BestRES

Best practices and implementation
of innovative business models
for renewable energy aggregators

European policy workshop
"RES Aggregators as Enablers of Prosumers and Active Market Participation"

CEER – Council of European Energy Regulators

Brussels, 11th February 2019

Author: Silvia Caneva (WIP)

February 2019
www.bestres.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 691689.

Acknowledgement

This report has been produced within the BestRES project "Best practices and implementation of innovative business models for Renewable Energy aggregatorS".

The logos of the partners cooperating in this project are shown below and information about them is available in this report and at the website: www.bestres.eu

Disclaimer

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Context and Objectives

Aggregators should be intermediaries to put "*Consumers at the heart of the Energy Union*". Currently, aggregators are mostly acting for large scale and industrial consumers. Consumers, and prosumers, do not have means to trade directly in the energy markets and require the services of an aggregator. Aggregation service providers are therefore central players for the active participation in the energy markets. In the short and medium term, aggregation appears to be more attractive in the field of large applications. The regulations in the "Clean Energy for all Europeans" Package envisage a situation in long term prospective where the consumers and prosumers are more integrated in the energy market.

The workshop provided the participants with an overview on the real-life implementation of business models for aggregators acting in the future markets to support prosumers engagement and their clients of decentralized RES production units. The workshop provided a set of National and European enabling conditions identified during the BestRES project for the uptake of business models for RES aggregation to support policy makers in elaborating strategies and ease the transition towards cleaner sources of energy.

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Summary of the presentations

Introduction to the workshop

Silvia Caneva (WIP) opened the workshop by providing the participants with an overview of the two sessions of the workshop: the first session focusing on the technical aspects of the RES aggregation and the second section focusing on the enabling conditions for the market uptake of the business models for RES aggregation.

Session 1: Overview on Technical Issues

Moderator: Jens Merten, CEA – French Alternative Energies and Atomic Energy Commission LITEN – Institute of Technologies for New Energies
Program Manager Solar Technology Division

BestRES project overview - Silvia Caneva (WIP)

Silvia Caneva (WIP) provided the participants with an overview of the BestRES project mentioning that the project started in March 2016 and will end in February 2019. The aim of the project was related to:

- development, implementation of business models for renewable energy aggregators
- Identification of enabling legal and regulatory conditions for their market uptake

The target group of this project, the renewable energy aggregators, has been directly involved in the BestRES project consortium as partners and they are Next Kraftwerke Germany, Next Kraftwerke Belgium, Good Energy, EDP and oekostrom. The consortium includes also the research center FOSS. The target countries covered by the aggregators and FOSS are shown in Figure 1.

The innovative business models developed during the project were based on on-going business models available in Europe and adapted to the future market designs by research institutions and energy expert partners such as the Energy Economic Group of the Technical University of Vienna (TUW-EEG) and 3E. The consortium also included a legal expert, SUER (Stiftung Umweltenergierecht /Foundation for Environmental Energy Law), who provided a relevant contribution to the development of National and European recommendations on the business models implementation. The research center FOSS covered the target country Cyprus. The BestRES project is coordinated by WIP – Renewable Energies. The project communication and dissemination are carried out by WIP with the support of Youris.

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Figure 1 BestRES target countries

For the BestRES project an Advisory Board has been established at the beginning of the project. The Members of the BestRES Advisory Board were:

- EURELECTRIC (European Association of Electricity Industry)
- EDSO for Smart Grids (European Distributor System Operator´s Association for Smart Grids)
- EREF (European Renewable Energy Federation)
- EFET (European Federation of Energy Traders)
- SmartEn, former SEDC (Smart Energy Demand Coalition)
- KIC InnoEnergy
- Solar Power Europe
- ENTSO-E (European Network of Transmission System Operators)
- CEDEC (European Federation of Local Energy Companies)
- Europex (Association of European Energy Exchanges)

Silvia Caneva (WIP) mentioned that the progress of the project can be summarized in the three phases shown in Figure 2.

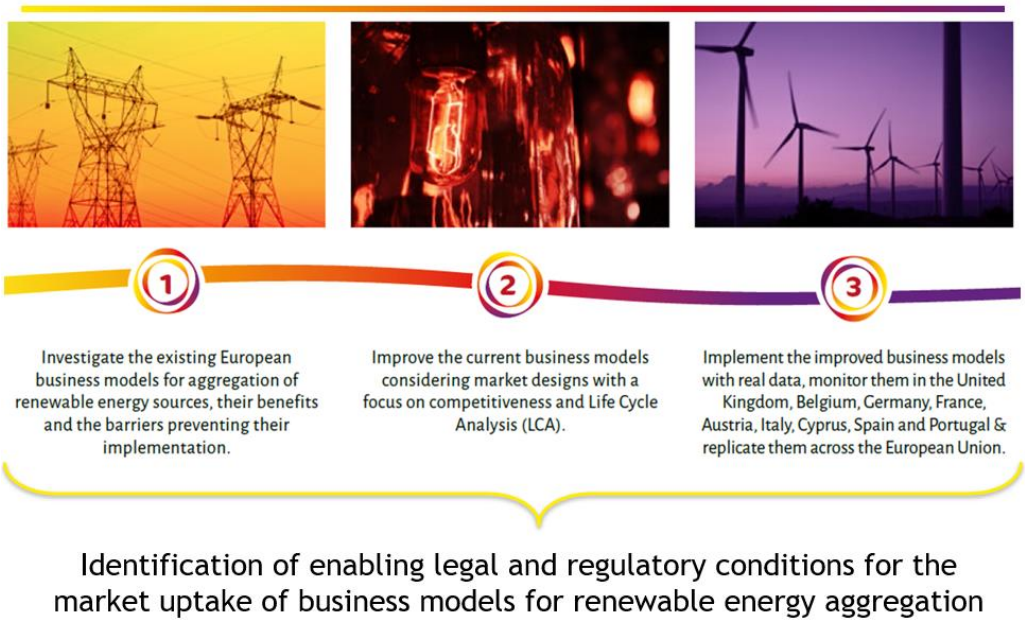

Figure 2 - BestRES project phases

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She closed her presentation with an overview of the workshops organized within the project to disseminate the results to the relevant stakeholders:

- 1st European workshop on the analysis of the business models in the current market design (Brussels, 27th September 2016)
- 2nd European workshop on improved business models for RES Aggregation (on the occasion of the EU PVSEC, Amsterdam, 26th September 2017)
- 3rd European workshop on the implementation of the improved business models for RES Aggregation (on the occasion of the European Utility Week, Vienna, 6th November 2018)
- European policy workshop (Brussels, CEER, 11th February 2019)

She invited the participants to visit the BestRES project website www.bestres.eu and download the documentation developed during the three years of the project implementation.

Overview of simulation-based results - Georg Lettner (TUW)

Georg Lettner (Technical University of Vienna) presented the results from the simulations of the BestRES business models (Fig. 3).

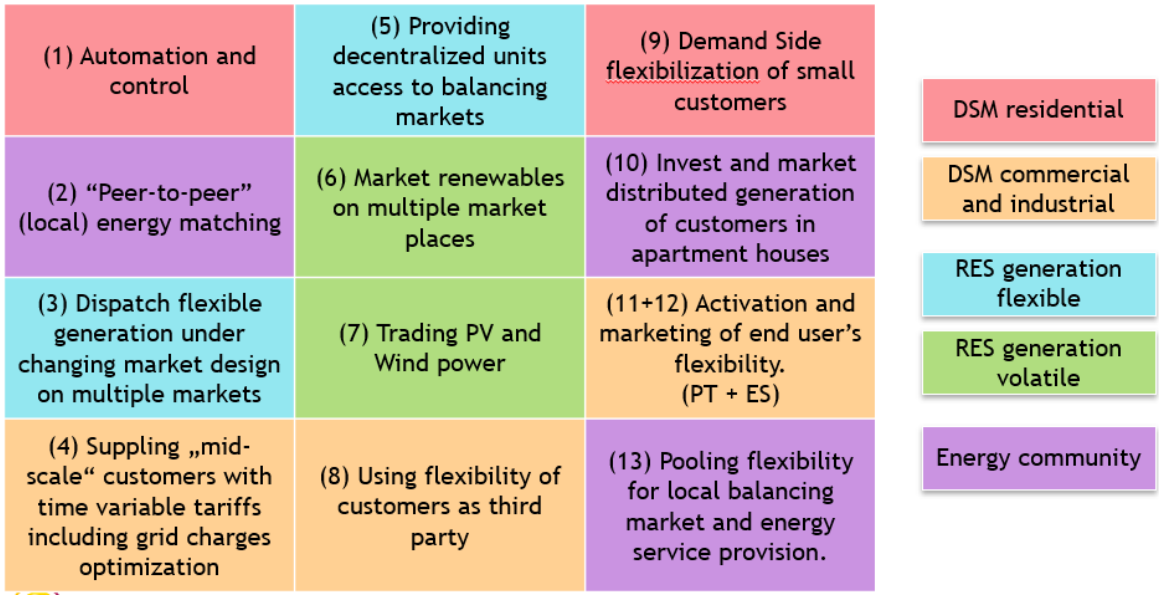

Figure 3 - BestRES business models (BMs)

He focused his presentation on business models implemented under real-life conditions, highlighting that simulations have been based on real-data for the business models:

- Automation and Control - Good Energy (UK)
- Dispatch flexible generation under changing market design on multiple markets – Next Kraftwerke (DE)
- Supplying mid-scale customers with time variable tariffs including grid charge optimization – Next Kraftwerke (DE)
- Market renewables on multiple marketplaces– Next Kraftwerke (IT)
- Trading PV and wind power from third party assets – Next Kraftwerke (BE)
- Using flexibility of customers as third party – Next Kraftwerke (BE)
- Valorize distributed generation of customers in apartment houses – Oekostrom (AT)
- Activation and marketing of end user's flexibility – EDP (PT)

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He mentioned that for the simulation-based analysis the Femto-Toolbox (developed at TUW-EEG) has been used and the following aspects have been taken into account:

- Framework for techno-economic Mixed Integer Linear Programming (MILP) optimization models and simulation models for Aggregators
- Flexibly adaptable to different technology portfolios (energy producers, energy storage systems, flexible loads, e-mobility)
- Consider (multiple) different markets (day-ahead and intraday, balancing markets)

Georg Lettner (Technical University of Vienna) closed his presentation by highlighting the key results emerging from the simulations:

- Using demand side flexibility to react on price signals (flexible tariffs, expected imbalances, market prices) can create value and reduce cost for the customers.
- The profitability of DSM business models depends very much on the characteristics and availability of the flexibilities and the prices
- For flexible RES producers (like biogas power plants) balancing markets are more suitable than energy-only markets due to high short-run marginal costs.
- The feasibility of business models with volatile RES production depends on the opportunity cost: Market value vs end user bill.
- No clear recommendation between intraday and imbalance market could be identified for forecast errors of volatile RES.
- 3rd party activation of flexibility can contribute to agent engagement and total system flexibility but requires bilateral contracts or a suitable legal framework.

Implementation of aggregation business models in Europe: selected experiences - Simon De Clercq (3E)

Simon De Clercq (3E) provided the participants with the results from selected case studies on real-life implementation of business models for RES aggregation.

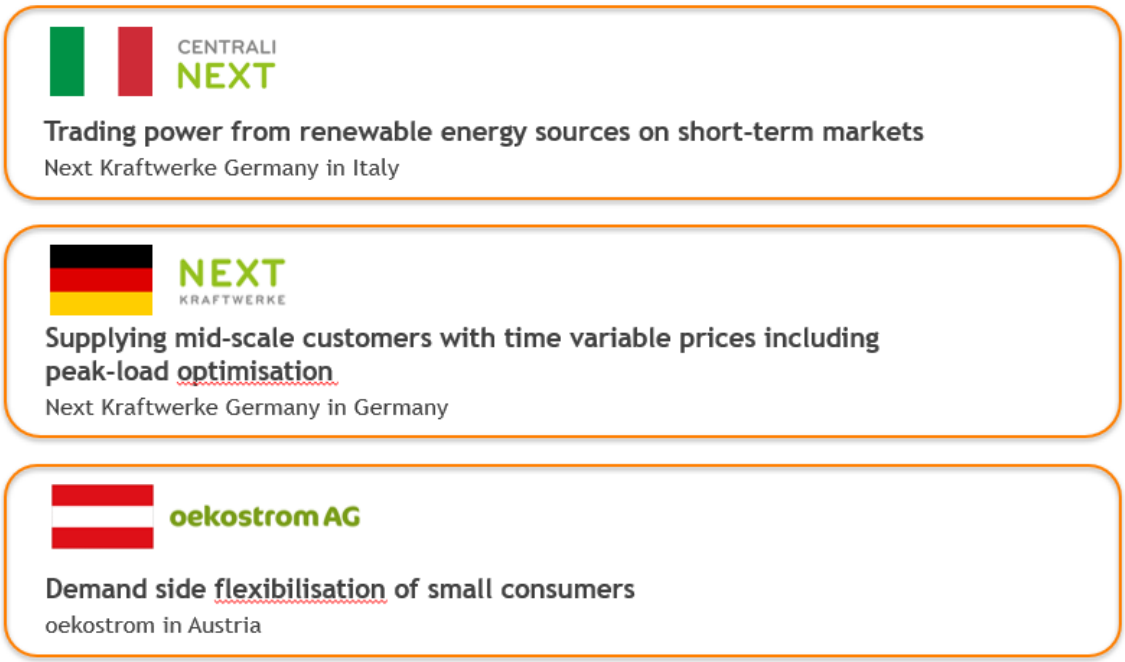

Figure 4 - Selection of BestRES business models (BMs)

The details of the selected business models are shown in Fig. 5.

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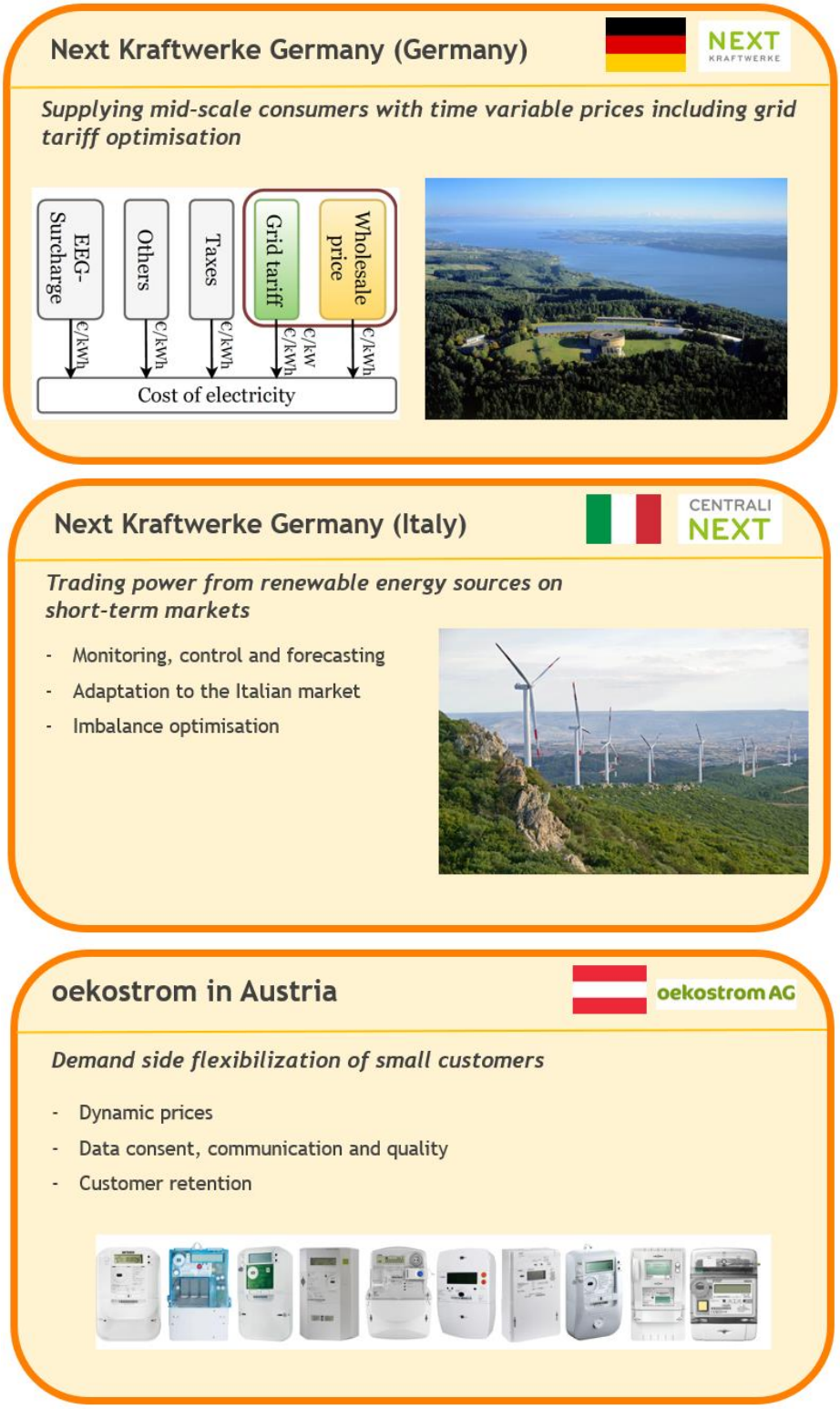

Figure 5 – Selected business models

Simon De Clercq (3E) mentioned that a successful aggregation Business Model should offer a solution that is compatible with a wide range of assets or customer types to maximise the addressable market. The Business Model should at the same time be adapted to the size of the customer and to the relevant national and or regional context.

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Offering a competitive price and limiting the asset owner's risk is the most important value proposition for the clients of aggregation business models. Valorisation of assets in all short-term and long-term markets hedges the customer's risk of price volatility in power markets.

Offering a combined set of services (electricity supply, flexibility services, trading of Guarantees of Origin) to create a one-stop-shop for customers is a successful way of integrating the role of aggregators in European electricity markets. A general lesson learnt is that large-scale data analysis is the key to deal with the complexity of decentral and renewable electricity sources.

Aggregation BMs require a clear revenue sharing model in which the monetary benefits are shared between the aggregator and the customer. Country-specific subsidy schemes, tariff components, access to balancing markets and legal metering requirements significantly affect the opportunities for aggregators in specific electricity markets.

Aggregation: key to unlock decentralized flexibility - Elias De Keyser (Next Kraftwerke Belgium)

Elias De Keyser (Next Kraftwerke Belgium) provided the participants with a presentation on the key role of virtual power plants in the provision of flexibility for decentralized renewable energy units.

He highlighted that flexibility in the energy system is more and more needed nowadays due to the changes of the energy landscape, which has to adapt itself to the rise of intermittent generation, decentralized power production and the regionalization of the electricity sector (Fig. 6).

Figure 6 - Trends in the energy sector

These changes represent a challenge for the operators of the AC-grid which have to guarantee a stable frequency of the grid to safeguard the balance of the energy system. At the time being several options can be implemented to stabilize the grid (Fig. 7).

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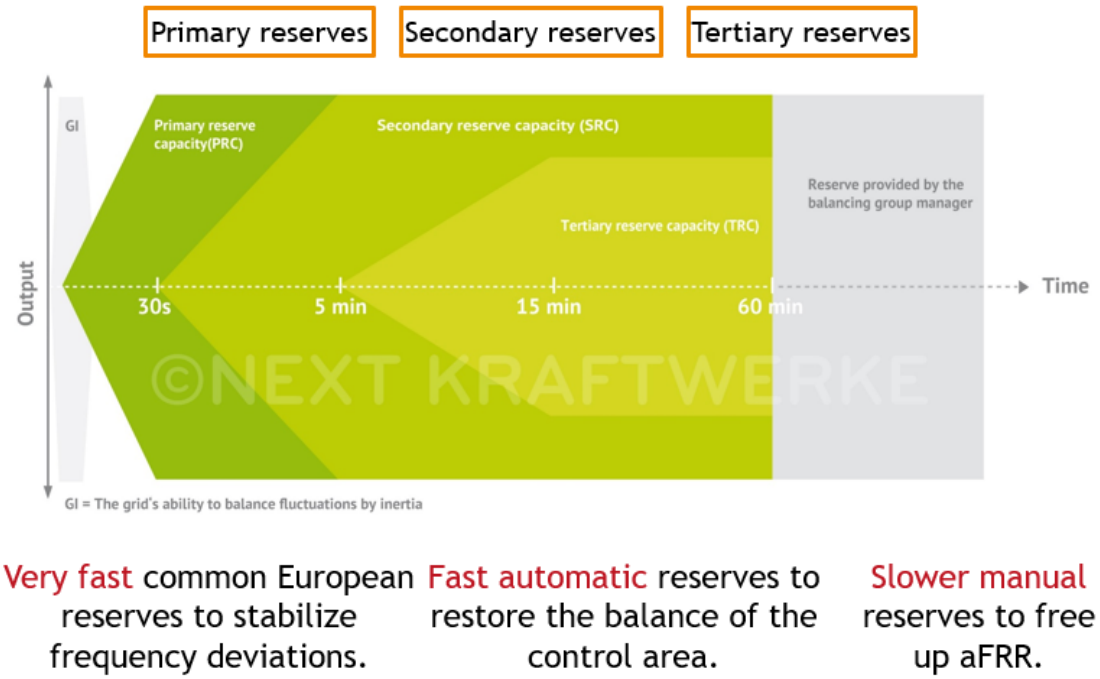

Figure 7 - Restoring the balance

Elias De Keyser (Next Kraftwerke Belgium) highlighted that new solutions must be implemented to face the challenges in this transitional. Flexibility is the key.

Flexible *adjective*

flex·i·ble | \ ˈflek-sə-bəl \

characterized by a ready capability to adapt to new, different, or changing requirements

Decentralized renewable energy units can reduce imbalances by pooling and provide system services with small-scale flexibility (Fig. 8).

Figure 8 - Restoring the balance via decentralized renewable energy units

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The key technology to ensure the provision of flexibility through decentralized renewable energy units is the virtual power plant, which is defined as

> *technology platform that connects distributed energy resources to markets and services which they might otherwise not have access to*
> (Reference: Bloomberg New Energy Finance)

Aggregation of decentralized renewable energy units is made possible through digitalization (Fig. 9), which makes possible the access to new markets and services otherwise not accessible for decentralized renewable energy units (Fig. 9 and 10).

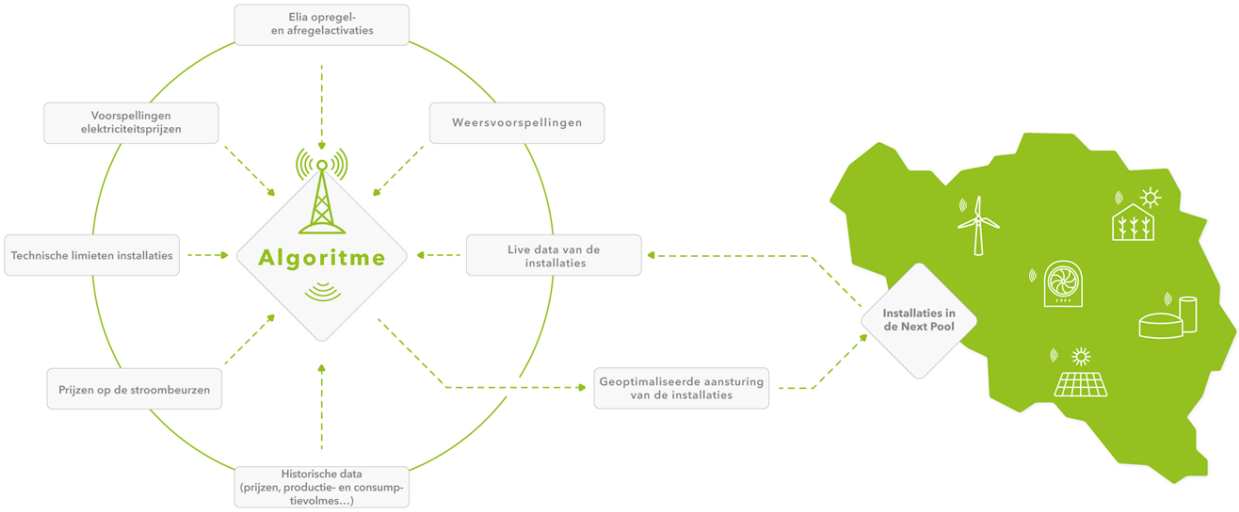

Figure 9 - Aggregation though digitalization: virtual power plant

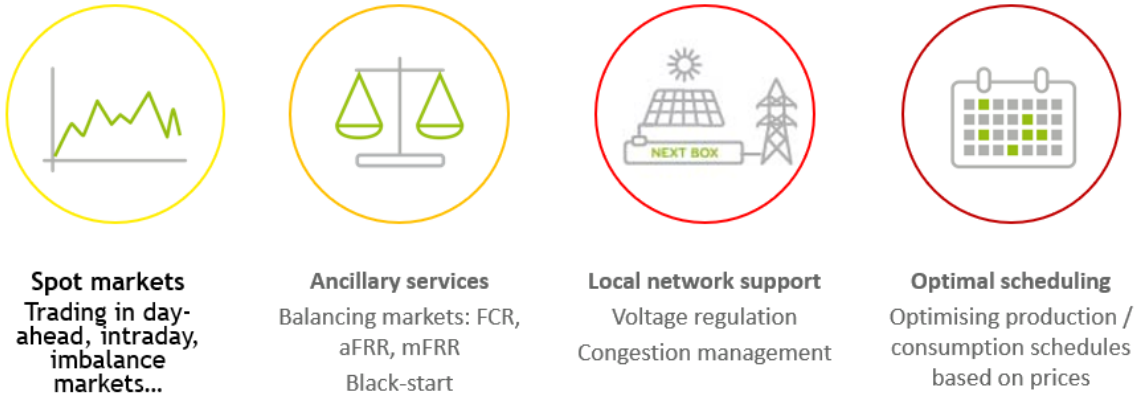

Figure 10 - Access to markets and services

Elias De Keyser (Next Kraftwerke Belgium) mentioned that Next Kraftwerke operates one of the largest VPPs in Europe with 8 countries covered, 6100 units connected, and 6 GW of flexibility provided (Fig. 11).

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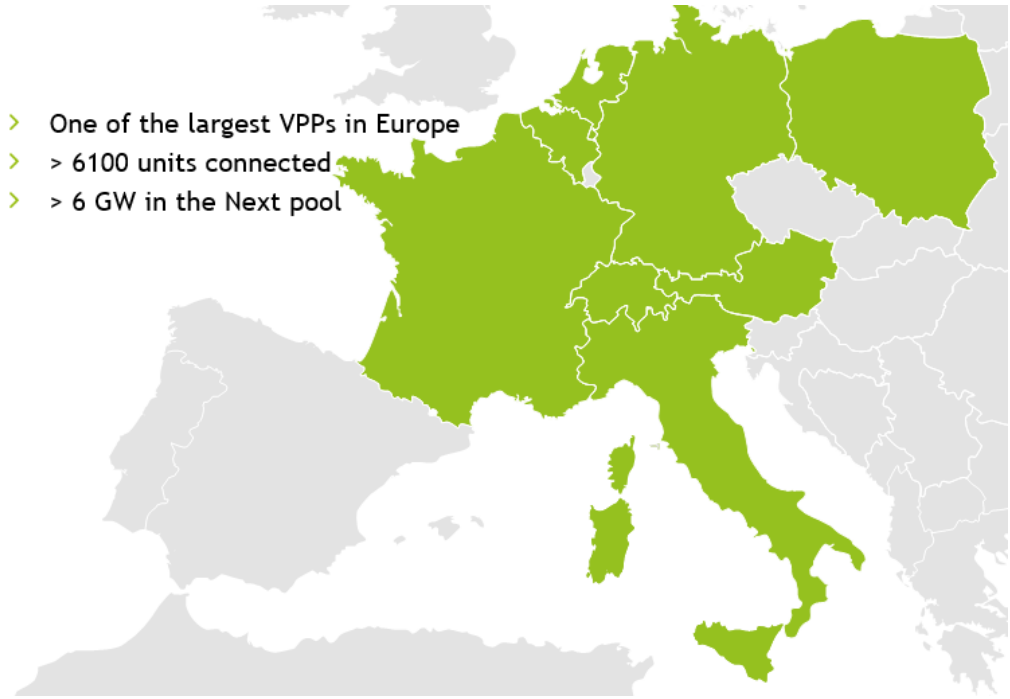

Figure 11 – Next Kraftwerke countries outreach

Energy power trading on spot market and the provision of ancillary services is already a reality for decentralized renewable energy units operating as virtual power plants (Fig 12, 13 and 14).

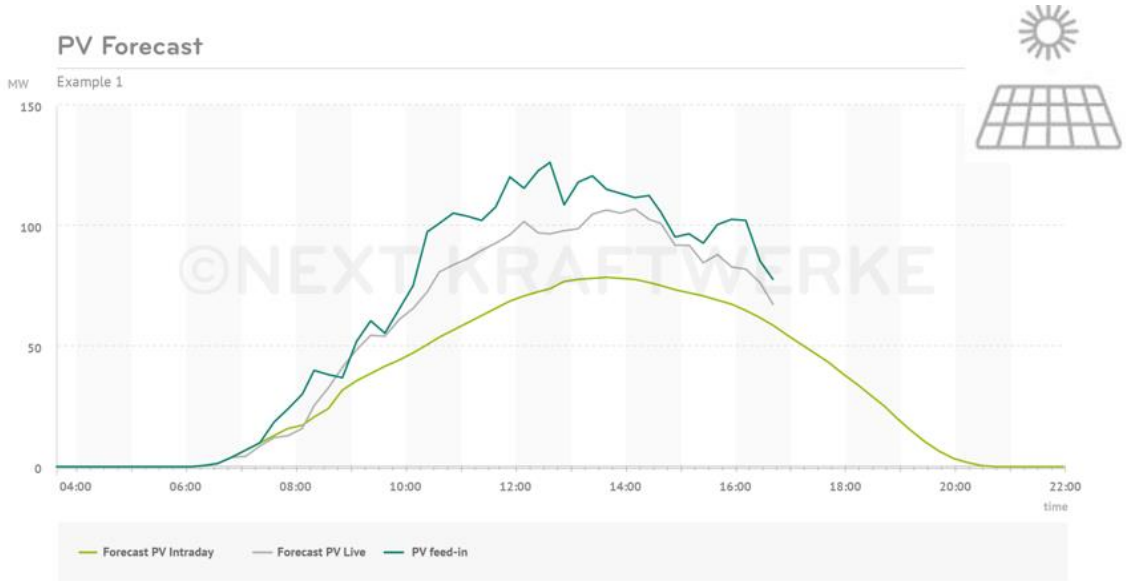

Figure 12 – PV power trading on spot markets

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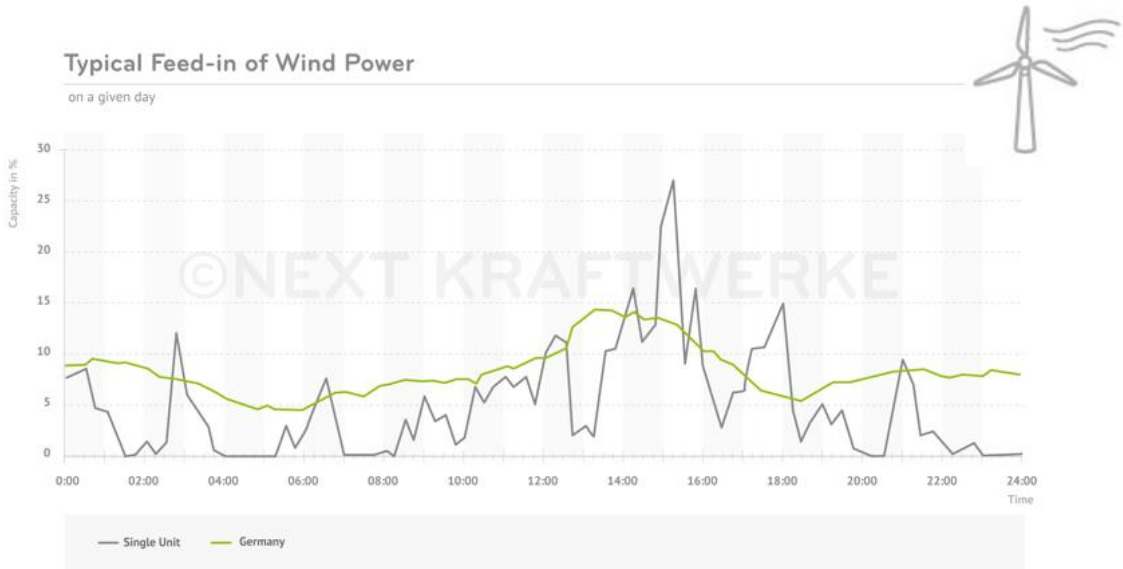

Figure 13 – Wind power trading on spot markets

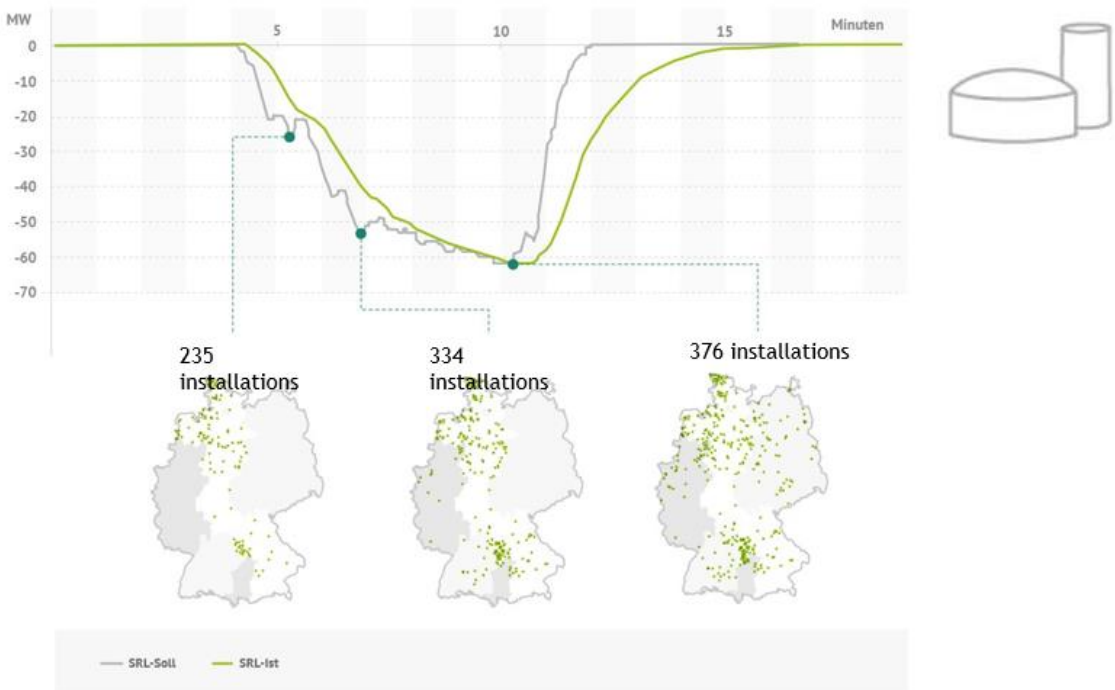

Figure 14 – Provision of ancillary services in secondary reserve market

Elias De Keyser (Next Kraftwerke Belgium) closed his presentation by providing some conclusions to the next steps to be done in this phase of energy transition.

He mentioned that electricity system requires flexibility and we can use decentralized renewable assets to provide that flexibility. VPPs are the enablers since they cluster decentralized renewable energy units and automatically dispatch the generated renewable electricity.

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Session II: Overview on Legal & Policy Issues

Moderator: Silvia Caneva, Senior Project Manager – WIP Renewable Energies

Silvia Caneva (WIP) opened the second session of the BetRES policy workshop by sharing with the participants the apologies from Georgia Rambelli (ICLEI) and Doerte Fouquet (Becker Buttner Held) who could not attend the workshop. She invited Fabian Pause (SUER) to come at the stage for his presentation on the enabling legal and regulatory conditions for the uptake of business models for renewable energy aggregation.

Enabling legal and regulatory conditions for the uptake of business models for renewable energy aggregation - Fabian Pause (SUER)

Fabian Pause (SUER) summarized for the participants the steps which led to the identification of the legal and regulatory conditions for the uptake of the business models for renewable energy aggregation:

- Comprehensive analysis of existing barriers for aggregation in countries of project partners (D2.3, Legal and regulatory barriers with a national and European perspective, August 2016)
- Assessment of legal and regulatory barriers for implementation of each of the 13 improved business models (D4.1, September 2017)
- Assessment of the impact of Clean Energy Package on legal and regulatory barriers for aggregators (September 2018)

The national barriers have been highlighted for each business models analyzed during the BestRES project (Fig. 15).

	Access to the balancing market	Customers' data access	Network charges/ Grid tariff flexibility
UK (BM 1 & 2)			X
Germany (BM 3 & 4)			X
France (BM 5)	X		
Italy (BM 6)	X		
Belgium (BM 7 & 8)	X		X
Austria (BM 9 & 10)		X	
Portugal & Spain (BM 11 & 12)	X	X	
Cyprus (BM 13)			

Figure 15 – Identification of barriers

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Fabian Pause (SUER) provided an overview of the main legal and regulatory barriers preventing the implementation of the business models for RES aggregation:

- Market rules in general, market participation in particular
- Wholesale and network tariffs
- Inadequate national support schemes for RES and market "not fit for RES"
- Lack of provisions on local settlement of generation and self-consumption
- Need of standardization, lack of standards and processes for interactions between market actors
- Lack of data provision/access and data forwarding
- Lack of clear rules for data and privacy protection

He focused then his presentation on the main points of the legal framework for aggregation provided in the Clean Energy Package:

- non-discriminatory market access for all resource providers and electricity customers, […] facilitate aggregation of distributed demand and supply (Art. 1 IEM-Reg.))
- Customers should be allowed to make full use of the advantages of aggregation of production and supply (Recital 40 IEM-Dir.)

He highlighted that the new definition of aggregation is based on two pillars:
- Aggregation means a function taken by a natural or legal person that combines multiple customer loads or generated electricity for sale, for purchase or auction in any electricity market. (Art. 2 No. 14 IEM-Dir.)
- Independent aggregator means a market participant that performs aggregation that is not affiliated to its customer's supplier. (Art. 2 No. 15 IEM-Dir.)

Fabian Pause (SUER) provided the participants with an overview of the possible functions of the aggregators as defined in the Clean Energy Package (Fig. 16).

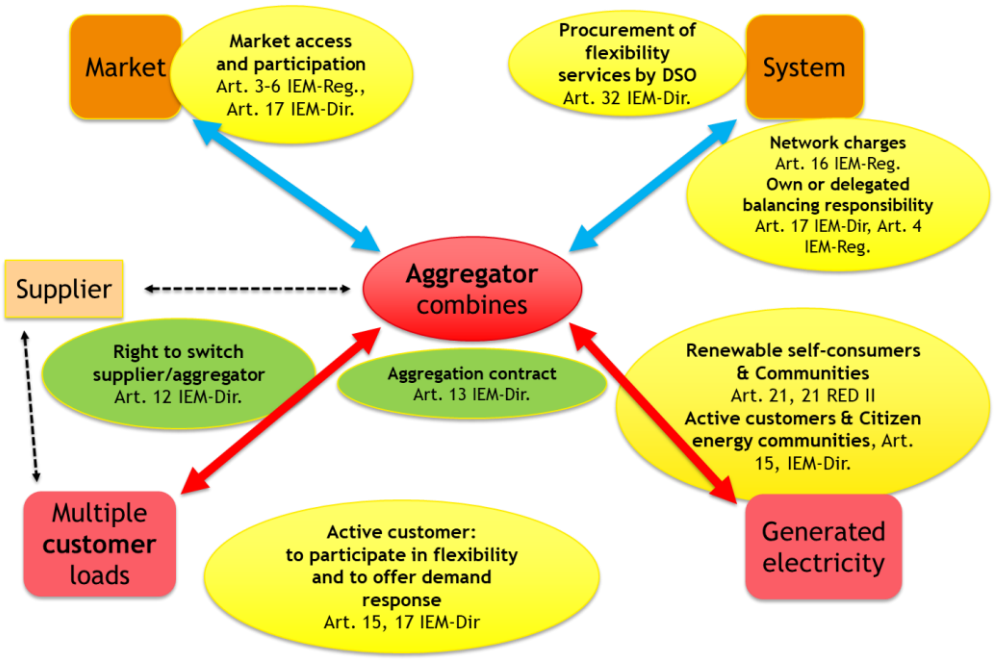

Figure 16 - Aggregators as enabling intermediaries

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He highlighted the new framework for RES and local settlement of generation and self-consumption of the Clean Energy Package. He mentioned that we are moving from a centralised to a decentralised concept for energy production and this requires a new legal framework for the promotion of RES.

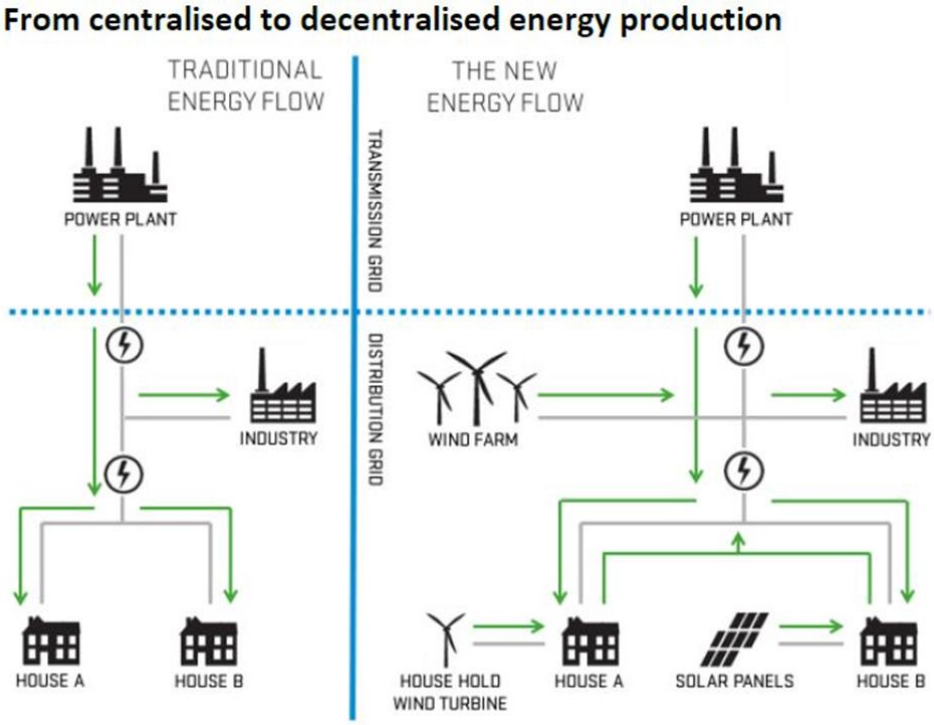

Figure 17 – The pathway to decentralized energy production

He summarised for the participants the key points of the Clean Energy Package related to the new legal framework for RES highlighting the link to the aggregation.

Renewables self-consumers, Art. 21 RED II:

- Are, individually or through **aggregation**, entitled to generate renewable electricity, including for their own consumption, store or sell their excess production of such electricity, including through renewables PPA, electricity suppliers and peer-to-peer trading arrangements, […]
- Enabling framework of MS shall grant renewables self-consumers, for self-generated renewable electricity that they feed into the grid, non-discriminatory access to […] all electricity market segments.

Renewable energy communities, Art. 22 RED II, are entitled:

- to generate, consume, store and sell renewable energy, including through power purchase agreements;
- access all suitable energy markets both directly or through **aggregation** in a non-discriminatory manner.

Active customers, Art. 15 IEM-Dir. are entitled to:

- operate either **directly or through aggregation**;
- sell self-generated electricity including through PPAs;
- participate in flexibility and energy efficiency schemes.

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Active customers, Art. 15 IEM-Dir. are financially responsible for imbalances they cause in electricity system; to this extent they shall be balance responsible parties or shall delegate their balance responsibility.

Member States shall ensure that CEC (Citizen energy communities (CEC), Art. 16 IEM-Dir.):

- can access all electricity markets either directly or through **aggregation** in a non-discriminatory manner;
- are treated in a non-discriminatory and proportionate manner with regard to their activities, rights and obligations as final customers, generators, suppliers, distribution system operators or market participants engaged in aggregation;

A citizens energy community can be engaged in electricity generation, distribution and supply, consumption, **aggregation**, storage or energy efficiency services […]; CEC shall be financially responsible for imbalances they cause in the electricity system; to this extend they shall be balance responsible parties or shall delegate their balance responsibility.

Fabian Pause (SUER) closed his presentation with an overview of the main conclusions from the analysis and assessments carried out during the BestRES project:

- Aggregators = enablers for market access of consumers/prosumers.
- Non-discriminatory market access for aggregators is an important topic in the Clean Energy Package.
- Renewable self-consumers/energy communities and Active consumers/Citizen energy communities allow new business models for aggregators.
- Access to and exchange of data crucial for aggregators (negative: not explicitly mentioned as eligible parties in Art. 23 IEM-Dir.); high level of protection of customers' data to be kept.
- An open balancing market (especially aFRR) for all technologies very important for flexibility business models.
- Technological progress, esp. in the area of smart meter, facilitates access to customers' data and its protection.
- The regulatory design of network tariffs and grid charges should foster the use of renewable energy and flexibility.

RES Aggregators as Enablers or Prosumers? Leigh Hancher (FSR)

Leigh Hancher (Florence School of Regulation, FSR) focused her presentation on the role of aggregator in the new energy market. She highlighted that the concept of aggregation can create value by closing the gaps of information and by facilitating the engagement with customers.

New markets have opened to new tasks and consequentially to new players:

- Electric Service Providers
- Balance responsible parties
- Brokers

She highlighted that we must ask ourselves whether aggregation delivers value at the whole system, which is highly dependent on the regulatory and technical context.

In order to attract multiple aggregators, the market should be appealing for them.

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We are in a phase of transitory aggregation which includes:
- Management of complexity
- Closing information gaps
- Engaging power system agents
- Coordinating agents for system operations

It is important to avoid opportunistic aggregation, which may be encouraged by current regulations and generate:
- Inadequate regulations for procurement of balancing services
- Flaws in the allocation of balancing cost
- Inefficient locational prices and network charges

The Commission´s view - Manuel Sánchez (EC) & Mikolaj Jasiak (EC)

Manuel Sánchez (Team leader for Smart Grids, European Commission, DG Energy) closed the workshop with an intervention on the commission´s view in regard to renewable energy aggregation.

He highlighted that aggregation of flexibility is not the target. The target is to push the use of renewables and improve energy efficiency. The way we generate energy is changing and the flexibility can bring economic benefits to the consumers. Flexibility has to be seen as a new opportunity. The potential of flexibility in Europe can be quantified as 60 GW. Today only 10% of this potential is deployed. Obstacles must be removed to fully deploy the potential of energy flexibility. The main areas to be addressed are technology, market and legislation, as done in the BestRES project.

The technology is already available and can help us make the system more efficient. Being able to get data from all around Europe through a virtual power plant is a huge value. Installation of smart-meters are the pre-conditions. He stressed on the fact that aggregators should have access to all energy markets without the permission of the suppliers. Several barriers still have to be removed to make this possible. The Clean Energy Package's intention is to remove barriers. A political agreement among the Council and the Parliament has been reached in December 2018, now it is under revision and will be discussed again in March. By April 2019 the final regulation should be ready.

Manuel Sánchez Jiménez (EC) mentioned that the BestRES Consortium has done a remarkable work, but in the consortium some key stakeholders are missing, such as DSOs, TSOs and traders. Silvia Caneva (WIP) mentioned that DSOs and TSOs are members of the BestRES Advisory Board and represented by EDSO for Smart Grids and ENTSO-E, while the aggregator Next Kraftwerke partner of the BestRES Consortium is also a trader.

Manuel Sánchez (EC) has invited to the stage his colleague Mikolaj Jasiak (EC) to provide the participants with further highlights. Mikolaj Jasiak (EC) mentioned that the role of energy communities as aggregators should be explored further. Aggregation is a commercial activity. Member States recognise aggregation, but its actual implementation depends on National regulations. It is fundamental to shift from a concept of "market by label" to "market by function". Legislation should be flexible to allow space for non-regulated activity. National and EU regulations are interrelated also for the flows of data and therefore data privacy and data protection which is regulated by the GDPR, the General Data Protection Regulation. Therefore, there should be a common interpretation in the Clean Energy Package.

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Wrap up & Conclusion

Silvia Caneva (WIP) thanked all the presenters for their interesting presentations and the audience for their valuable input, and to Dr. Jens Merten for his moderation of session I and Dr. Manuel Sanchez for his intervention which highlighted the key points of the workshop and provided a relevant feedback for the finalisation of the BestRES project.

Silvia Caneva (WIP) closed the workshop informing the participants that the minutes and presentations will be available soon on the respective project´s websites: www.bestres.eu.

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Agenda of the Workshop

13:00 – 14:00	**Registration & Networking Lunch**	
14:00 – 14:10	**Introduction to the Workshop**	
Session I - Overview on Technical Issues ***Moderator: Jens Merten, CEA – French Alternative Energies and Atomic Energy Commission*** ***LITEN – Institute of Technologies for New Energies*** ***Program Manager Solar Technology Division***		
14:10 – 14:30	**BestRES project overview**	Silvia Caneva, WIP – Renewable Energies
14:30 – 14:50	**Overview of simulation-based results**	Georg Lettner, Technical University of Vienna
14:50 – 15:10	**Implementation of aggregation business models in Europe: selected experiences**	Simon De Clercq, 3E
15:10 – 15:30	**Aggregation: key to unlock decentralized flexibility**	Elias De Keyser, Next Kraftwerke Belgium
15:30 – 16:00	**Coffee break**	
Session II - Overview on Legal & Policy Issues ***Moderator: Giorgia Rambelli, ICLEI – Local Governments for Sustainability*** ***Coordinator Sustainable Resource, Climate and Resilience*** ***PROSEU Project – Prosumers for the Energy Union***		
16:00 – 16:20	**Enabling legal and regulatory conditions for the uptake of business models for renewable energy aggregation**	Fabian Pause, SUER - Foundation for Environmental Energy Law
16:20 – 16:40	**The new European electricity market design- RES Aggregators as Enablers or Prosumers ?**	Leigh Hancher, Florence School of Regulation
16:40 – 17:00	**The role of renewable energies in the future electricity market**	Doerte Fouquet Becker Buttner Held
17:00 – 17:20	**The Commission´s view**	Manuel Sánchez Jiménez, European Commission
17:20 – 17:30	**Wrap-up & Conclusions**	

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Technical references

Project Acronym	BestRES
Project Title	Best practices and implementation of innovative business models for Renewable Energy aggregatorS
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* PU = Public

PP = Restricted to other programme participants (including the Commission Services)

RE = Restricted to a group specified by the consortium (including the Commission Services)

CO = Confidential, only for members of the consortium (including the Commission Services)

v	Date	Beneficiary	Author
1.0	22.02.2019	WIP	Silvia Caneva
2.0	26.02.2019	SUER	Fabian Pause
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