so much data been available for energy management systems as it is today, and never before has it been possible to incorporate so much information into the strategic direction of a company. It is all the more astonishing that only a few players in this market actively push this development forward. Only those who know how to intelligently process data, provide services for the implementation of EMS and set the right priorities will succeed in the long term.

There are some regulatory obstacles on a national level for the implementation of EMS and the associated IT services. Technological developments are usually years ahead of the legal framework. This can be seen very well using the example of Smart Grids and EMS in Austria. As early as the mid-2000s, innovative network operators, technology companies and research institutes began planning their first model regions in Austria and testing new grid technologies. Apart from the international recognition of the Austrian smart grid model regions, there have already been concrete use cases in the last five years apart from the research projects, which were also financially recognized by the regulator.

However, the recognition of intelligent solutions can not be planned from the point of view of network operators at the moment. This situation triggers uncertainty in investment decisions, limiting the number of operators involved in this field.

The regulatory requirement for network operators is to keep the costs for network infrastructure as low as possible while at the same time maintaining a high level of security of supply. If the increasing of costs in network operation can be reduced through the use of new technologies, then this is to be passed on to the consumer. However, the classic network expansion is currently preferred because the investment incentives for smart solutions are lacking, although these would be cheaper in the long run.

With the new regulatory regime from 2019 (“ElWOG”), the regulator will have the opportunity to recognize smart grids as a real alternative to traditional network expansion and anchor them in the law. The legal basis would give network operators more courage to invest in innovative technologies and to try out new solutions for their network infrastructures.

On a national (and regional) level there are a number of non-technical barriers and obstacles for the further development of EMS in electricity grids:

- Lack of coordination of the different ministries involved at federal level,

- Lack of recognition of short-term rising costs in the implementation of intelligent energy systems and the associated IT services,
- No clarity on the new roles and IT services and which existing actor will take which part in the new systems,
- Open discussions on the security and privacy of customer data,
- Lack of alignment of existing national funding programs for the large-scale implementation of EMS including IT services,
- Low level of distribution and recognition of new business models,
- Need to harmonize the standards of communication in the ICT sector between the different market solutions.

There are incentives on different levels available, addressing respectively different levels of players in the market – regions, cities and single network users. For regions and cities, the incentives are provided by federal institutions and programmes, for single network users the situation is different – in Styria and Tyrol for example, there are financial incentives available from the federal state for the implementation of EMS for network users. But mainly financial incentives are only offered by the various power supply companies, and not on the part of the state.

Regarding regulatory modifications, the regulatory regime in Austria needs to become much clearer for a better planning security for all players in the market, as already outlined above. Alongside with the (already available) financial incentives for the research in this field, there is also a need for financial aids for the implementation of EMS and IT-service platforms and recognition of eventually higher short-term costs, that may come with the implementation.

Renewable energy sources and ancillary services & balancing markets

Through the utilization of renewable energy, greenhouse gas emissions in the amount of around 30.2 million tonnes of CO2 equivalents could be avoided in Austria in 2016. Primary turnover in renewable energy technologies in 2016 was € 7.2 billion. Employment in this sector can be estimated for the year 2016 with a total of approximately 41,600 jobs. However, the economic significance of the use of renewable energy in Austria goes far beyond the primary revenue and employment effects. The increased use of renewable energy also causes an increase in national self-sufficiency with energy, a reduction in foreign exchange outflow for the import of fossil fuels, a reduction in dependence on fossil energy imports and thus the vulnerability of the economy and leads to a restructuring of the economy towards a sustainable economic and energy system.

At European level, one regulatory obstacle to a better cross-border link between renewable energy technologies and electricity markets is the inconsistency and unpredictability of national support measures. In addition, missing or unclear national strategies and the lack of coordination between national and regional decision-makers lead to a certain degree of uncertainty in the market.

At the national level, some regulatory or institutional barriers can be identified as well, such as long approval processes for big projects, acceptance problems for wind power, hydropower and grid expansion projects and a lack of integration of new energy policies into the overall policy context.

Most green power technologies in Austria are already marketable today. However, the electricity market is not a "normal" market, but strongly shaped by the fact that new power plants compete with existing ones built and financed long before liberalization in a monopoly power industry. The energy market - and specifically the electricity market - has always been heavily dependent on regulations. Most power stations in Austria were built before 1985, long before market liberalization. Due to the overcapacities, the spot electricity prices do not reflect the full costs of new power plants. At the current "market price", no technology can profitably build new production capacity. Therefore, either compensation is needed to allow for investment, or a reasonable CO2 tax that takes external costs into account.

Regarding certain advanced technologies, there are still some technical obstacles, especially when it comes to technologies with a number of conversion steps (power-to-heat, power-to-gas, fuels from biomass, etc.), but generally technical aspects are only a minor issue. Surveys in Austria show also, that non-technical aspects – such as public acceptance and willingness to investments – are no big issue, therefore it can be concluded that for the further development mainly regulatory and political boundary conditions need to be addressed.

There is a large number of various financial incentives for RES in Austria on different levels available, ranging from R&D-programmes to feed-in-tariffs or investment subsidies for renewable energy technologies. However, the policy of subsidies changed very much in the last decades. Currently there is a new legislation in review (“EAG 2020”), which shall be implemented soon and which will regulate the development and further expansion of renewable energy (subsidies) in Austria.

As the new legislation on renewable energy development (“EAG 2020”) is still in review, there are a lot of details unknown at the moment, how exactly the new policies will be implemented. Therefore, it is difficult to give an outline of further necessary regulatory modifications to be addressed. A strong focus needs to be on buildings, electricity grid infrastructure and further development of the decentralisation of the energy sector (prosumers). In this sense, favourable boundary conditions for smart buildings, systems and networks need to be set. However, what will be important also, is that the focus will not only be on the electricity market and electricity based infrastructure, but on a sound mix of all RES. The importance of biomass for the production of green gas needs to be recognized as well as the importance of biomass-based plants for the participation in the control energy market.

In the context of described obstacles and barriers for the case of Austria we could summarise these in:

Low intensity of spreading smart meter technologies, technological and data standards

- In Austria, in December 2017, the Minister of Economic Affairs amended the Intelligent Meter Implementing Regulation (IME-VO) from 2012,
- Until the end of 2020 80% and until the end of 2022 95% of all Austrian electricity customers must be equipped with an intelligent measuring device (smart meter),
- There are no considerable obstacles regarding the regulation in Austria.

Quality IT support (platform) for the implementation of EMS, which includes all entities (DSO, TSO, aggregators, network users)

- The status quo of the Austrian energy industry reveals a great catching-up potential in the use of data, which is a prerequisite for the effective implementation of EMS,
- The Austrian grid operators have already dealt more with digitization and nearly half of the grid operators are storing data for analysing purposes,
- There are some regulatory obstacles on a national level for the implementation of EMS and the associated IT services,
- On a national (and regional) level there are a number of non-technical barriers and obstacles for the further development of EMS in electricity grids, like the lack of coordination of the different ministries, lack of recognition of short-term rising costs, open discussions on the security and privacy of customer data, etc.

Renewable energy sources and ancillary services & balancing markets

- On national level, some regulatory or institutional barriers could be identified,
- There are long approval procedures for larger projects, acceptance problems for wind power, hydropower and grid expansion projects and a lack of integration of new energy policies into the overall policy context,
- Regarding certain advanced technologies, there are still some technical obstacles, but generally technical aspects are only a minor issue,
- There is a large number of various financial incentives for RES in Austria on different levels available, ranging from R&D-programmes to feed-in-tariffs or investment subsidies for renewable energy technologies,
- A new legislation is still under review in Austria ("EAG 2020") that will bring again, new possibilities, challenges and obstacles.

XI. Identified barriers and solutions in case of Montenegro

Electricity spot market is not fully established

Implementation of "soft energy measures" within WB6 initiative with aim for establishing a regional electricity market is also obligation of Montenegro.

A company responsible for establishing a power exchange, BELEN, was set up by the market operator COTEE, the transmission system operator CGES and the incumbent utility EPCG in August 2017. BELEN is in the process of selecting a strategic partner supported by technical assistance under the WB6 regional energy market connectivity programme. The tender procedure is expected to be finalised in Q3 2018. The launch of the day-ahead market, envisaged for the first half of 2019, will largely depend on an agreement with the selected partner.

There are no obstacles in regulation because the legislative framework needed for establishing the organised electricity market is set by the 2015 Energy Law and the Law on Cross-border Exchanges of Electricity and Natural Gas adopted in 2016.

Supporting the functioning of the day-ahead markets, VAT law is also needed to prevent and combat VAT fraud in cross-border trade. Opening of national retail and wholesale markets and their regional and Pan-European integration requires a level playing field for all participants, including also harmonization of public procurement rules, in particular procurement of energy by contracting authorities and procurement procedures applicable to energy undertakings. Montenegro has not begun adjusting his VAT legislation.

The roadmap for day-ahead market integration in the Western Balkans includes coupling projects with all neighbouring WB6 parties and with Italy. No concrete progress has yet been made, since the decision on market coupling depends on the selection of the strategic partner.

To reach the aim Montenegro should adjust VAT legislation.

Summary of identified barriers in case of Montenegro are:

- Electricity spot market not fully established,
- VAT legislation needs to be adjusted.

XII. Identified barriers and solutions in case of Hungary

Low intensity of spreading smart meter technologies

Taking into consideration the recent developments on the electricity market it is a fact that involving electricity consumers as active participants would be a key element in the future. An important tool to make this possible is the use of smart meters as widely as it is reasonable from economic and user-friendliness aspects. As SMART meter supports consumers in their energy efficiency aspirations by registering the exact period of consumption which is essential for dynamic pricing and for the fulfilling of pricing and billing requirements (on both DSO and retail sides), the mass roll out of these equipments is inevitable in the long term.

From theoretical point of view, there are no obstacles for the installation of smart meters in Hungary as the current regulatory environment enables the use of SMART meters and the implementation of SMART pilot projects. However, the regulation is based on the use of traditional measuring instruments. In addition, there is no legal obligation for a full ranged rollout: the only obligation is to provide smart meters and variable tariffs where it is economically reasonable.

Beside the regulation apsect economic reasons could also hinder the roll-out of smart meters as with the current Hungarian price level and smart metering costs for small consumers the cost-benefit analysis (CBA) is negative:

- An economic assessment was carried out in 2012 with the conclusion that it was not economically reasonable to implement smart meters in the residential sector. This assessment was based on a theoretical CBA analysis,
- There was also a Pilot Project in 2012-2014 performed by DSOs with the involvement of more than 10.000 household customers. The evaluation of this project finished in 2015, with the same results, that is, the implementation of smart meter was still not economically reasonable.

Another smart metering Pilot Project was managed by MAVIR (Hungarian TSO) which targeted a model based on centralized metering operator concept. The project provides data for economical assessment according to 2009/73 EC directive appendix 1. point 2. The launch of the Pilot Project was in October 2016 led by a subsidiary company of MAVIR pursuant the provisions of the Government Regulation No. 26/2016, involving approximately 20.000 consumers, mainly in electricity, and in lesser proportion in gas, water utility and district heating. The result of the economical assessment is not yet known.

Regarding the incentives for a wider roll-out of smart meters, there are some forward-looking steps though and we can consider that the Regulator would like to encourage the spread of intelligent solutions (e.g. SMART meter): within the regulation a 110% incentive is given to DSOs for smart solutions when calculating their eligible costs.

All together we think that financial incentives are more useful than prescriptive regulation.

Smart metering data is essential for dynamic pricing, as it is necessary to register the exact period of consumption in order to be able to fulfill pricing and billing (on both DSO and retail sides). The aim is to involve those consumers as active participants of the electricity market (taking into consideration economic aspects) by supporting the mass roll out of smart meters. The SMART meter supports consumers in their energy efficiency aspirations.

Theoretically there are no obstacles for the installation of smart meters in Hungary. However, the current regulatory environment is based on the use of traditional measuring instruments, but it also enables the use of SMART meters and the implementation of SMART pilot projects.

No legal framework exists for a mandatory rollout. Currently there is only an obligation to provide smart meters and variable tariffs where it is economically reasonable.

The more the final consumer price is linked to Day Ahead and Intra Day market price, expectably the better the result of CBA would be.

Possible barriers which should be removed:

- Smart meter roll-out economically is not reasonable (CBA analysis result), the cost incurred and the future tariff system connection is not clear,
- Due to a legacy thechnologies Hungary has to face more meters in one PoD in case of many customers (B tariff system for radio, ripple control; H tariff system for heat pumps), in case of smart meter introduction is is not feasable to use more smart meters in one PoD,
- There is no clear standardistation backgound for the interoperability of smart meters and the possible home and building energy management systems (HEMS and BEMS) which could be the one basis of the future exploitation of the flexibility of end users.

Liquidity of ID market

Customer side regulation can efficiently support the continuous and safe operation of the electric energy systems by creating additional flexibility along with the power plant regulations. In order to have this flexibility utilized in the electric energy system, it has to be transparent for the market participants and/or system operator. The customer side regulation possibility entering the ID markets can provide an efficient solution for this.

The Hungarian intraday market underwent a significant development in the past 3 years. As until a few years ago only a few transactions were typical within a day on the OTC market, while since the launch of the HUPX ID markets intraday trade continuously developed. By now HUPX ID market already has 30 members, who have traded approximately 50 GWh electric energy during 2017 on the organized market, and the electric energy stock exchange participated in settling a further approximately 65 GWh electric energy. Several factors played a role in the intraday market development:

- TSO and DSOs publish measurement data more frequently,
- System operators reduced the 4 hours' schedule deadlines utilized in international trade to 1 hour in case of several cross-border lines, as a result of which the availability of retractable sources increased,
- With regulation tools the forecast requirements of the power plants' generation from renewable resources are lined with the market conditions and the market operator channeled the trade shorts and overs coming from the more precise forecasts directly to the organized market as a result of which it contributed to the significant liquidity increase.

In general, it can be said that due to the above changes today the Hungarian intraday organized market is already a good tool to track the changes within the day, but in certain extreme cases – like unexpected significant weather change, significant power plant generation cut – there are still rooms for improvement. The following changes can also contribute to intraday trade development, to its liquidity increase:

- Reduce keeping ahead of the schedule deadlines, in order to involve more retractable sources,
- Increase reliability of the system level data published by TSOs, in order to support intraday trade effectiveness,
- Regional/international level unity of the intraday organized markets, in order to join the available sources and the demand.

The above changes basically affect the competence of the regulating authorities and/or system operators; therefore, active role is needed from their side to increase intraday market liquidity.

Possible barriers which should be removed:

- Poor liquidity of the Intraday market which can have an effect on flexibility trading,
- There is no enough information between sources and demand at regional/international level, the aggregation of these information is lacking.

Missing smart metering technological standards and data standards and their aim and importance

There are no regulatory obstacles, however, there are ongoing discussions on data privacy issues which are related to GDPR.

Currently in Hungary the regulator does not prescribe technological standardization, as a contrary, Germany does. The German example is a result of the intense competition, and the German regulator therefore stimulates competition.

There are no data standards. However, there are prescriptions between MAVIR (system operator) and other market players (see XML format, etc...). When standardisation is examined it is woth distinguishing between two areas, namely communication standardisation and the smart meter technology standardisation. This differentiation rises e.g. the following questions: who has to set up the data connection, and the quality requirements attached to that (bandwidth, access time, etc.)? For example, in Germany, metering and communication connections are regulated separately, there are separate prescriptions (e.g. under 2 sec data connection set-up from meter to metering centre). In case of Hungary there are no explicit rules imposed by the Regulator.

Furthermore, if the smart meter technology itself is examined in case of 3Smart the minute-data sampling is not really compatible with the systems of the meter manufacturers, and this causes difficulties. Therefore, the data sampling prescriptions are important in the standardization, and later may have consequences, too.

Generally speaking, the smart metering uniformed technological standards and specifications are also missing or are in an early state in terms of application details. But this statement is a bit exaggerated. Each manufacturer has its own tools, programmes, protocols. Unfortunately, in many cases these cannot be combined: it depends on the meter what kind of data it gives to the communication modem; in many cases the meter manufacturers dictate, and to the metering centre all meter type needs its own adapter. Standardization between meter manufacturers has already been started, but it’s not at all complete, and meter processors emerged specially to meters, and the meter manufacturers have to adapt to this. This technological advancement, namely the convergence of the usage of the processors also points to a kind of standardization, of course not imposed by any regulator, it is “governed” by the market.

Concerning the communication standardisation there is an example which shows that the convergence of the standardisation at this area has begun, namely appeared the DLMS/Cosem protocol: this is a communication protocol, that goes towards standardization. This is an already existing one, and the meter manufacturers must adapt to that. However, it is not yet capable to have the metering tools communicate with each other smoothly.

Example: in case of mobile telecommunication there is penetrability between certain service providers and appliances.

In case of mass processes, the manufacturers use this DLSM/ Cosem protocol, in case of individual demands they cannot be flexible. E.ON expects DLMS/ Cosem protocol in the specification from all Smart meter suppliers.

Question of tariff change: does meter technology affect tariff structure? An example of so called B tariff in Hungary (separated meter and switching equipment for boilers) – where there could not be established a sensible smart meter construction that can manage day tariff A and night Tariff B together in one meter. Probably with the emerge of e-mobility the question will arise again. Major spread of smart meters in Hungary is also hindered by the unsolved Tariff B issue; it is not worth to set two meters, smart meters with two metering possibilities are not really wide-spread, and more expensive, too.

A more detailed description about Tariff B issue can be found following for sake of understanding of this subject:

The owners and operators of the Ripple Control System are the DSOs. E.ON also has partial ownership in the Long-Wave Radio Control (LWRC) operating company EFR, however the sending infrastructure (from the point of view of E.ON Hungária this means the Lakihegy tower) belongs to a third party.

The greatest part of controlled load is composed of residential electric storage water heaters (ESWHs) and to some less extent space heaters. Usually each household that participates in the DLC program owns one control signal receiver. This receiver has a relay that performs load control. After receiving the control signal (either ripple control or radio control signal) the receiver decodes the signal into an address and a command part, and issues the command (typically “ON” or “OFF”) to its relay only if the decoded address complies with its own address.

The Ripple Control (RC) receivers are not addressed one-by-one, but groups of such receivers are formed (called RCGs hereafter), so that one control signal has control over thousands of appliances at once. The load that is switched in one group ranges typically from 2 to 20 MW, and the number of groups is typically 10-20 for each DSO.

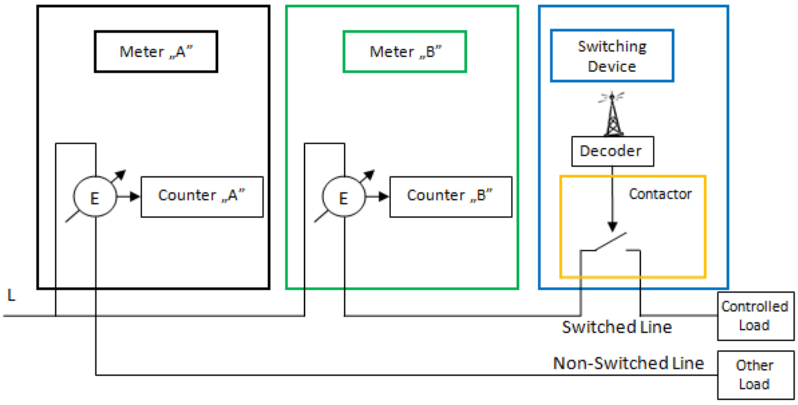
LW Radio Control receivers can be addressed with a much better granularity: theoretically each receiver could be addressed separately.

Those customers who participate in the DLC program have two meters installed: one for the controlled load (the energy consumed on the switched line is measured separately) and one for all other appliances. The tariff (called “B” tariff) at which the controlled load is accounted is 60% of the tariff of other domestic electricity consumption (which is called “A” tariff).

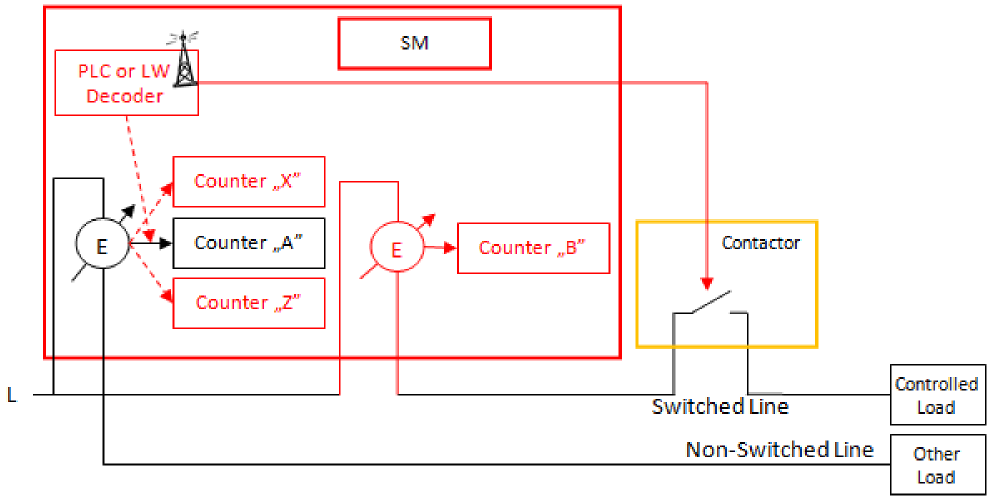
The control programs of the DSOs are coordinated by the TSO in order to avoid system balance problems due to simultaneous switching of large amounts of loads. Main aspects considered when defining control programs are: a.) avoidance of delivery in peak hours (when purchased energy might be more expensive), b.) filling up system-wide load valleys in the early morning hours (around 2-4 AM), c.) a total daily on-time of 8 hours for each customer's controlled load.

According to current Hungarian regulations a total of 8 hours (7 hours in summer-time) of up-time (when the RCG is switched ON) has to be ensured, 2 to 3 hours of which have to be provided in peak-period (6-22 in winter-time, 7-23 in summer-time), finally the up-time in peak-period has to be minimum 30 minutes for each command. It is included in residental tariff.

As already mentioned, those customers who participate in the DLC program have two meters installed: one for the controlled load (the energy consumed on the switched line is measured separately) and one for all other appliances. The third equipment that is installed is the switching device (either the old timer-driven, or the newer ripple control receiver or recently the LW radio receiver).



If one smart meter should measure both tariffs then "A" and "B" and the receiver are replaced by one smart meter, which has the functionality of introducing different tariffs. The switching among different tariff periods is performed by means of PLC or LW radio signal. Either the old switching device can be used as a contactor or a new contactor can be built in.



Since the smart meter is a dual-element device (it has two energy metering elements), it is capable of measuring the energy consumed by controlled and non-controlled load separately. However, such a device is probably more expensive than the single-element meter. But in this way we could not lose the advantage of DLC. Nevertheless, it is worth considering whether new tariff system would be better or the relatively expensive equipment.

In case of Hungary the collected data is a lot. (15 min load curve, event log, voltage quality data), while in Germany they set a quasi-dumb meter with remote communication (they transfer few information -> commercial data: consumption and generation data, that needs much simpler communication interface, few hundred bytes is enough), which means one-way communication. Base data is cast in iron, e.g. tariff change cannot be administered remotely. There is a hub on the meter, and any kind of IT service provider can operate that in Germany. Multi-utility, smart home, etc, could be served via this hub. While in Hungary communications modem is within the meter, that is operated and read by the distribution company. Theoretically in Hungary there is a regulation that prescribes that data transfer is ensured by the customer (although this was elaborated to the remote metering, and not yet been touched upon), in practice DSO establishes it, does not wait for the customer; it increases the installation costs.

So based on the above example it is worth expressing that not only the communication standard and smart meter technology standard can have an influence about spreading of smart meters and their usage for DSM but the system structure and data gathering prescription also can have an impact on it. From communication standardisation point of view, it would be useful if regulator imposes some rules on meter operators because it has an impact on needed communication technology. If DSO decides to gather a lot of data with high time resolution it implies a more sophisticated and expensive communication technology and can hinder the spreading of smart meter technology. So the gradual introduction of not only the technology but the data gathering approach is very important.

One of our key findings is that only special smart meters are able to communicate with the building and the grid. because of the time resolution. Connection between meter and modem is weak. 9600Baud, in this case 4G connection can not be useful (modem and communication infrastructure connection) if the meter can not communicate with the modem in a faster way. Therefore, time resolution brings along the technological change, too, that is ensured by meter manufacturers on demand, at extra cost (e.g. extra storage in meter which ensures the faster communication between meter device and its modem, and in this way 4G will be useful).

There are no explicit regulations in Hungary in terms of technology and data standards, so standards should be elaborated. Data privacy issues related to smart meters should be regulated on EU level, and applied in all Danube region countries.

Households, small consumers can be involved easier if online metering data and comparison charts, analysis are available from their own consumption.

Nevertheless customers can reach own data, e.g. E.ON Hungary has a Smart meter portal solution, and furthermore EON Hungary DSO has also developed a mobile application for this. However, only previous day and before consumption can be seen; for online data display local displayer would be necessary which costs about 75-100 EUR, it is comparable with the smart meter.

Products based on smart meter data cannot spread, because there is no regulation for that – therefore customers are afraid of data mishandling. Cyber security regulation is very much needed, that could convince people to safely chose smart technology.

There is not showed why a smart technology is useful, e.g., there are no dynamic tariffs, therefore no demand, and manufacturers do not go ahead with them, either. This means that not only technological standardization, but also a higher level of standardization would be needed, such as on functional, business level fields. (tariff structures).

Tariff changes would go smoothly if we manage them in the backend systems, and not the smart meter, but if the customer would like to see the status, they cannot see locally. System access rights would be needed. This raises further questions.

Regulation could prescribe prerequisites similarly to Germany, e.g. under 2 sec data connection set-up, etc.

General knowledge circulation is completely missing, that would formulate the common knowledge, and more could be reached by that.

In about 5 years it is expected to have unified standards in the following fields:

1. Does the data derive from the given appliance? Such as, the data carries the information about the appliance. Customer can only be made pay after validated status.
2. Hardware key: two appliances (meter-metering centre) can only connect if there is a token (virtual token).
3. Encrypting: data coding, so that only the data owner can see the data (e.g. DSO).

Complete regulation, standardization of the above would solve the spread of smart technology. Remote smart management is only possible with complying with the above regulations. e.g. remote cut (at present in HU pilot we can provide this only on closed grid, APN which is much more expensive. For the cheaper remote management, the above regulations are needed). E.g. in Italy, there is an own standard, that makes remote cut of the customers possible. Currently in EHU the Narrow-Band IoT communication is tested, which is a closed system, so that could also be a solution, if the regulation cannot get ahead with the above standards.

There are no regulatory obstacles, however, there are ongoing issues and discussons on data privacy issues which are related to GDPR.

There are no data standards.

The smart metereing uniformed technological standards and specifications are also missing or are in an early state in terms of application details.

Limited access to DA and ID markets for all electricity market participants

In general, it can be stated that day ahead and intraday trade are mainly realized on the stock exchange. With the liquidity increase of the stock exchanges OTC market intraday and day ahead markets are more and more forced into the background. However, stock exchange trade has several administrative requirements and it goes with significant financial costs. Among others an administrative requirement is: stock exchange membership can only be initiated with having a trade permission issued by the Hungarian Energy and Public Utility Regulatory Authority, respectively contracts must be concluded between the clearing house and all the member companies. Besides a market participant has to deposit significant financial guarantees to gain trading rights on the organized market. Based on the previously said it can be stated that only those market participants can afford day ahead and intraday stock exchange membership who have significant market share on the wholesale markets.

Recognizing the scale economy standpoints, the currently planned European Union principles enhance the emerging of the so-called aggregators, and their increasing role. The task of the aggregator is with taking the optimization and utilization possibilities at the customers' side into consideration to offer flexible capacities on the wholesale market and/or to the system operator, while at the same time the trader ensures the usual energy supply. In this model the aggregator summarizes the flexible capacity of the customers it has contractual relations with and shares the revenues coming from that and the financial results with the involved users. The model enhanced by the European Union requires the availability of such technical tools with which the aggregator can continuously follow customer consumption and in case of need can control the consumption according to the traded flexible capacities. The operational model further requires an active role of the local regulation authority in relation to the aggregator's activity launch, in the field of customer-trader-aggregator contractual relations, settlement and information share.

In summary it can be said that based on scale economy standpoints, administrative and financial barriers, the emerge and spread of aggregators can offer substantive support on the customer level wholesale markets and especially in the emerge of that on the organized markets. However, for the spread of these the active and efficient role of EU level incentives and local regulation authorities are indispensable.

Possible barriers which should be removed:

- For Smaller entities there are administrative and financial barriers to enter into DA and ID market,
- The smaller entities who could provide fleixibility have not yet enough capability to create a flexibility service procedure which could be marketable.

Missing market place for flexibility trading transactions, clearing the role in using flexibility between the market participants

In order to have an electricity market where flexibility services are broadly available it is inevitable that the data exchange between TSOs and DSOs work in a smooth and effective way. The conditions for that kind of data exchange are not yet given in Hungary.

However, there are some initiatives to make further steps to improve this segment along different theoretical models known from international studies and practices. It is very positive, that all the market players in Hungary are already involved into the discussion. Although this work has just begun and no bigger change is expected in the near future, this phenomenon should not be considered as a barrier in the regulation: it is rather some kind of lack in the market operation which should be developed in the longer run taking into consideration the special needs of the electricity market in transition.

Besides, as the technology is given, there are no barriers in the law to contract the DSO and the consumer bilaterally in order to use flexibility for congestion management.

Possible barriers which should be removed:

- Local (DSO) and global interests can be contradictory in case of flexibility usage which can have an effect on both DSO network and system balance,
- The future roles of players in case of felxibility (DSO, TSO, possible Aggregator, Supplyer, etc.) are still vague,
- There is no procedure for flexibility procurement,
- There is no explicit amrketplace for flexibility (onyl for balancing market exist which of coirse can be further developed to serve the future needs in tersm of flexibility usage).

8. Proposals for removing barriers

I. Proposals in case of Germany

Timing and technology of the smart meter roll-out, grid-building interface standardization

Germany has been hesitant in pursuing renewable energy generation compare to its Western European counterparts in embracing smart grid technologies, especially high volume smart meters. The main reason was due to high cost, technical and security challenges. However, recently in July 2016, a legislation came out namely Digitisation of the Energy Turnaround Act. It provides guidelines for smart meter initial roll out set to begin in 2017 which is the groundwork for new phase in Engergiewende.

Energiewende's energy transition made Germany to shift from centralized generation to fulfil 80% of the country's demand with solar and wind energy by 2050. Nevertheless, energy transition has many integration challenges including voltage instability, bidirectional power, power quality, capacity constraints, over-utilization (damage to existing asset base), and load levelling/peak shifting. Installing smart meters will alleviate these issues by giving clear information on energy production and consumption. This helps the grid operators to react more effectively in current grid conditions.

In addition, a cost-benefit analysis of nationwide smart meter rollout was performed by the German Minister of Economics contracted EY. EY concluded that smart meter installation target as its 80% smart meter penetration for 2020 would bring negative economic impact for German consumers. Nevertheless, as of 2018, energy regulators are looking for a way to kick start smart meter market by passing the Digitization of the Energy Turnaround Act. Under this legislation, the Smart Meter Operation act defines the role of project stakeholders and outlines the rollout specification.

Starting 2017, large consumers with yearly consumption exceeding 10,000 kWh should install smart meters. This will decrease the threshold to 6,000 kWh in 2020 for nearly 15% of the electricity consumers. This will result in installing 7.5 million smart meters across the country. As the household energy consumption is around 3500 kWh, they remain unaffected. Although the legislation allows for outsourcing to third party providers, the Germany's grid operation will still be responsible for installing and operating the smart metering system. In case of the households in which they are not required to install smart meters, the utility will supply the technology with a cost price cap of €40 per year. Even though the overall program can last until 2032, some consumers and operators will be required to finish before the end of 2024. Moreover, careful attention must be taken in smart meter rollout, and how the issue of date entry is addressed.

German regulators and energy consumers take date protection as a very important concern. In addressing these concerns, protectionary guidelines were drafted as part of this Act which highlights date collection, management and transmission. As per the legislation, consumers can have transparent monitoring, the right to object or correct user date. In date gathering, meter reading intervals are limited to protect user habit exposure. Date management regulation call for in the moment date processing and temporal limit on smart meter date storage. Finally, date transmission is protected through encrypting and limiting the date transfer to specific members, moreover it prohibits the use of date for commercial usage without the consumer consent. Germany as a leader in smart grid date security practices these strict guidelines.

However, it should be mentioned in addition to the above factual description that there are several aticles, experts in public events which consider the digitalisantion as an inevitable mean of the future energy system:

“A fully decentralised renewable supply is impossible without digitalisation,” bitkom’s Spanheimer told the Clean Energy Wire. “We have arrived in the next phase of the energy transition. Without the internet, the Energiewende can’t be completed.

“The question is no longer which technologies provide the cheapest electricity – it’s wind and solar, no one doubts that. Attention has shifted to the question of how to deal with the special properties of this power, and how to integrate it in the most cost-efficient way.”

The adjustment of power consumption to intermittent renewable supply is another key step. This approach is currently limited to large industry applications, such as aluminium smelters.

But it is likely to extend to households in the future. For example, charging e-cars at times of scarce renewable generation might be discouraged by higher prices in contracts with flexible pricing.

Car batteries - like household heat pumps - might also become part of virtual power stations: cloud-based IT control systems pooling large numbers of decentral power producers and flexible consumers. By smartly distributing and trading electricity, virtual power plants can relieve the grid and allow the integration of renewable power into existing electricity systems.

Companies with entirely new business models are able to enter the energy market thanks to digital technologies. These turn ordinary power consumers into electricity traders, or link household appliances with industry machines and batteries in internet-based networks.

But despite the progress it remains unknown what digitalisation will do to the energy sector, its businesses, and people’s behaviour, in the long term.

“It’s a bit like trying to predict the effects of the internet before it was invented,” says Reetz.

So the above two different part of the text represent two different approaches only seemingly. The first part although represent a more or less conservative smart meter roll-out, but if it will be merged together with a well thought out digitalisation road-map with Energiewende then it could be succesfull both from economic and technology point of view. Newertheless the risk-averse behavior (e.g sacrificing long-term opportunities for short-term financial goals) may lead to a backlog from socio-economic point of view.

It is worth highlighting that the above mentioned situation is very similar to the situation in CEE countries (Slovakia, Czech Republik and Hungary, **at least from smart metering point of view**).

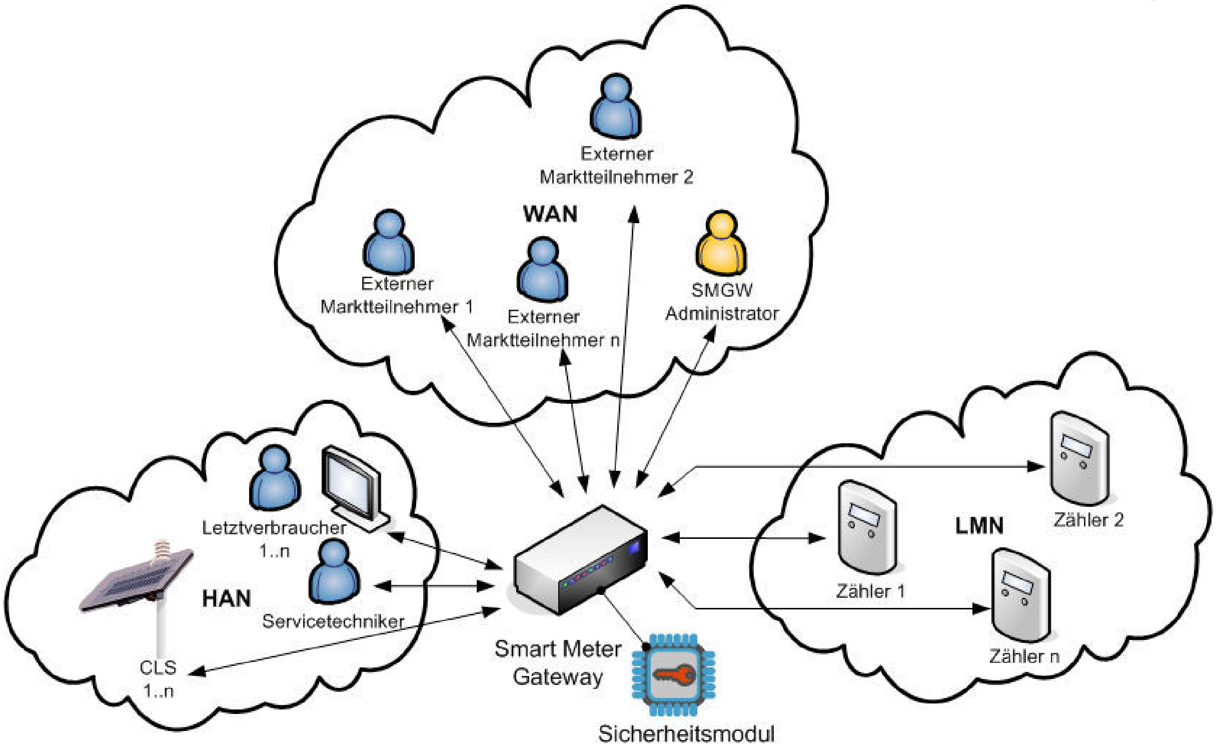
Directives and Regulations of the Clean Energy for all Europeans package states:

“When the deployment of smart metering is negatively assessed as a result of cost-benefit assessment referred to in paragraph 2, Member States shall ensure that this assessment is revised and at least every four years, or more frequently in response to significant changes in the underlying assumptions and to technology and market developments. Member States shall notify to the responsible Commission services the outcome of their updated economic assessment as it becomes available.”

Since the CBA analysis was negative (calculated by Ernst & Young) and the technology advancement in terms of digitalization (not only smart meter technology itself) can change rapidly in the future therefore it is recommended a more frequent than every 4 years (e.g 2 years).

Grid-building interface standardization

It is worth repeating the already presented picture, which describes the technological architecture of the smart metering system nearby the customer premises:



From interoperability point of view the German "way" of interaction of home smart appliences and e.g. an ESCO company, or Aggregator is depend on the regulation strongly (in case of other countries also), but the roles and responbilities of the Smart Meter Gateway operator is a focal point in this context.

Directives and Regulations of the Clean Energy for all Europeans package states:

"In order to promote energy efficiency and empower final customers, Member States or, where a Member State has so provided, the regulatory authority shall strongly recommend that electricity undertakings and other market participants optimise the use of electricity, inter alia by providing energy management services, developing innovative pricing formulas, and introducing interoperable smart metering systems in particular with consumer energy management systems and smart grids in accordance with the applicable Union data protection legislation."

It is recommended to pay special attention to the interaction of Meter operator (e.g DSO)-Smart Meter Gateway operator. Other market player who provides any energy related services (such as aggregation, energy management services e.g through HEMS or BEMS system) both from technology and regulation point of view.

Missing market place for flexibility trading transactions, clearing the role in using flexibility between the market participants

Energy market design and roles of the energy market players are under discussion within the European Union. The EU is in the process of updating its energy policy framework in a way that will facilitate the clean energy transition.

With national implementation of the Directives and Regulations of the Clean Energy for all Europeans package, the German market organization and regulatory framework will also changed. The national implementation is already ongoing processes in case of 4 Directives from the 8 (January 2019).

	European Commission Proposal	**EU Inter-institutional** Negotiations	**European Parliament** Adoption	**Council** Adoption	**Offical Journal** Publication
Energy Performance in Buildings	30/11/2016	Political Agreement	17/04/2018	14/05/2018	19/06/2018 - Directive (EU) 2018/844
Renewable Energy	30/11/2016	Political Agreement	13/11/2018	04/12/2008	21/12/2018 - Directive (EU) 2018/2001
Energy Efficiency	30/11/2016	Political Agreement	13/11/2018	04/12/2018	21/12/2018 - Directive (EU) 2018/2002
Governance	30/11/2016	Political Agreement	13/11/2018	04/12/2018	21/12/2018 - Regulation (EU) 2018/1999
Electricity Regulation	30/11/2016	Political Agreement	-	-	-
Electricity Directive	30/11/2016	Political Agreement	-	-	-
Risk Preparedness	30/11/2016	Political Agreement	-	-	-
ACER	30/11/2016	Political Agreement	-	-	-

1. Figure Current state of the Clean Energy for all Europeans package

With the national implementation of the Regulations and Directives, trading flexibility and using flexibility as a service will become a real possibility for the market players and customers. In case of Hungary, it is needed to provide a new definition of the market participant's roles, in harmonizaion with the ***Proposal for a Directive of the European Parliament and of the Council on common rules for the internal market in electricity (11 January 2019) (hereinafter Directive)***. The main, key questions are from the Demand Rensponse point of view (very similar to the Hungarian situation):

- **Data management, data exchange between DSO and TSO, new role definition between DSO and TSO regarding balancing responsibility and ancilliary services**
  In order to ensure energy efficient and cost efficient operation of the transmission and distribution networks, DSO and TSO need to negotiate and define the roles in a proper way. Data exchange should be developed between the two players (Directive, Chapter 2., Art. 40), and the balancing responsibilities needs to be shared and defined very precise. Using flexibility for local balacing (mitigation of network contstraints) should handled or at least permitted by the DSO, because DSO is responsible for the level of service and mitigation of the network contsraints.

- **Aggregator's role and responsibility definition, with highlighting the responsibility in local balance**

The role of the aggregator needs to be defined and regulated at national level. The Directive contains a definition for the aggregation (Chapter 1, Art.2, (14) and (15)), and the role and responsibilities of the aggregator (Chapter2, Art.12., 13, 17). Still should be examined, if the "imbalances" in the text means the local, technical imbalances also. Demand responses in case of the loads are activated at the same time and direction, could cause network constraints, overloads or in special cases even breakdowns. In order to avoid these network constraints, it is needed to keep the DSO deeply involved into organization of Demand Response activation.

- **DSO's incentives for flexibility, possibility of using flexibility services for mitigation of the network constraints (Directive, Chapter2, Art. 32.)**
  It is needed to organize an extensive discussion between the market participants and provide a regulatory framework at national level in terms of the conditions of flexibility services's procurement. Specification and standardization of the procurements (technical requirements, costs and benefits, processes) are needs to be agreed also at national level.
  "DSOs needs to be adequately remunerated for the procurement of such services in order to recover at least the corresponding costs, including the necessary information and communication technologies expenses and infrastructure costs."

- **Market place for flexibility services, model definition**
  According to the Directive, Art. 26., the market model can be defined at national level:
  "Member States should be free to choose the appropriate implementation model and approach to governance, for independent aggregation while respecting the general principles as laid out in this Directive. This could include market-based or regulatory principles which provide solutions which achieve the provisions set out in this Directive, including models where imbalances are settled or where perimeter corrections are introduced. The chosen model should contain transparent and fair rules to allow independent aggregators to fulfil this role and to ensure, that the final customer adequately benefits from their activity."

Despite the barriers described above, there is a strong will to help the development of flexibility markets in Germany. In this process, Germany's first exchange-based flexibility market was launched for grid congestion management in the beginning of 2019. One of the aim of this project is to demonstrate that a voluntary market-based instrument can prevent forecasted grid congestions. This is to be achieved by better matching generation and consumption while taking into account local flexibility assets as well. With this project, supply and demand are the basis of an efficient pricing mechanism, and a concrete value is given to flexibility.

The goal of the initiative is to develop a consensus on a concept for a flexibility market. To achieve this an appropriate regulatory framework has to be created, while as a specialist for the operation of power markets, EPEX SPOT can act as a neutral intermediary between system operators and flexibility providers.

As for the regulation, the German Energy Agency (dena) published its guiding principles in January 2019 regarding flexibility markets. Dena underlines that the barriers existing today should be eliminated already during the actual legislation period and the regulator would like to be one of the promoters of this process. To support this, a catalogue of regulatory measures will be elaborated until the middle of this year in close cooperating with the market players.

Limited access to DA and ID markets for all electricity market participants

Organization of day-ahead and intraday markets

According to Article 3 of the Proposal for a Regulation of the European Parliament and of the Council on the internal market for electricity (recast) (hereinafter: Regulation), market participation of consumers and small businesses shall be enabled by aggregation of generation from multiple generation facilities or load from multiple demand facilities to provide joint offers on the electricity market and be jointly operated in the electricity system, subject to compliance with EU treaty rules on competition.

Also, according to Article 6 of the Regulation, transmission system operators and nominated electricity market operators shall cooperate at the European Union level or, where more appropriate, on a regional basis in order to maximise the efficiency and effectiveness of the European Union electricity day-ahead and intraday trading.

This article states also that day-ahead and intraday markets should be organized:

- *in a non-discriminatory way* - which should mean the equal access of all market participants, and
- *in a way to ensure that all markets participants are able to access the market individually or through aggregation*.

The ID and DA trade itself works well in Germany, in January 2019 power trading of DA markets accounted for 43 588 335 MWh which means a 3,4% growth according to the same period in 2018, while the growth in the ID market reached 4,5% with 6 909 513 MWh.5 Still, the participation of smaller entities could contribute to an even bigger growth, increasing liquidity and diversification of the traded products. Based on the barriers listed, either the administrative and financial requirements should be made less strict by the national regulator (lower entry costs to the ID and DA market), either new incentives should be elaborated by the Exchange/Regulator in order to boost the participation of smaller entities.

A kind of aggregation could be used also, or a service provider who fulfills the actual requirements or the eventually modified ones and helps the integration of these smaller entities.

Summary of identified proposals in case of Germany are:

Timing and technology of the smart meter roll-out, grid-building interface standardization

- Due to rapid change in digitalization technology the usual CBA analysis frequency seems not sufficient,
- Paying special attention to the interaction of Meter operator (e.g DSO)- Smart Meter Gateway operator and other market players who provides any energy related services (such as aggregation, energy management services e.g through HEMS or BEMS system).

Missing market place for flexibility trading transactions, clearing the role in using flexibility between the market participants

- In order to resolve the possible contradiction between local (network congestion management by DSO) and global (system balancing by TSO) interests Data exchange should be developed between the two players,
- The future role of Aggregator has to be clearly defined in order to prevent the possible contradictions between the parties (Aggregator vs. DSO, Supplyer, etc.),
- Clear definition of the flexibility service procuemrent procedure is needed,
- Clear Market place framework for flexibility services should be established.

Limited access to DA and ID markets for all electricity market participants

- Administrative and financial requirements should be made less strict by the national regulator (lower entry costs to the ID and DA market), either new incentives should be elaborated by the Exchange/Regulator in order to boost the participation of smaller entities,
- A kind of aggregation could be used, or a service provider who fulfills the actual requirements or the eventually modified ones and helps the integration of these smaller entities.

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II. Proposals in case of Bosnia and Herzegovina

In the context of described obstacles and barriers for the case of Bosnia and Herzegovina and according to proposals [L3, L8], the following proposals can be formulated:

- Remove major legal and contractual obstacles to establishing organized electricity markets and market coupling,
- Adhere to a power exchange or, if economically justified (considering liquidity and economic viability), create an own power exchange, enabling wholesale market trade,
- Ensure liquidity of the domestic electricity markets by appropriate regulatory measures such as contract reviews, capacity releases, virtual power plants etc,
- Coupling of organised day-ahead electricity markets with at least one neighbouring country,
- Increase intensity of spreading smart meter technologies,
- Enable participation of RES in ancillary services and balancing markets.

III. Proposals in case of of Serbia

Related to the legislative and regulatory barriers for the smart grid implementation, there are three main problems indentified, namely:

- Low intensity of spreading smart meter technologies, technological and data standards,
- Need for quality IT support (platform) for the implementation of EMS (Energy Management Systems),
- Low share of renewable energy within the current electric grid.

For each of these categories the proposals for overcoming these issues are given. The strategies should address the main aspects of the problems, and serve as a milestone for the future smart grid integration and development in Serbia.

Low intensity of spreading smart meter technologies, technological and data standards

For tackling this issue, the main point of reference is the change of the way people are approaching the smart meter implementation. The inquiries should be done in order to evaluate current state of willingness for smart meter implementation within the population of Republic of Serbia. This will help in indentifying the main constraints and concerns most people have when it comes to smart meter implementation.

On the other hand, along with the first step, the series of educational workshops should be organized to point out the benefits of the smart meter application in households and larger objects. The clear benefit is one of the biggest motivators for the people.

Regarding the legislative and regulatory framework, the Ministry of Mining and Energy of Serbiais should conclude the work on the law on rational use of energy, as soon as possible to make smart meter technology come to life in Serbia.

Need for Quality IT support (platform) for the implementation of EMS, which includes all entities (DSO, TSO, aggregators, network users)

Along with the elimination of regulatory and infrastructural barriers with the EMS implementation, another important goal is to set the quality, reliable and robust IT platform, which will be able to control and monitor the whole implementation process.

The first thing that should be done is stronger connection between the mid and large scale IT companies with the governmental regulatory bodies in Serbia. This would enable better understanding, communication and interconnection between the energy sector and the IT experts. This will therefore, accelerate the EMS in Republic of Serbia.

Low share of renewable energy within the current electric grid

The proposal for the using more renewable energy in electric grid is strongy dependent on the auxcilliary services within the grid and with the governmental subventions. Therefore, the two main proposals for tackling this issue are:

The current energy system and electric grid of Republic of Serbia should be modified to meet the requirements for accepting more electricity produced from renewables. Here is ment on the first place on ancilliary services, such as, for example energy storages.

The second very important proposal is that the government give better subvention conditions for the electricity produced from the renewables. This way, many small and medium enterpreneurs would be interested in investing in renewable energy production in Serbia.

IV. Proposals in case of Croatia

In accordance with the low intensity of spreading smart meter technologies, technological and data standards, and the "EC recommendation on preparations for the roll-out of smart metering systems 2012/148/EU", this is the sysnthesis of HEP DSO obligation scheme:

1. Recommendation 2012/148/EU – for the customer:

Provide readings directly to the customer and any third party designated by the consumer. This functionality is essential in a smart metering system; as direct consumer feedback is essential to ensure energy savings on the demand side.

There is a significant consensus on provision of standardised interfaces which would enable energy management solutions in 'real time', such as home automation, and different demand response schemes and facilitate secure delivery of data directly to the customer.

HEP DSO:

Local reading from the advanced metering device. The remote-sensing consumption data is displayed via the website. Readings and billing data are always delivered with the account to the customer for use of the network.

To enable EMS functioning according to the scheme as introduced in 3Smart, there needs to be a possibility to read out the billing meter by the customer on the level of at least one minute. DSO should allow such a reading access by the customer or a third party entitled by the customer.

2. Recommendation 2012/148/EU – for the customer:

Allow readings to be taken frequently enough to allow the information to be used to achieve energy savings.

HEP DSO:

The consumption data is read daily; the measurement is carried out:

- At hourly intervals for household (tariff model Blue and White),
- In 15-minute intervals for entrepreneurship (tariff model White).

Historical data is available through websites.

3. Recommendation 2012/148/EU – for the metering operator:

Allow remote reading of meters by the operator.

HEP DSO:

It is necessary to provide the equipment with communication modules for remote reading of measurement and control data.

4. Recommendation 2012/148/EU - for the metering operator:

Provide two-way communication between the smart metering system and external networks for maintenance and control of the metering system.

HEP DSO:

It is necessary to provide the equipment for communication modules that enables two-way communication with the networking system.

5. Recommendation 2012/148/EU - for the metering operator:

Allow readings to be taken frequently enough for the information to be used for network planning.

HEP DSO:

The consumption data is read daily; the measurement is carried out:

- At hourly intervals for household (tariff model Blue and White),
- In 15-minute intervals for entrepreneurship (tariff model White).

6. Recommendation 2012/148/EU - for commercial aspects of energy supply:

Support advanced tariff systems. Smart metering systems should include advanced tariff structures, time-of-use registers and remote tariff control.

HEP DSO:

A system for networking advanced metering devices or a system to which it forwards the collected data enables tariff from manifest load curves (possible 24 different daily tariffs for households).

The customer shall be informed of the options of advanced tariff systems in addition to the invoice and on the website.

Advanced tariff is a function that will primarily be used by final customer suppliers.

7. Recommendation 2012/148/EU – for commercial aspects of energy supply:

Allow remote on/off control of the supply and/or flow or power limitation.

HEP DSO:

Equipped with a remote on/off control with the possibility of remote temporary suspension of supply of electricity and restoration of the end-customer power supply and remote adjustment of the permissible peak load.

8. Recommendation 2012/148/EU – for security and data protection:

Provide secure data communications. This functionality relates to both the demand side and the supply side. High levels of security are essential for all communications between the meter and the operator. This applies both to direct communications with the meter and to any messages passed via the meter to or from any appliances or controls on the consumer's premises. For local communications within the consumer's premises, both privacy and data protection are required.

HEP DSO:

Using DLMs protocol with the ability to protect communication. Communication takes place through the outsourced, protected channels of public communications or through its own infrastructure. The final purchaser will be able to obtain a one-time insight into all the information that is being read on the metering points based on the written request. Servers with metric databases, network user data, metering point data, are physically placed in spaces under the responsibility of the system operator.

9. Recommendation 2012/148/EU - for security and data protection:

Fraud prevention and detection. This functionality relates to the supply side: security and safety in the case of access. The strong consensus shows the importance attached to this functionality. This is necessary to protect the consumer, for example from hacking access, and not just for fraud prevention.

HEP DSO:

Indicator of the opening of the meter casing, logging into the power failure event book and parameter changes, corresponding openings on the casing for the placing of safety seals preventing and assisting in detecting the physical opening of the device.

10. Recommendation 2012/148/EU – for distributed generation:

Provide import/export and reactive metering. This functionality relates to both the demand side and the supply side. Most countries are providing the functionalities necessary to allow renewable and local micro-generation, thus future-proofing meter installation. It is recommended that this function should be installed by default and activated/disabled in accordance with the wishes and needs of the consumer.

HEP DSO:

Two-way measurement of working and reactive energy in four quadrants for electricity producers.

Summary of identified proposals in case of Croatia are:

- To enable EMS functioning according to the scheme as introduced in 3Smart, there needs to be a possibility to read out the billing meter by the customer on the level of at least one minute,
- It is necessary to provide the equipment with communication modules for remote reading of measurement and control data,
- Allow readings to be taken frequently enough for the information to be used for network planning,
- Support advanced tariff systems,
- Allow remote on/off control of the supply and/or flow or power limitation,
- Provide secure data communications,
- Fraud prevention and detection (security and safety in the case of access),
- Provide import/export and reactive metering.

V. Proposals in case of of Slovenia

- We sugest that the effort given by Agency of Energy through the scheme of investment in smart meters is to be stronger. The goal of installing of smart meters in all point of deliverable (POD) in Slovenia could be concluded early then in 2022 and also established the 15 min measurement for all points of deliverable and make it avaible to the retailer. This could accelerate the maket transformation and open the door to the new products in the field of smart tehnologies (demand response, system services),

- We also suggest to think about of standardarization of the MV/LV transformer stations with all necessary measurements. Because still today new transformer stations do not have all measurements that allow of full use of all options in the field of smart grids,
- We also suggest that the dynamic tariffs must be taking in the consideration very seriously and in both part of electricity bill. In the part of energy cost this could allow to develop the business model for using more energy in hours that costss less. And also in part of electricity bill that have costs for network charge. Here is the possibility to develop the business model that could stimulate the peak shaving and also using the net metering model that allow the consumer to be self sufficient as much as possible. So the dynamic tariffs must stimulate the demand response system on both side, the building side and grid side.

VI. Proposals in case of Slovakia

In the context of the above described obstacles and barriers for the case of Slovakia, the following proposals can be formulated:

- Promotion and implementation of dynamic tariff systems and a more liberal framework for electricity distributors to respond to the potential smart meters are introducing in the energy market
- A wider smart meter roll-out to get a real market penetration, not only implementation of smart meters for consumers with more than 4 MWh annual consumption
- A favourable regulatory and legal framework on a national scale for EMS as well as financial support for the necessary infrastructure for a wide implementation of EMS and smart systems
- Disruption of the dominant role of nuclear power in the energy market and cancellation of the subsidies for energy production from coal
- Creation of a long-term vision and strategy regarding the national energy system, with ambitious goals, well-targeted policies and generation of public support for energy transition.

VII. Proposals in case of in case of Romania

There are quite few barriers for full EMS implementation in Romania. For some of them the government and ANRE (Romanian Energy Regulatory Agency) have the plan already being put into practice, such as the installation of the smart meters and performing necessary changes in the electric grid to meet the requirements of the smart grid.

Finding proper solution for certain barriers is of the most importance for implementation of EMS in Romania. Those barriers are:

- High initial investments and lack of funds and budgets,

- High risk of error rates from the new systems due to incompatibilities,
- Dependency on technology providers and on the IT systems (especially with regards to errors in reading data),
- Consumer resistance.

Proposals for the solution of these key issues are given as follows:

High initial investments and lack of funds and budgets

The government of Romania will have to do the revision of the state budget and make all necessary steps to ensure implementation of EMS. This is crucial, as this is the starting point for planning all other activities related to the project. All future stages of EMS implementation in Romania are strongly dependent on it.

High risk of error rates from the new systems due to incompatibilities

New systems bring new opportunities, but new challenges and obligations, as well. There is a great need to upgrade existing systems to work and be compatible with new systems, such as smart metering. Therefore, few things need to be done. The number of engineers, scientists, and workers have to be involved in solving this complex issue. One part of the involvement would refer to education and informing experts about new systems. Other part is the development of the reliable system that can bridge the gap between new and existing energy distribution system. In order to prevent or at least bring the error rate to the minimum, the government should bring the exact measures and steps in the form of recommendations to be the guide for the process of the new system implementation.

Dependency on technology providers and on the IT systems (especially with regards to errors in reading data)

One of the biggest challenges of EMS implementation will be the need for development of new secure, accurate and reliable network that will support the process of EMS implementation in the initial stage, and control, monitor and provide user data during the grid life time. Proposed solution to ensure satisfactory secure system is the government of Romania to contract the certain number of IT companies which will be obligated to deveop the system, and transparently share all information during and after the IT network is build. This will, on one hand give the government access to the process of creating the network, and on the other hand make the stronger connection and cooperation between the technology providers and governmental bodies.

Consumer resistance

It is justified to expect certain level of resistance when it comes to implementation of the new technology, such as new EMS and smart meters. The proposed way of tackling this issue is to gradually introduce changes among the population of Romania. First step should be to inform the citizens through mass media, leaflets and similar, about the government intentions and plans about implementation of smart meters. The benefits and possible complications are to be clearly stated. The second step should be the inquiry, if need, to determine the citizen will and level of agreement for new changes to come in power.

VIII. Proposals in case of of Bulgaria

In spite the fact of relatively low level of market openness, with relatively strong retail price regulation, future plans should be focused on further development of intraday market as prebalancing market, procurement of reserves through auctions, stronger role of balancing groups and higher balancing energy prices.

More efforts are needed to be done to increase the market's liquidity so that it becomes a credible reference through (a) the implementation of market-based purchase of losses and (b) the stronger market integration of generators with long-term power purchase agreements and feed-in tariffs. The latter could be achieved by introducing contracts for difference (CfDs) that is the premium price model. The main players on the Bulgarian market are the state-owned power plants, hence if there is a measure to ensure liquidity it should be executed by them. Regarding the Bulgarian market one of the main issues is the high concentration, leaving it open to potential abuse of market functioning, and a large share of generation is tied to existing contractual and legal obligations. Namely the three state owned companies in Bulgarian energy holding can rise an isse, when they make decision on reduction of volumes, consequently the prices rise and when the supply is limited the demand is high which leeds to high volatility in the day ahead or month ahead market. In such conditions the regulator should act much more active role.

Various sources studying energy efficiency behaviour of Bulgarian households show that energy poverty is a serious issue in the country. According to statistics for 2016, 39,2% of the total population of Bulgaria cannot maintain adequate thermal comfort in their households. Energy poverty is defined as "a situation in which a household must allocate more than 10 % of its income in order to achieve a satisfactory level of heating in their home".

According to the data of the EU Energy Poverty Observatory, Bulgarian households are among the most vulnerable in this regard in the EU. The rising electricity and district heating prices inthe last years have forced many households towards using coal and wood for heating, which further worsens air and living quality. The electricity prices for households in Bulgaria have increased from 8.13 euro cents per kWh in 2010, to 9.55 euro cents in 2017. Although the prices are still the lowest in the whole EU, around 444,000 households are claimed to be highly vulnerable to increases in electricity prices, while another 149,000 households are income-poor and could quickly become energy-vulnerable in case of further energy price increases. Although the social tariff has been already introduced, much more effort is needed to be done. Social assistance programs expanding by integration of the social tariff with the existing social assistance system would be a good way in the medium term for solving this issue. Furthermore, the ongoing energy efficiency programs (such as the

National Program for Energy Efficiency in Residential Buildings) could be revisited to provide targeted grant support to low-income households.

Regarding the smart metering and smart tecnologies, there should be an action plan on carrying out a mandatory smart-meter rollout initiated by the regulator. In parallel the favourable market conditions have to be created for new services, products and entrants, as these are needed to reap the full benefits of smart meters. The market for using smart meter data and functionalities to create added value for consumers should be supported with the right quantity and quality of regulation and by reasonable energy market procedures.

Summary of identified proposals in case of Bulgaria are:

- Relatively low level of market openness, with relatively strong retail price regulation,
- More efforts are needed to be done to increase the market's liquidity,
- Energy poverty is a serious issue in the country (Bulgarian households are among the most vulnerable in this regard in the EU),
- The electricity prices are still the lowest in the whole EU,

There should be an action plan on carrying out a mandatory smart-meter rollout initiated by the regulator.

IX. Proposals in case of Czech Republic

In according to the barriers that we listed in Chapter 7 the proposals for the Czech Republic are:

- **Low intensity of spreading smart meter technologies**
  The most important fact is that the cost-benefit analysis (CBA) is negative with current Czech electricty price level and smart metering costs for small consumers.
  Our proposal is where deployment of smart metering is that in case of non economical viability the state still insists in developing and suporting it with all possible mechanisms (EU and state level support).

- **Market place for flexibility services, model definition**
  According to the Directive, Art. 26., the market model can be defined at national level:
  "Member States should be free to choose the appropriate implementation model and approach to governance, for independent aggregation while respecting the general principles as laid out in this Directive. This could include market-based or regulatory principles which provide solutions which achieve the provisions set out in this Directive, including models where imbalances are settled or where perimeter corrections are introduced. The chosen model should contain transparent and fair

rules to allow independent aggregators to fulfil this role and to ensure, that the final customer adequately benefits from their activity. "

Because of very beginning of the development of this market model the market model should answer and solve main questions.
The main point of views during the implementation:

1. Estimated operational cost of the flexibility market,
2. Expected effect on the network tariffs and energy prices,
3. Responsibilities of TSO and DSO in balancing and activating flexibility services,
4. Expected effect on the liquidity of existing ID and DA markets,
5. Needed data exchange and interface solutions.

Once these main questions will be solved, the national autority could continue with the implementation of the flexibility market and services in Czech Republic.

- **Missing smart metering technological standards and data standards and their aim and importance**

There are no regulatory obstacles; however, there are ongoing discussions on data privacy issues which are related to GDPR. Currently in Czech Republic the regulator does not prescribe technological standardization; there are no data standards although some part of consumers has already installed smart meters. The problem of the standardization of data and integration of data between market players could apear in the future when the exchange of data will be put in function.

Because the standardization on EU level already began the problem mentonied above will automatically be solved once the EU directive will be put in force.

- **Limited access to DA and ID markets for all electricity market participants**
  Organization of day-ahead and intraday markets

In according to the Proposal for a Regulation of the European Parliament and of the Council on the internal market for electricity the day-ahead and intraday markets should be organized:

- *in a non-discriminatory way* - which should mean the equal access of all market participants, and
- *in a way to ensure that all markets participants are able to access the market individually or through aggregation*.

Non relevant barrier are also the administrative and financial requirements. They should be made less strict by the national regulator (lower entry costs to the ID and DA market), either new ways of access should be granted so that smaller entities could enter this market, too.

All the costs could be made proportional based on the traded volume. Regarding the new ways of access, aggregation could be a solution.

In the context of described obstacles and barriers for the case of Czech Republic the following proposals can be formulated:

- Low intensity of spreading smart meter technologies,
- Market place for flexibility services, model definition,
- Missing smart metering technological standards and data standards and their aim and importance,
- Limited access to DA and ID markets for all electricity market participants.

X. Proposals in case of of Austria

In the context of the above described obstacles and barriers for the case of Austria, the following proposals can be formulated:

- Better coordination of the different ministries involved at federal level,
- Recognition of short-term rising costs in the implementation of intelligent energy systems and the associated IT services,
- Legal clarification of the new roles and IT services and a guideline provided by e-control which existing actors will (or can) take which part in the new energy system,
- Promotion and dissemination of the new business models for a better recognition of the new market structures,
- Financial incentives by government for the implementation of EMS and IT-service platforms,
- Legislative anchoring of battery storage systems as storage asset for distribution grid operators,
- Enable distribution grid owners to own storage assets as an integral part of their grid infrastructure and to operate them in support of the grid,
- Definition of an expanded framework for designing the grid tariff model and grid compensation system for feeding energy into and withdrawing it from storage systems in connection with billing for the provision of storage capacity at respective grid levels
- Development and recommendation of funding schemes for the installation of distributed generation systems combined with storage assets for the optimisation of local generation and consumption.

XI. Proposals in case of Montenegro

According to [3], proposals for Montenegro are:

- Remove major legal and contractual obstacles to establishing organized electricity markets and market coupling,

- Adhere to a power exchange or, if economically justified (considering liquidity and economic viability), create an own power exchange, enabling wholesale market trade,
- Ensure liquidity of the domestic electricity markets by appropriate regulatory measures such as contract reviews, capacity releases, virtual power plants etc,
- Coupling of organised day-ahead electricity markets with at least one neighboring country.

XII. Proposals in case of Hungary

Missing market place for flexibility trading transactions, clearing the role in using flexibility between the market participants

Proposals

With national implementation of the Directives and Regulations of the Clean Energy for all Europeans package, the Hungarian market organization and regulatory framework will also change. The national implementation is already an ongoing process in case of 4 Directives from the 8 January 2019. (See 1. Figure Current state of the Clean Energy for all Europeans Package)

With the national implementation of the Regulations and Directives, trading flexibility and using flexibility as a service will become a real possibility for the market players and customers. In case of Hungary, it is needed to provide a new definition of the market participant's roles, in harmonizaion with the ***Proposal for a Directive of the European Parliament and of the Council on common rules for the internal market in electricity (11 January 2019) (hereinafter Directive)***. The main, key questions are from the Demand Rensponse point of view (very similar to the German situation):

- **Data management, data exchange between DSO and TSO, new role definition between DSO and TSO regarding balancing responsibility and ancilliary services**
  In order to ensure energy efficient and cost efficient operation of the transmission and distribution networks, DSO and TSO need to negotiate and define the roles in a proper way. Data exchange should be developed between the two players (Directive, Chapter 2., Art. 40), and the balancing responsibilities needs to be shared and defined very precise. Using flexibility for local balacing (mitigation of network contstraints) should be handled or at least permitted by the DSO, because DSO is responsible for the level of service and mitigation of the network contsraints.

- **Aggregator's role and responsibility definition, with highlighting the responsibility in local balance**
  The role of the aggregator needs to be defined and regulated at national level. The Directive contains a definition for the aggregation (Chapter 1, Art.2, (14) and (15)),

and the role and responsibilities of the aggregator (Chapter2, Art.12., 13, 17). Still should be examined, if the "imbalances" in the text means the local, technical imbalances also. Demand responses in case of the loads are activated at the same time and direction, could cause network constraints, overloads or in special cases even breakdowns. In order to avoid these network constraints, it is needed to keep the DSO deeply involved into organization of Demand Response activation.

- **DSO's incentives for flexibility, possibility of using flexibility services for mitigation of the network constraints (Directive, Chapter2, Art. 32.)**
  It is needed to organize an extensive discussion between the market participants and provide a regulatory framework at national level in terms of the conditions of flexibility services procurement. Specification and standardization of the procurements (technical requirements, costs and benefits, processes) are needs to be agreed also at national level.
  "DSOs needs to be adequately remunerated for the procurement of such services in order to recover at least the corresponding costs, including the necessary information and communication technologies expenses and infrastructure costs."

- **Market place for flexibility services, model definition**
  According to the Directive, Art. 26., the market model can be defined at national level:
  "Member States should be free to choose the appropriate implementation model and approach to governance, for independent aggregation while respecting the general principles as laid out in this Directive. This could include market-based or regulatory principles which provide solutions which achieve the provisions set out in this Directive, including models where imbalances are settled or where perimeter corrections are introduced. The chosen model should contain transparent and fair rules to allow independent aggregators to fulfil this role and to ensure, that the final customer adequately benefits from their activity. "

  There are different models in the literature, with the own advantages and disadvantages. In case of Hungary, there are initiatives for discussions regarding the future market model.
  The main point of views during the implementation:

  1. Estimated operational cost of the flexibility market,
  2. Expected effect on the network tariffs and energy prices,
  3. Responsibilities of TSO and DSO in balancing and activating flexibility services,
  4. Expected effect on the liquidity of existing ID and DA markets,
  5. Needed data exchange and interface solutions.

Since this is an ongoing discussion at national level, there is no final decision regarding the choosen model. There are shared, integrated, local, centralized, or fully integrated flexibility market models, but all the models will cause changes in responsibilities of the parties. National Regulatory Authority is currently working on finding the suitable solution common with the main local stakeholders.

Low intensity of spreading smart meter technologies

The most important fact is that the cost-benefit analysis (CBA) is negative with current Hungarian price level and smart metering costs for small consumers.

Directives and Regulations of the Clean Energy for all Europeans package states:

When the deployment of smart metering is negatively assessed as a result of cost-benefit assessment referred to in paragraph 2, Member States shall ensure that this assessment is revised and at least every four years, or more frequently in response to significant changes in the underlying assumptions and to technology and market developments. Member States shall notify to the responsible Commission services the outcome of their updated economic assessment as it becomes available.

Furthermore, the Package states:

Member States that proceed with smart metering deployment shall ensure that final customers contribute to the associated costs of the roll-out in a transparent and non-discriminatory manner while taking into account the long-term benefits for the whole value chain. Member States or, where a Member State has so provided, the designated competent authorities, shall regularly monitor this deployment in their territories to track the delivery of benefits to consumers.

Our proposal is where deployment of smart metering was negatively assessed (in case of Hungary this is the situation) the revised CBA should care about more intensively the cost part of the analysis and tariff structure together. A more market oriented tariff structure could leverage the spread of smart metering because it could handle the equipment cost in a fair manner which could serve not only the final customer but the all stakeholders in the society, e.g DSO, TSO, Sales companies as well.

Missing smart metering technological standards and data standards and their aim and importance

Below it is highlighted two main parts of the obstacles.
There are no regulatory obstacles, however, there are ongoing discussions on data privacy issues which are related to GDPR. Currently in Hungary the regulator does not prescribe technological standardization, there are no data standards. However, there are prescriptions between MAVIR (system operator) and other market players (see XML format,

etc...). When standardisation is examined it is worth distinguishing between two areas, namely communication standardisation and the smart meter technology standardisation.

Question of tariff change: does meter technology affect tariff structure? An example of so called B tariff in Hungary (separated meter and switching equipment for boilers) – where there could not be established a sensible smart meter construction that can manage day tariff A and night Tariff B together in one meter. Probably with the emerge of e-mobility the question will arise again. Major spread of smart meters in Hungary is also hindered by the unsolved Tariff B issue; it is not worth to set two meters, smart meters with two metering possibilities are not really wide-spread, and more expensive, too.

Both part somehow can be derived from technology, nevertheless the latest one connects to the tariff system as well.

Directives and Regulations of the Clean Energy for all Europeans package states:

In order to promote energy efficiency and empower final customers, Member States or, where a Member State has so provided, the regulatory authority shall strongly recommend that electricity undertakings and other market participants optimise the use of electricity, inter alia by providing energy management services, developing innovative pricing formulas, and introducing interoperable smart metering systems in particular with consumer energy management systems and smart grids in accordance with the applicable Union data protection legislation.

Member States shall ensure the interoperability of these smart metering systems as well as their ability to provide output for consumer energy management systems. To this respect, Member States shall have due regard to the use of relevant available standards including those enabling interoperability, best practices and the importance of the development of smart grids and of the internal market in electricity.

It is worth highlighting the following sentence: "…… providing energy management services, developing innovative pricing formulas, and introducing interoperable smart metering systems in particular with consumer energy management systems and smart grids." Without fostering the energy management system and its interoperability it is not possible of resolving the "two meters" system in Hungary. Our proposal is that Member state should care about the solution of the "more metering" system in Hungary, otherwise neither the CBA will be positive nor the DSR (Demand side response) potential of end customer will be exploited in a appropriate manner. Regarding technology standardisation, it can be stated generally that the interoperability and its standardisation of HEMS (Home energy management system) and BEMS (Building energy management system) with the smart metering system is a prerequisite of the future exploitation of the flexibility of the end customers (both retail-> HEMS and commercial-> BEMS cutomers).

Limited access to DA and ID markets for all electricity market participants

- ***Organization of day-ahead and intraday markets***

According to Article 3 of the Proposal for a Regulation of the European Parliament and of the Council on the internal market for electricity (recast) (hereinafter: Regulation), market participation of consumers and small businesses shall be enabled by aggregation of generation from multiple generation facilities or load from multiple demand facilities to provide joint offers on the electricity market and be jointly operated in the electricity system, subject to compliance with EU treaty rules on competition.

Also, according to Article 6 of the Regulation, transmission system operators and nominated electricity market operators shall cooperate at the European Union level or, where more appropriate, on a regional basis in order to maximise the efficiency and effectiveness of the European Union electricity day-ahead and intraday trading.

This article states also that day-ahead and intraday markets should be organized

- *in a non-discriminatory way* - which should mean the equal access of all market participants, and
- *in a way to ensure that all markets participants are able to access the market individually or through aggregation*.

Based on the barriers listed, either the administrative and financial requirements should be made less strict by the national regulator (lower entry costs to the ID and DA market), either new ways of access should be granted so that smaller entities could entry this market, too. For the first one, all the costs could be made proportional based on the market share of the eventual market participant and on the traded volume, or some kind of restricted trading licence could be issued for these smaller entities with lower fee requirements. Regarding the new ways of access, aggregation could be a solution.

Increasing the liquidity of ID market

Increasing the liquidity of the Intraday market can be supported by the emergence of new sources, channeling it to wholesale markets, and reducing the administrative rules for the trading of existing flexible resources. The above options appear both in the Winter package and in the domestic regulatory efforts.

The Winter Package introduces the concept of Aggregators, thereby creating a market role that is not explicitly aimed at the supply of electricity but rather at the market uptake of flexible capacities of producers and consumers. Generally speaking, a significant number of customers do not know the flexibility potential of their own consumption, or prefer the power supply constructions that can plan their supply costs on the basis of a fixed supply price. The aggregators to be created by the Winter Package can activate flexibility options for these consumers that can be sold on the system-wide services market on the one hand and on the wholesale markets on the other. In this way, aggregators can add new resources to markets that specifically increase market liquidity during Intraday periods.

The steps taken to create a single European energy market will also serve to increase market liquidity. By shifting national energy markets into increasingly narrow or broader regional markets, there is a potential for country-specific resilience to be activated in countries where there is a shortage of that product. This type of market interconnection increases the potential for flexible capacities and the liquidity of Intraday markets.

In the recent period, more and more emphasis has been placed on the production of electricity from renewable energy sources. This type of energy production is characterized by a high degree of unpredictability. It is a fundamental objective to encourage these production units to increase forecasting accuracy through continuous redesign. In addition to supporting system security, a significant benefit of redesigning can be to channel the volumes corresponding to the refined production plans to the Intraday markets.

The administrative support for increasing Intraday's liquidity and traffic can also be a reduction in scheduling deadlines. If traders are able to make their decisions close to the relevant settlement period, they can channel more consumption and production information into their own decisions and thus to the wholesale Intraday markets.

Summary of proposals in case of Hungary are:

Missing market place for flexibility trading transactions, clearing the role in using flexibility between the market participants

- In order to resolve the possible contradiction between local (network congestion management by DSO) and global (system balancing by TSO) interests Data exchange should be developed between the two players,
- The future role of Aggregator has to be clearly defined in order to prevent the possible contradictions between the parties (Aggregator vs. DSO, Supplyer, etc.),
- Clear definition of the flexibility service procuemrent procedure is needed,
- Clear Market place framework for flexibility services should be established.

Low intensity of spreading smart meter technologies

- The revised CBA should care about more intensively the cost part of the analysis and tariff structure together,
- Member state should care about the solution of the "more metering" system in Hungary, otherwise neither the CBA will be positive nor the DSR (Demand side response) potential of end customer will be exploited in an appropriate manner,
- In terms of technology standardisation, it can be stated generally that the interoperability and its standardisation of HEMS (Home energy management system)

and BEMS (Building energy management system) with the smart metering system is a prerequisite of the future exploitation of the flexibility.

Limited access to DA and ID markets for all electricity market participants

- Administrative and financial requirements should be made less strict by the national regulator (lower entry costs to the ID and DA market), either new incentives should be elaborated by the Exchange/Regulator in order to boost the participation of smaller entities,
- A kind of aggregation could be used, or a service provider who fulfills the actual requirements or the eventually modified ones and helps the integration of these smaller entities.

Increasing the liquidity of ID market

- Increasing the liquidity of the Intraday market can be supported by the emergence of new sources, channeling it to wholesale markets, and reducing the administrative rules for the trading of existing flexible resources,
- Emergence of aggregators can add new resources to ID markets that specifically increase market liquidity during Intraday periods.

9. Recommendations

A. Market Rules and Commercial Arrangements

RECOMMENDATION 1. ASSESS THE FLEXIBILITY POTENTIAL AND MAXIMISE THE VALUE OF FLEXIBILITY

Member States should assess, under the guidance of the European Commission, the overall Demand Side Flexibility (DSF) potential (realistic vs. theoretical), which DSF potential is already used and what upfront investments will be necessary to tap realistically achievable potential for different types of consumers (i.e. residential, commercial and industrial). A Cost Benefit Analysis, overall impact analysis and ambition setting are needed [L2].

Based on such an assessment, **Member States and NRAs should ensure that the value of flexibility is maximised to the consumers and other providers of that flexibility, and continues to be maximised in an evolving market over time**. When developing new flexibility services for different types of customers, a careful assessment of costs and benefits related to different market design options should be undertaken.

RECOMMENDATION 2. EQUAL ACCESS TO ELECTRICITY MARKETS

Consumers shall be given the possibility to exploit the benefits of modifying their flexible consumption and injection. To ensure that the market is free from barriers and provides equal access for existing parties and new entrants, market rules (including the European Network Codes) should ensure that all service providers compete on a level playing field:

- Market rules for intra-day, day-ahead and balancing and technical requirements should ensure a level playing field between supply side and flexible demand side resources, including prosumers. **Member States should adapt market rules so that the flexibility provided by demand side measures and all sizes of generation can compete on a level playing field with existing actors in these markets**.
- Aggregators and suppliers should have the same ability to extract the value of flexibility services on behalf of their consumers. **Member States and NRAs should:**

  - **Ensure that the participation of aggregated flexibility is legal, facilitated and enabled in all markets.**

  - Make sure that demand side flexibility is treated on an equal footing with generation on the basis of the volumes effectively delivered (whether in the form of electricity generated at customer site or demand variations).

  - Ensure that essential technical requirements are fulfilled by the new service providers for a well-functioning market.

RECOMMENDATION 3. CONTRACTUAL ARRANGEMENTS

Contractual arrangements should be simple, transparent and fair and allow consumers to access any service provider of their choosing, without previous permission of the BRP or supplier (although it may be necessary to protect consumers from multiple contracts for flexibility that conflict).

In the case of demand response being activated by a third party aggregation service provider, the BRP/Supplier should always be informed. Standard contracts should be put in place to ensure smooth contractual process, fair financial adjustment mechanism and standard communications procedures between aggregation service provider and the BRP/supplier. Where required, contracts, communication and money flows can be directed through an independent third party.

In the case of flexibility being valued through supply contracts, this does not apply.

Only when it is proved that existing means of metering would not be sufficient to measure flexibility provided by consumers, the aggregator should be allowed to provide the appropriate means of measuring that service. As regards data used for settlement purposes, that data needs to be certified by an independent third party, such as the TSO or DSO.

To protect consumers from unnecessary administrative and legal burdens, the aggregated pool of demand side resources should be treated as a single resource. Pre-qualification, verification should wherever possible be performed at this pooled level. For grid constraint management on the DSO level, local specifications will need to be taken into account.

European Commission and NRAs should collaborate in order to ensure that the regulatory framework enables the creation of these contractual arrangements.

RECOMMENDATION 4. FINANCIAL ADJUSTMENT MECHANISMS

Streamlined, simple payment arrangements between TSOs, DSOs, suppliers, BRPs, BSPs and aggregators are key to facilitate consumer participation.

This is particularly relevant in creating a financial adjustment mechanism between aggregators and BRPs/supplier in the case of a DR action being initiated by third party aggregators. The financial adjustment mechanism should enable competition, allowing for customer participation. This mechanism should ensure that all the electricity sourced on the market and consumed by end-customers is paid to the actor who sources it; and at the same time avoiding the BRP from having unfair costs incurred through the fulfilment of its balancing requirements.

The financial adjustment mechanisms should as much as possible be applicable and symmetric for both regulation-up (demand curtailment) and regulation-down (demand enhancement).

Two main principles should be respected when establishing financial adjustments mechanisms:

- The financial adjustment for the energy sourced should reflect the sourcing costs.
- The financial adjustment should ensure that benefits, risks and costs are directed to the party that causes them.

The European Commission should work with NRAs to develop relevant financial adjustment mechanisms facilitating further integration of the different EU energy markets and allow demand side flexibility to participate on a level playing field. Market rules should be holistic and developed in close cooperation with stakeholders, including aggregators, BRPs, consumers, suppliers and network operators.

RECOMMENDATION 5. DEFINITION OF BALANCE RESPONSIBILITY IN A CONNECTION

Keeping current role and responsibility of BRP intact is essential for well-functioning of electricity markets. Having a balance responsibility in a connection is crucial for maintaining system stability and security of supply. **Member States should ensure that the definition of balance responsibility in a connection is put in place**. That responsibility must be unambiguously defined in relation to all market parties that are supplying/receiving energy and/or invoking flexibility on that connection.

Gaps or overlaps in the balance responsibility of different actors on a connection must be avoided.

If a customer has contracts with more than one market actor on a connection, there needs to be separate settlement.

Certified metering data is necessary to allow the amounts to be allocated to the BRP and then settled in the settlement process if aggregated flexibilities want to participate in balancing markets.

As regards the interval for collection of metered values, a balance needs to be found between the need for accuracy and speed of the information on the one hand, and the related metering costs on the other.

B. Measurement of Flexibility

RECOMMENDATION 6. STANDARDISED MEASUREMENT METHODOLOGY FOR FLEXIBILITY

Where required, Member States should define a standardised measurement methodology for flexibility. The methodology should enable the allocation of the demand action of each service provider for a single connection. In order to enable cross border flexibility trade, there is in the longer perspective a need for harmonised EU wide principles and methodologies. This methodology should preferably be based upon smart metering data.

C. Consumers

RECOMMENDATION 7. TIMELY ACCESS TO DATA WHILE ENSURING CONSUMER PRIVACY

As access to data has significant potential to fuel market growth and market competition, the data manager should equally provide to all market parties – new and existing - sufficient, differentiated and timely data via appropriate market facilitation services.

To encourage energy service providers to offer contracts and services built around spot market prices, such as dynamic pricing and home and business automation controls, consumers should have the right to request and receive metering at a frequency corresponding to the national balancing settlement regime. Smart metering systems with a reading interval corresponding to the settlement time period are a technical prerequisite for participation in flexibility markets.

Accurate consumption information and accurate billing based on actual consumption are critical enablers of demand side flexibility, for domestic consumers in particular. Customers should maintain control of their data and always explicitly give their consent before their data is made available to third parties (to which the customer does not already have a contract).

The customer has the right to withdraw his/her consent. The data access should be monitored and protected by Member States.

NRAs should ensure these possibilities are in place, as well as how costs are recovered. The five CEER guiding principles of data management should be observed (Privacy and security, transparency, accuracy, accessibility and non-discrimination.)

RECOMMENDATION 8. CLEAR FRAMEWORK FOR DOMESTIC CUSTOMERS

To achieve inclusivity and a positive domestic customer reception of demand side flexibility options, **industry and NRAs should work together especially on the introduction of aggregation services and dynamic pricing, taking into account the following**:

- Services and offers must be comprehensible.

- While recognising that customers can benefit from their ability to modify load through specific price offers, comparability in these offers must be supported.

- Identify feasible models for limiting the liability of customers when contracting with an aggregator or supplier.

- Ensure that information on flexibility services is simple and transparently provided to the customer.

- Enhance comparisons between services regarding flexibility by providing comparable key information without impeding competition and innovation.

- Consider the impact of demand side flexibility options on all domestic customers and especially vulnerable consumers, so that the benefits are shared appropriately and no one is adversely affected. Vulnerable customers may need additional protections.

NRAs and consumer protection agencies should seek innovative solutions to ensure consumer protections are adapted and not relaxed to accommodate demand side flexibility options.

D. Grid Operation

RECOMMENDATION 9. COMMUNICATION & COORDINATION FOR SECURE GRID OPERATION

DSOs and TSOs must have in place constraint management procedures in order to tackle constraints on their networks, including the right to require modification of flexibility activations in accordance with these procedures.

To ensure safe, secure and cost-efficient distribution and transmission network operation and development, both the DSOs and TSOs must have access to flexibility services and all technical relevant data needed to perform their activities both at pre-qualification stage and in real time (or close to real time).

DSOs and TSOs shall exchange relevant operational data with each other. When congestion areas occur, DSOs and TSOs will make the appropriate information available to all concerned parties (BRP, aggregators, suppliers etc.).

Relevant activation of flexibility – or its modification - by DSOs or TSOs shall be exchanged with each other in advance, before the selection of the flexibility to be activated. Regulated revenues should allow the recovery of these costs in a way that does not distort the optimal economical arbitrage for the system between distribution and transmission system grid reinforcement/development versus costs of managing grid congestions without this grid extension.

The European Commission should work together with NRAs, DSOs, TSOs suppliers and aggregators on the above issues and identify necessary actions.

E. Incentives

RECOMMENDATION 10. OPEN AND INTEROPERABLE STANDARDS FOR INTERFACES

Devices on the customer premises (e.g. smart appliances, in home displays) may need to have the ability to communicate with the smart meters. The smart metering systems should be equipped with a gateway or interface to the home, which would support energy management systems and home automation. Therefore, to enable demand response, **Member States should ensure that internationally accepted open and interoperable standards for interfaces are in place**. While developing these, the legal/regulatory framework should keep as many options as possible open for the consumer, recognising that the development of aggregation services will trigger technology and marketing innovation.

Member States should incentivise the use of these standards through national initiatives as well as promotion of already available and coming standards. Such incentives should foster open systems, open standard, open protocols for demand response, as well as open devices and appliances.

RECOMMENDATION 11. SECURE COMMUNICATION INFRASTRUCTURE AND SERVICES & UTILITY-TELCO SYNERGIES

Commission, Member States and NRAs should encourage TSOs, DSOs, telecommunication companies and ICT companies to identify a favourable business, regulatory and technological environment for the cost-effective deployment of secure and manageable communication infrastructures and services for Smart Grids which support the further development of flexibility.

The process of conclusion of commercial agreements by TSOs, DSOs and telecommunication operators should, where necessary, be facilitated, in view of possible efficiency gains for both sectors. Member States and NRAs should support synergies between smart grid and broadband deployment while ensuring a secure and stable energy grid operation (electricity and gas) and respecting each party’s roles and responsibilities.

RECOMMENDATION 12. INCENTIVISE GRID OPERATORS TO ENABLE AND USE FLEXIBILITY

In order to cope with increasing investment needs in network infrastructure, **NRAs and Member States should incentivise grid operators to make efficient long-term investments that will support the EU's Energy and Climate targets for 2030 rather than focus on short-term optimisation.** This would reduce the risk of stranded assets at the expense of the generality of distribution network customers. Measures for achieving this should include:

- Member States and NRAs should ensure that grid operators are given the tools for optimising investment in networks through the use of flexibility and smart grids solutions. Member States and NRAs should remove regulatory provisions that prevent grid operators from having the option to contract flexibility, while maintaining their position as neutral market facilitators, where applicable. Cost recovery should be assured by NRAs when grid operators are purchasing flexibility for grid services in an efficient way.

- Innovative investments (such as smart metering roll out) should be treated adequately and their costs should be recovered on time. Regulation should be technology neutral and incentives for OPEX should be treated, similarly to incentives for CAPEX. Costs of demonstration and pilot projects should not be treated as costs under an efficiency incentive but under dedicated innovation/demonstration and pilot projects incentive.

- National regulatory authorities should define, on the basis of a wide stakeholders' consultation, transparent, fair and clear boundary conditions for the market-based, where possible, provision of flexibility services.

- Schemes allowing connecting grid customers to reduce their costs through adopting smart technologies (such as variable network access offered as a discounted connection) should be developed.

- The European Commission should consider the further funding of smart grid projects which should not be limited to any voltage level.

- Coordination between national and EU funding should be enhanced to make best use of the available financing possibilities.

<u>RECOMMENDATION 13. IMPROVE PRICE SIGNALS TO INCENTIVISE CONSUMERS' RESPONSE</u>

NRAs and Member States should work towards creating a favourable business, regulatory and technological environment designing policies and measures tailored to the different groups of customers to effectively enhance their participation and engagement and to ensure value for money for consumers in the prioritization of investments to be undertaken via:

- Progressively phasing out **regulated prices** for all customers.

- Enabling **innovative grid tariff structures** that incentivise network customers for delivering the needed flexibility to the system, (e.g. through time of use tariff schemes, more power/capacity based tariffs or different contractual options). Distribution network tariffs should be allowed to be cost-reflective and have a transparent allocation of network costs, with appropriate information, gradual transition and protections where necessary.

- Assessing the **impact of increasing taxes and levies** within the end-user electricity prices on customers' flexibility and better linking wholesale and retail energy prices that would allow providing better price signals for flexibility to customers.

- Facilitating self-consumption through efficient economic signals and incentives.

- Measures tailored to the different groups of consumers to **effectively enhance their participation**, such as facilitating frameworks for self-consumption, dedicated policies to help consumers control their energy costs and new types of contracts between consumers and suppliers and third party services. Specific benchmarks should be developed to assess ex post the efficiency of policies and ensure that concrete benefits are delivered to final consumers.

A full assessment of the impact of the different policy alternatives on the respective consumer segments is required, including vulnerable consumers and residential customers for whom the benefits of flexibility will only become possible in the later stages of the development of markets with flexibility. Existing social and environment protections (including energy affordability), and fair and inclusive treatment of all customers should be safeguarded.

RECOMMENDATION 14. SMART APPLIANCES FOR END USERS

As enablers of active demand side participation at residential level, smart appliances could potentially receive incentives in the early stages of their development. Such incentives would aim to reduce the initial acquisition cost to end users in order to speed up the uptake of smart appliances and encourage residential consumer participation in the electricity market. However, the case would have to be made that this expense would deliver a clear benefit to all consumers.

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Project Deliverable Report

Smart Building – Smart Grid – Smart City

http://www.interreg-danube.eu/3smart

DELIVERABLE D3.4.2.

Action plan for the strategy to remove the regulatory framework barriers

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v1.0	30 June 2019	Final quality checked version	Hrvoje Pandžić, 3Smart qualityx assessment manager, Mario Vašak (FER)

Table of Contents

Executive summary

The document provides the action plan for the strategy to remove the regulatory barriers related to implementation of integrated grid-building real-time energy management systems including demand response.

It inherits the conclusions and recommendations for different Danube region countries provided in the preceding stratgey, and then orders the recommended measures in a sequence of steps needed to enable participation of prosumers in flexibility provision.

1. Introduction

The goal of the Work Package 3 in the project 3Smart is to provide regulatory and technology framework for successful integration and active role of flexible distributed sources and prosumers in low carbon energy system. The focus of this project is on demand response, however we aim to provide a wider and more comprehensive proposal to national regulatory agencies, which means we should at the early stage include all active participants at the distribution level (generation, storage, demand response, etc).

One part of WP3 is the Activity 3.4. which includes the proposals for removing barriers and action plan. This document takes into account the designed strategy within the preceding document D3.4.1 and provides the action plan for its implementation.

2. Stucture of Energy Management System technology/regulation within the 3Smart project

Objectives of the 3Smart WP3 are:

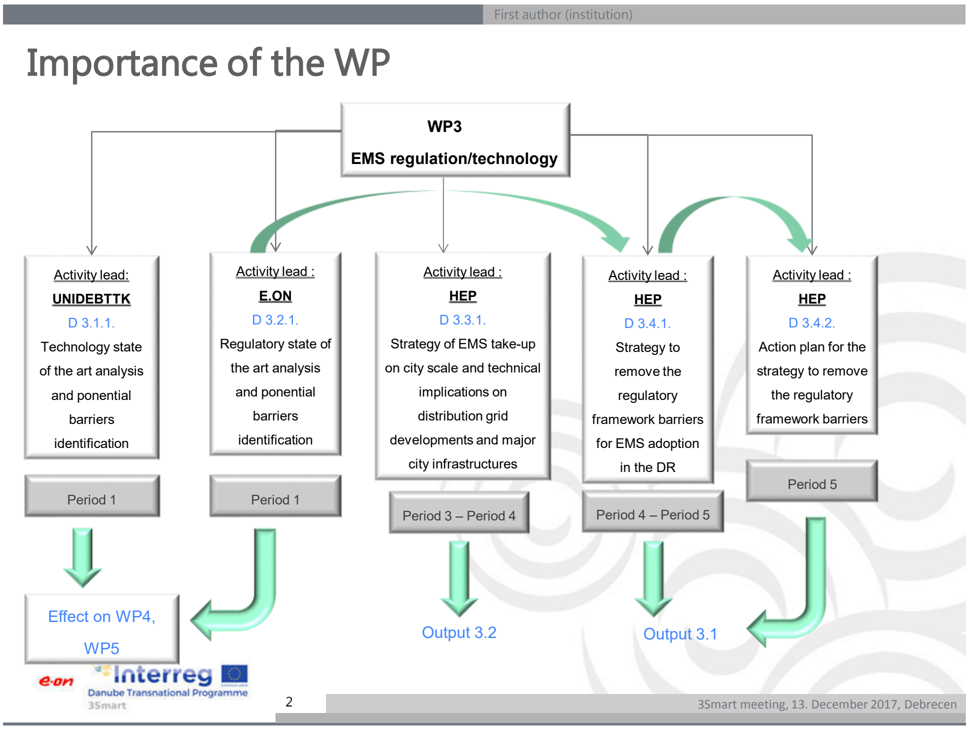
(1) Facilitate the technical developments on the project by assesing current technical and regulatory state with respect to cros-spanning building-grid energy management across buildings, energy grids and infrastructure.

(2) Derive the local/regional up-scaling paths for the developed EMS

(3) Assess a plan to overcome identified regulatory barriers

The following figure presents the WP3 structure on EMS regulation/technology:

- Technology state-of-the-art analysis and potential barriers identification (D3.1.1),
- Strategy of EMS take-up (D3.3.1) and
- Regulatory state-of-the-art analysis, overcome strategy and action plan (D3.2.1, D3.4.1 and D3.4.2).



3. Proposals for removing barriers

I. Proposals in case of Germany

Summary of identified proposals in case of Germany are:

Timing and technology of the smart meter roll-out, grid-building interface standardization

- Due to rapid change in digitalization technology the usual CBA analysis frequency seems not sufficient,
- Paying special attention to the interaction of Meter operator (e.g DSO) - Smart Meter Gateway operator and other market players who provide any energy related services (such as aggregation, energy management services e.g through HEMS or BEMS system).

Missing marketplace for flexibility trading transactions, clearing the role in using flexibility between the market participants

- In order to resolve the possible contradiction between local (network congestion management by DSO) and global (system balancing by TSO) interests Data exchange should be developed between the two players,
- The future role of Aggregator has to be clearly defined in order to prevent the possible contradictions between the parties (Aggregator vs. DSO, Supplier, etc.),
- Clear definition of the flexibility service procurement procedure is needed,
- Clear Marketplace framework for flexibility services should be established.

Limited access to DA and ID markets for all electricity market participants

- Administrative and financial requirements should be made less strict by the national regulator (lower entry costs to the ID and DA market), new incentives should be elaborated by the Exchange/Regulator in order to boost the participation of smaller entities,
- A kind of aggregation could be used, or a service provider who fulfills the actual requirements or the eventually modified ones and helps the integration of these smaller entities.

II. Proposals in case of Bosnia and Herzegovina

Summary of identified proposals in case of Bosnia and Herzegovina are:

- Remove major legal and contractual obstacles for establishing organized electricity markets and market coupling,

- Adhere to a power exchange or, if economically justified (considering liquidity and economic viability), create an own power exchange, enabling wholesale market trade,
- Ensure liquidity of the domestic electricity markets by appropriate regulatory measures such as contract reviews, capacity releases, virtual power plants etc,
- Coupling of organised day-ahead electricity markets with at least one neighbouring country,
- Increase intensity of spreading smart meter technologies,
- Enable participation of RES in ancillary services and balancing markets.

III. Proposals in case of Serbia

Summary of identified proposals in case of Serbia are:

- Low intensity of spreading smart meter technologies which should be changed, technological and data standards for the meters which should be delivered,
- Need for quality IT support (platform) for the implementation of EMS (Energy Management Systems),
- Low share of renewable energy within the current electricity grid.

IV. Proposals in case of Croatia

Summary of identified proposals in case of Croatia are:

- To enable EMS functioning according to the scheme as introduced in 3Smart, there needs to be a possibility to read out the billing meter by the customer on the level of at least one minute,
- It is necessary to provide the equipment with communication modules for remote reading of measurement and control data,
- Allow readings to be taken frequently enough for the information to be used for network planning,
- Support advanced tariff systems,
- Allow remote on/off control of the supply and/or flow or power limitation,
- Provide secure data communications,
- Fraud prevention and detection (security and safety in the case of access),
- Provide import/export and reactive metering.

V. Proposals in case of Slovenia

Summary of the identified proposals in case of Slovenia are:

- The effort given by Agency of Energy through the scheme of investment in smart meters is to be made stronger. The goal of installing of smart meters in all points of delivery (POD) in Slovenia could be concluded earlier than in 2022 and also established the 15 min measurement for all points of delivery and make it available to the retailer. This could accelerate the market transformation and open the door to the new products in the field of smart technologies (demand response, system services),
- Perform standardization of the MV/LV transformer stations with all necessary measurements. Because still today new transformer stations do not have all measurements that allow of full use of all options in the field of smart grids,
- The dynamic tariffs must be taken into consideration very seriously and in both part of electricity bill. In the part of energy cost this could allow to develop the business model for using more energy in hours that cost less. And also in part of electricity bill that contains network charges there is a possibility to develop a business model that could stimulate peak shaving and also using net metering model that allows the consumer to be self-sufficient as much as possible. So the dynamic tariffs must stimulate the demand response system on both sides, the building side and the grid side.

VI. Proposals in case of Slovakia

Summary of identified proposals in case of Slovakia are:

- Promotion and implementation of dynamic tariff systems and a more liberal framework for electricity distributors to respond to the potential smart meters are introducing in the energy market,
- A wider smart meter roll-out to get a real market penetration, not only implementation of smart meters for consumers with more than 4 MWh annual consumption,
- A favourable regulatory and legal framework on a national scale for Energy Management Systems (EMSs) as well as financial support for the necessary infrastructure for a wide implementation of EMSs and smart systems,
- Disruption of the dominant role of nuclear power in the energy market and cancellation of the subsidies for energy production from coal,
- Creation of a long-term vision and strategy regarding the national energy system, with ambitious goals, well-targeted policies and generation of public support for energy transition.

VII. Proposals in case of Romania

Summary of identified proposals in case of Romania are:

- Decrease high initial investments and lack of funds and budgets for EMSs,
- Diminish high risk of error rates from the new systems due to incompatibilities,
- Dependency on technology providers and on the IT systems (especially with regards to errors in reading data) should be reduced,
- Consumer resistance should be decreased.

VIII. Proposals in case of Bulgaria

Summary of identified proposals in case of Bulgaria are:

- Raise the current relatively low level of market openness, with relatively strong retail price regulation,
- More efforts are needed to be done to increase the market's liquidity,
- Energy poverty is a serious issue in the country (Bulgarian households are among the most vulnerable in this regard in the EU), while the electricity prices are still the lowest in the whole EU,
- There should be an action plan on carrying out a mandatory smart-meter rollout initiated by the regulator.

IX. Proposals in case of Czech Republic

Summary of identified proposals in case of Czech Republic are:

- Raise low intensity of spreading smart meter technologies,
- Market place for flexibility services and its model definition should be introduced,
- Smart metering technological standards and data standards should be introduced and their aim and importance clearly communicated,
- Access to DA and ID markets for all electricity market participants should be made feasible.

X. Proposals in case of Austria

Summary of proposals in case of Austria are:

- Better coordination of the different ministries involved at federal level on energy matters is needed,
- Short-term rising costs in the implementation of intelligent energy systems and the associated IT services should be recognized and properly addressed,
- There should be a legal clarification of the new roles and IT services and a guideline provided by the regulator (E-control) which existing actors will (or can) take which part in the new energy system,

- Promotion and dissemination of the new business models for a better recognition of the new market structures,
- Financial incentives by government for the implementation of EMS and IT-service platforms,
- Legislative anchoring of battery storage systems as storage asset for distribution grid operators,
- Enable distribution grid owners to own storage assets as an integral part of their grid infrastructure and to operate them in support of the grid,
- Define an expanded framework for designing the grid tariff model and grid compensation system for feeding energy into and withdrawing it from storage systems in connection with billing for the provision of storage capacity at respective grid levels,
- Development and recommendation of funding schemes for the installation of distributed generation systems combined with storage assets for the optimisation of local generation and consumption.

XI. Proposals in case of Montenegro

Summary of proposals in case of Montenegro are:

- Remove major legal and contractual obstacles to establishing organized electricity markets and market coupling,
- Adhere to a power exchange or, if economically justified (considering liquidity and economic viability), create an own power exchange, enabling wholesale market trade,
- Ensure liquidity of the domestic electricity markets by appropriate regulatory measures such as contract reviews, capacity releases, virtual power plants etc,
- Coupling of organised day-ahead electricity markets with at least one neighboring country.

XII. Proposals in case of Hungary

Summary of proposals in case of Hungary are:

Missing market place for flexibility trading transactions, clearing the role in using flexibility between the market participants

- In order to resolve the possible contradiction between local (network congestion management by DSO) and global (system balancing by TSO) interests Data exchange should be developed between the two players,

- The future role of Aggregator has to be clearly defined in order to prevent the possible contradictions between the parties (Aggregator vs. DSO, Supplier, etc.),
- Clear definition of the flexibility service procurement procedure is needed,
- Clear Marketplace framework for flexibility services should be established.

Low intensity of spreading smart meter technologies

- The revised Cost-benefit analysis (CBA) should care more intensively about the cost part of the analysis and tariff structure together,
- The state should find a solution to the "more metering" system in Hungary, otherwise neither the CBA will be positive nor the DSR (Demand side response) potential of end customer will be exploited in an appropriate manner,
- In terms of technology standardisation, it can be stated generally that the interoperability and standardisation of HEMS (Home energy management system) and BEMS (Building energy management system) with the smart metering system is a prerequisite of the future exploitation of the flexibility.

Limited access to DA and ID markets for all electricity market participants

- Administrative and financial requirements should be made less strict by the national regulator (lower entry costs to the ID and DA market), or new incentives should be elaborated by the Exchange/Regulator in order to boost the participation of smaller entities,
- A kind of aggregation could be used, or a service provider who fulfills the actual requirements or the eventually modified ones and helps the integration of these smaller entities.

Increasing the liquidity of ID market

- Increasing the liquidity of the Intraday market can be supported by the emergence of new sources, channeling it to wholesale markets, and reducing the administrative rules for the trading of existing flexible resources,
- Emergence of aggregators can add new resources to ID markets that specifically increase market liquidity during Intraday periods.

4. The sequence of measures to remove regulatory barriers

Based on the proposed solutions in Chapter 3 the list of measures for countries in the Danube region is listed as follows.

Power exchange

- Where non-existent, the power exchange should be established
- Access to DA and ID markets for all electricity market participants should be made easy / more easy,
- Major legal and contractual obstacles to establishing organized electricity markets and market coupling should be removed,
- Ensure liquidity of the domestic electricity markets by appropriate regulatory measures such as contract reviews, capacity releases, virtual power plants etc.

Missing marketplace for flexibility trading transactions

- In order to resolve the possible contradiction between local (network congestion management by DSO) and global (system balancing by TSO) interests Data exchange should be developed between the two players,
- The future role of Aggregator has to be clearly defined in order to prevent the possible contradictions between the parties (Aggregator vs. DSO, Supplier, etc.),
- Clear definition of the flexibility service procurement procedure is needed,
- Clear Marketplace framework for flexibility services should be established.

Smart meter

- Timing and technology of the smart meter roll-out should be assessed, together with grid-building interface standardization,
- Benefit part of the CBA should include also gains stemming from demand response and dynamic tariffs
- Increase intensity of spreading smart meter technologies,
- Spread of smart meter technologies, technological and data standards should be intensified,
- Provide secure data communications,
- Missing smart metering technological standards and data standards and their aim and importance.
- Ensure end-customers are allowed by the metering operators to read-out in real-time the billing smart meter with sampling time of one minute or less

Tariff systems

- Support advanced tariff systems,

- Promote and implement dynamic tariff systems and a more liberal framework for electricity distributors to respond to the potential smart meters are introducing in the energy market,
- Define an expanded framework for designing the grid tariff model and grid compensation system for feeding energy into and withdrawing it from storage systems in connection with billing for the provision of storage capacity at respective grid levels.

Renewable energy sources

- Enable participation of RES in ancillary services and balancing markets,
- Enable higher share of renewable energy within the current electric grid.

Energy management system (EMS)

- Need for quality IT support (platform) for the implementation of EMSs (Energy Management Systems),
- A favourable regulatory and legal framework on a national scale for EMSs as well as financial support for the necessary infrastructure for a wide implementation of EMSs and smart systems,
- Financial incentives by government for the implementation of EMSs and IT-service platforms.

Output Quality Report

Output title:Strategy to influence regulatory framework	
Type of output:	☐ Documented learning interaction ☑ Strategy/ Action Plan ☐ Tool ☐ Pilot action
Contribution to PO indicator:	**P23 No of strategies to improve energy security and energy efficiency developed and/or implemented**

Summary of the output (max. 1500 characters)

The output contains identified regulatory barriers and suggestions how to overcome them, with corresponding action plan, for integrated real-time grid-building Energy Management System adoption in the Danube region, including demand response. The first part of the document is an introduction of the demand response and requirements for flexibility service. The second part describes the barriers for flexibility services in each country of the Danube region, while the third part brings proposals for removing barriers, accompanied with an action plan.

The main proposals for removing barriers are:

- Recognition of high investment costs in the implementation of intelligent energy systems and the associated IT services,
- Legal clarification of the new roles and IT services taken by different actors in the new energy system,
- Promotion and dissemination of new business models that exploit new market structures.

Action plan for the strategy to remove regulatory barriers inherits the conclusions and recommendations for different Danube region countries provided in the preceding strategy, and then orders the recommended measures in a sequence of steps needed to enable participation of prosumers in flexibility provision.

Added value (max. 1500 characters)

The analysis made by this output gives the chance to have summed up data from Danube region countries about regulatory framework barriers and their overcome suggestions for integrated real-time grid-building Energy Management System adoption in the Danube region including demand response.

Applicability and replicability (max. 1500 characters)	
This report contains an overview of country-specific regulations and EU regulation about regulatory framework barriers that will allow further development of the legislative framework in order to harmonize with EU regulation. Also, report contains an overview of country-specific suggestions that will allow further development of the legislative framework in order to harmonize with EU regulation.	
Suggestions for improvement, if applicable (max. 1500 characters)	
Technically, the deliverables on regulatory framework 3.4.1 and 3.4.2 are sound and address all the issues in the considered countries. However, the text needs to be proofread, and the figures taken from the Internet should be referenced to their original source.	
Output Quality Level	☐ Low ☐ Average ☐ Good ☑ Excellent

Name of the Quality Manager

Assoc. Prof. Hrvoje Pandžić

Signature of the Quality Manager