FLEXIBILITY SERVICES FOR ENERGY COOPERATIVES

An overview of possible flexibility-based services using residential equipment control

RESCOOP.EU

FLEXCoop

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RESCOOP.EU

REScoop.eu is the European federation of citizen energy cooperatives, representing over 1,500 cooperatives and their 1 million citizens. REScoop.eu was one of the partners of the FLEXCoop project. With this document, REScoop.eu aims at sharing interesting insights from the project to its membership and beyond.

FLEXCoop *Demand-side flexibility tools opening new business models for energy cooperatives.*

This document is published as part of the FLEXCoop project and presents selected findings on accessible new business models for energy cooperatives. FLEXCoop was an EU project financed by the Horizon2020 research and innovation programme. FLEXCoop's objective was to contribute to democratizing energy markets through the introduction of innovative flexibility-based demand response tools and novel business and market models for energy cooperatives. FLEXCoop was a project led by a consortium of 13 organisations and ran from October 2017 to January 2021.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement No 773909.

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EXECUTIVE SUMMARY

The electricity market is at the beginning of a new era. Over the coming decades, it will change from a market characterized by commodity-oriented business models towards a market with a completely new set of digital services which will support an (even) more dynamic energy grid, largely based on renewable energy resources.

"Flexibility services will enable cooperatives to keep on being the pioneers of the energy transition."

Wind and solar energy are variable resources, and for this reason we need flexible ways to integrate them into our decentralised energy system. With the help of digital technologies, a set of new roles and activities have emerged to achieve such a decentralised system: aggregators and Energy Service Companies (ESCOs) are the key players to valorise consumer resources (demand-side) and improve their use through demand-side flexibility services.

Demand-side flexibility services may support (collective) self-consumption, aggregation for transmission and distribution services or the balancing of an energy retailer's portfolio. Digitalisation also brings along the possibility to develop service platforms such as local flexibility markets or a marketplace for electricity services.

Moreover, the energy transition offer opportunities for new electricity market actors. Cooperatives and citizen energy communities may have an important role to play due to their ability to mobilise citizens beyond commercial offers.

Two FLEXCoop case studies will be used to illustrate the new opportunities for energy cooperatives to engage in flexibility services. Som Energia, a cooperative retailer based in Catalunya (Spain) uses demand-side flexibility to maximise self-consumption and offer reduced retail electricity prices. ODE Decentraal, now referred to as Energie Samen, is the national federation of Dutch energy cooperatives. Together with two of their members they are aggregating loads as resources to use on balancing reserves of Transmission System Operators (TSO).

Finally two important players in the EU market are providing their insights on some key elements for successful demand-side flexibility services.

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ABBREVIATIONS

AFRR	automatic Frequency Regulation Reserves
BRP	Balance Responsible Party
BSP	Balancing Service Provider
CEC	Citizens Energy Community
DER	Distributed Energy Resources
DSO	Distribution System Operator
ESCO	Energy Service Company
EV	Electric Vehicle
E-mobility	Electric mobility
MV/LV	Medium Voltage/ Low Voltage
NECP	National Energy and Climate Plan
OSB	Open Smart Box
PV	Photovoltaic
REE	Red Electrica de España, the Spanish TSO
RES	Renewable Energy Source
SME	Small and Medium Enterprises
T&D	Transmission and Distribution
TSO	Transmission System Operator

FOREWORD

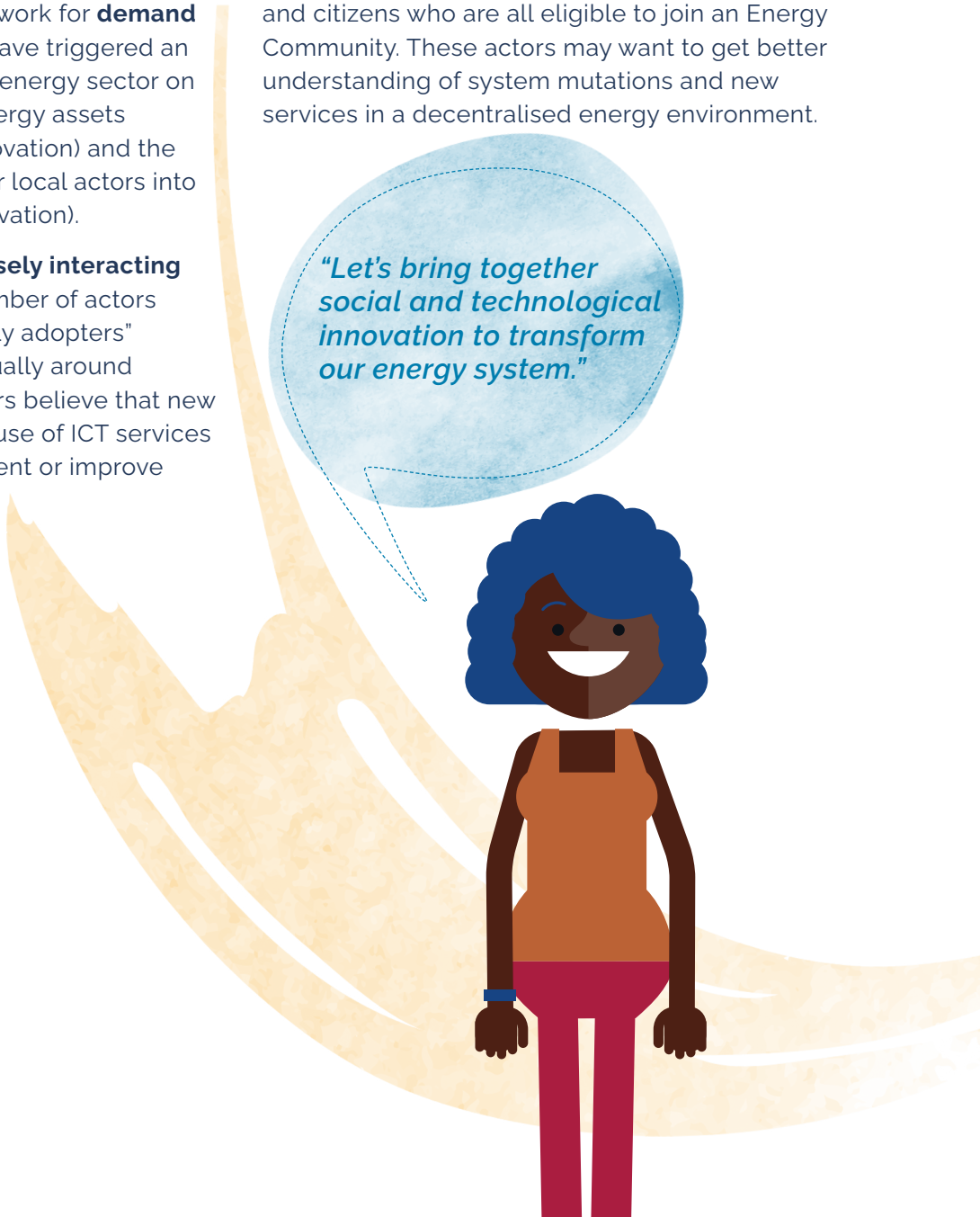
With the publication of the **Clean Energy for All Europeans Legislative Package**, the European institutions recognised the role for prosumers in tomorrow's energy system.

The two main innovations of this important legislative package are the introduction of the concept of **"Energy Community"** (e.g., Renewable Energy Community and Citizen Energy Community) and the development of a framework for **demand response**. These two concepts have triggered an interesting discussion within the energy sector on the role of digital services for energy assets management (technological innovation) and the involvement of citizens and other local actors into the energy transition (social innovation).

These two debates are also closely interacting with one another. A growing number of actors see Energy Communities as "early adopters" of innovative digital services (usually around self-consumption) whereas others believe that new technologies and the simplified use of ICT services provide opportunities to implement or improve energy transition projects.

This report aims to facilitate the dialogue between these two communities by clarifying the opportunities and the challenges that flexibility-related business models may bring along.

Our report mainly targets energy cooperatives and their members, but we are convinced that it also adds value to SMEs (including start-ups), local authorities (including cities and municipalities) and citizens who are all eligible to join an Energy Community. These actors may want to get better understanding of system mutations and new services in a decentralised energy environment.



1

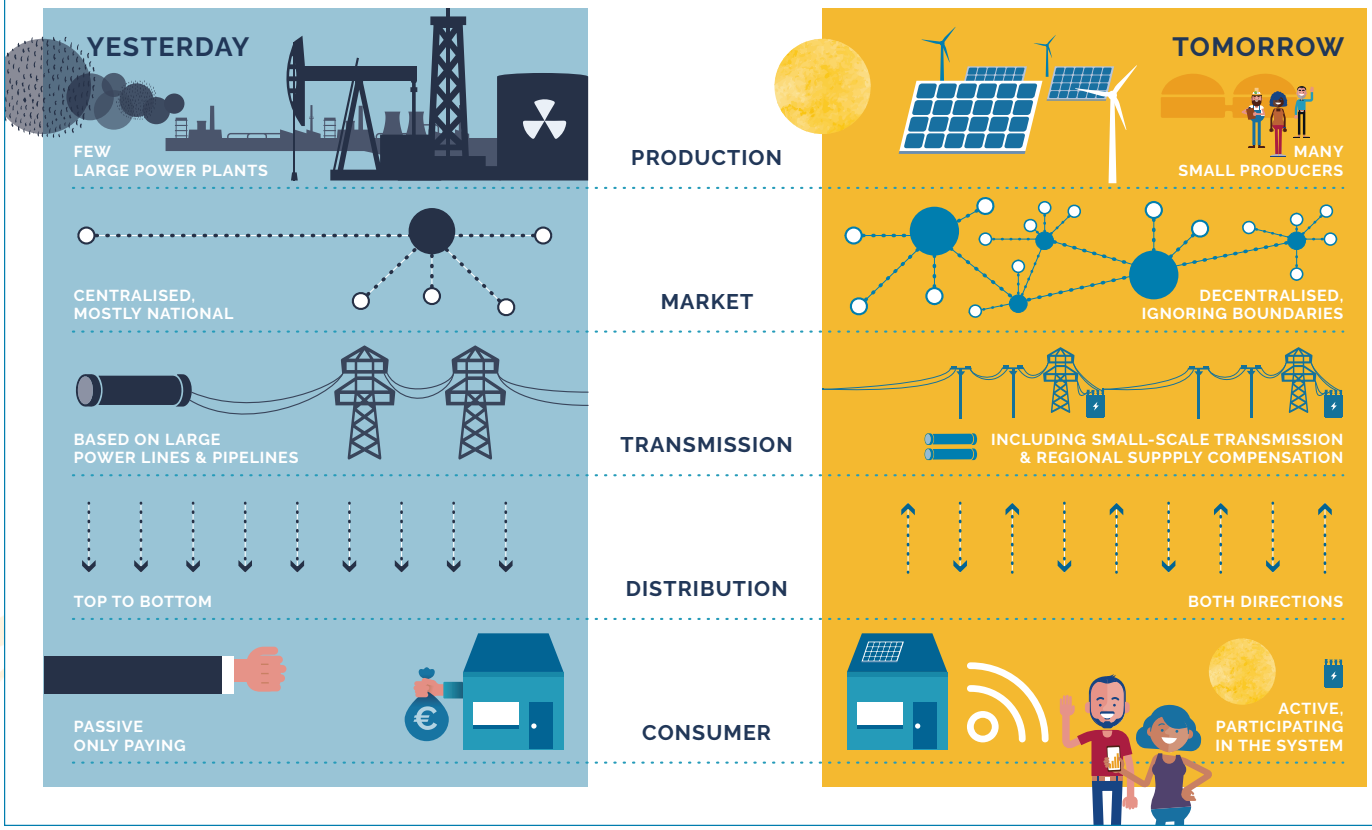
INTRODUCTION

WHY DO WE NEED "FLEXIBILITY"?

The electricity system that we inherited since the Industrial Revolution largely consists of big and centralised electricity generation plants. Most of them use fossil fuels and nuclear energy to produce electricity. In the old systems, the electricity generation depends on people's consumption. This means that each time you switch on the lights, or turn on an appliance, the impact on the electric system will command additional generation and as a consequence electricity being injected into the grid. This cascading logic is now being severely challenged. Massive releases of CO_2 into our atmosphere put the climate stability at risks and commands us to reduce our emissions. Renewable energy sources (RES) are key to answer this challenge. However, renewable energy doesn't work like fossil fuel. Solar panels produce electricity when the sun shines, wind turbines produce electricity when the wind blows – and this isn't always the case. For sure these flows (of sun radiations or of wind) can be anticipated with weather forecasts, but they cannot be commanded. In order to ensure we can still have access to electricity whenever we need it, we need to find new ways to manage our energy. We need to be able to be flexible and to adapt to these new generation patterns. This can be done in three ways:

- generation (with dispatchable RES resources like hydropower or biomass),
- storage (chemical storage like batteries or physical storage like pumped hydro),
- demand-side flexibility.

FIGURE 1: **CENTRALISED VERSUS DECENTRALISED SYSTEM FEATURES**



DEMAND-SIDE FLEXIBILITY IS A KEY RESOURCE FOR A RENEWABLES-BASED ENERGY SYSTEM

When looking at the electricity generation side, most renewable energy resources are not dispatchable, and storage technologies remain expensive. Hence, the ability for consumers to change their way of consuming energy is key to move towards a renewable energy-based electricity system.

Indeed, consumers may own devices that can be operated in different ways to support grid operation. For example, the operation of a heat pump can easily get interrupted for a period of time without causing noticeable differences for the end-user.

Demand-side flexibility is defined as the ability of a customer to deviate from its normal electricity consumption (production) profile, in response to price signals or market incentives. Demand-side flexibility consists of load, demand-side generation and demand-side storage [2]. Put differently, it is the capacity for consumers to use their heat pumps, solar panels, batteries, and other appliances differently in answer to an external signal. This means that a domestic hot water tank can be programmed to heat up when the sun is shining, or that a heat pump can be automated to answer to external requests to stabilise the grid.

FIGURE 2: **"FROM GENERATION FOLLOWING CONSUMPTIONS TOWARDS DEMAND FOLLOWS GENERATION",** ACCORDING TO ELIA [1]

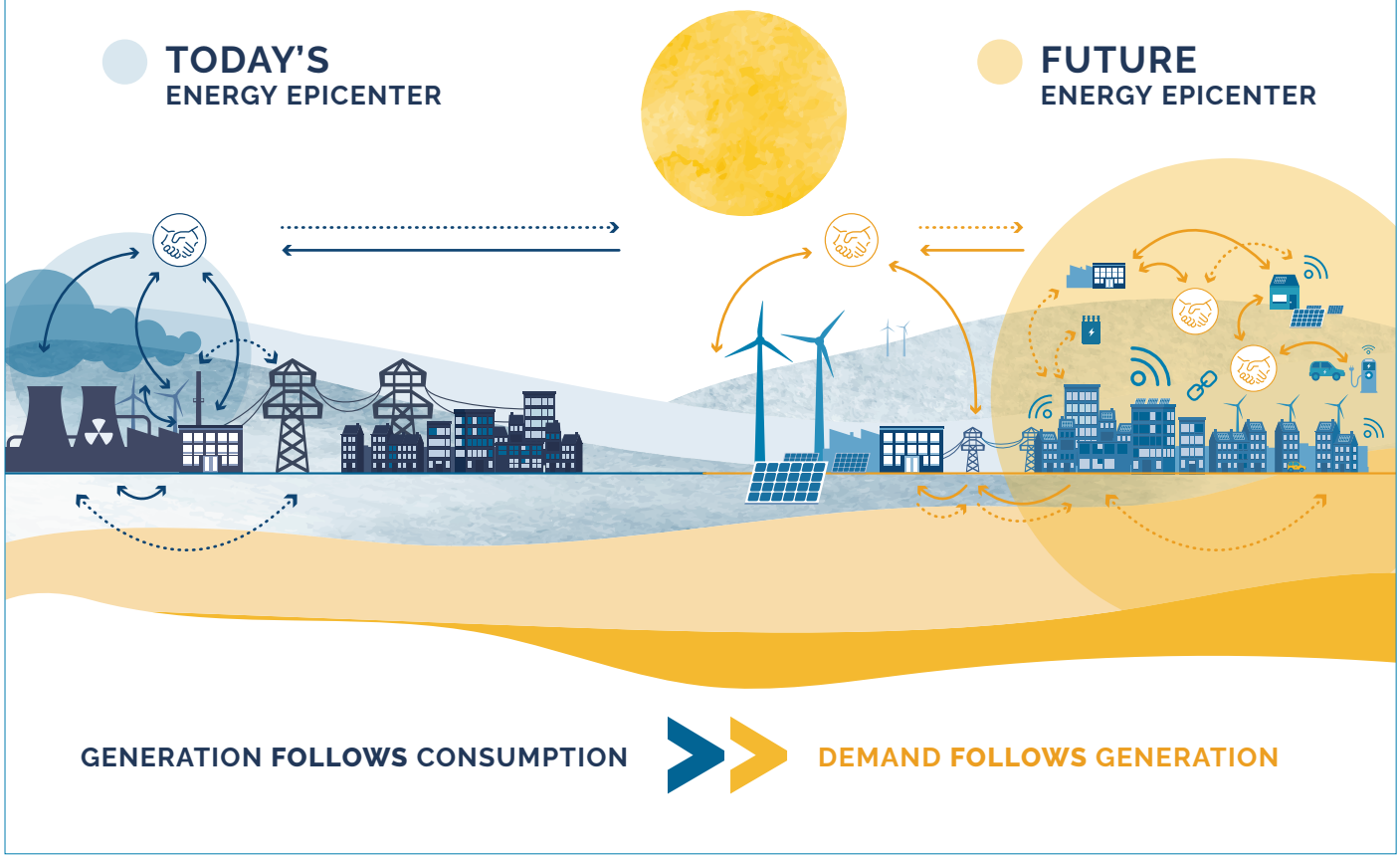


FIGURE 3: **DEMAND RESPONSE BENEFITS**

As illustrated above, shifting time of consumption may help the energy system for different reasons:

- matching the production of RES electricity (at system level, but also for self-consumption)
- contributing to the quality of electricity by keeping the frequency at the right level (50 Hz in Europe)
- supporting congestion management on the (local) grid by avoiding consumption peaks for example.

However, most consumers are not even aware that they can contribute to a renewable-based energy system. Making this possible requires dedicated services to provide tailored offers which are simple, accessible and beneficial to the user.

Renewable energy grid.
© lovelyday12

COMPANIES PROVIDING DEMAND-SIDE FLEXIBILITY SERVICES

Today, there are different entities that support consumers who are willing to use and benefit from demand-side flexibility, namely Energy Services Companies (ESCOs) and aggregators.

Energy Services Company (ESCO): a company that offers energy services which may include the implementation of energy efficiency and/or renewable energy projects, in many cases on a turn-key basis.

Aggregator: a market participant who combines multiple customer shifted consumption or generated electricity for sale, purchase or auction in any electricity market.

While executing energy efficiency measures or renewable energy projects at customers' premises, an ESCO may implement demand-side flexibility services. It can act as a self-consumption facilitator by automating 'flexible' devices to encourage consumption when electricity is generated locally.

The aggregator trades consumer's load reduction[1] on the market. In order to be usable and match the size of other resources used in the electricity markets, small flexible loads need to be combined or "aggregated". The role of the "aggregator" is therefore to create and operate a pool of loads that is capable of providing targeted services to the local Transmission System Operator (TSO), Distribution System Operator (DSO) or the wholesale market. For example, a heat pump at full power represents only little KW capacity, while the requested size for participation in the market can be 1 MW (e.g. for Dutch secondary reserves). In this example, the aggregator would have to shift the consumption of a portfolio of at least 1.000 heat pumps, all running at the same time to participate in such a scheme! An aggregator may then combine consumers with different devices (domestic hot water, electric vehicle, etc.) and different types of consumers (industrial installations or tertiary building) with different characteristics and higher consumption levels to obtain a complementary portfolio suitable for market participation.

FLEXIBILITY & ENERGY EFFICIENCY

Flexibility and energy efficiency can be combined to further support a decarbonised energy system. In practice, this means that the CO_2 footprint of a person living in a building can be reduced by:

1. reducing energy needs (energy sufficiency, e.g. reduce heating and add a sweater)
2. reducing waste (energy efficiency; e.g. improve home insulation)
3. generating and consuming electricity on-site (self-consumption, e.g. installing solar panels or a heat pump)
4. adapting your consumption to the time of energy generation (demand-side flexibility, e.g. programming domestic hot water tank for running when solar panels are producing).

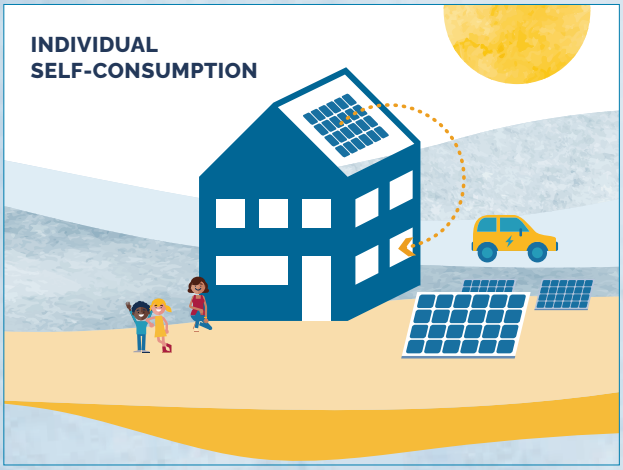
Regarding the latter, the same logic applies at system level where, beyond the building, demand response may foster and support the overall energy system (e.g. shifting consumption to times when a lot of renewable energy is available on the wholesale market).

1 Or load increase in more rare cases.

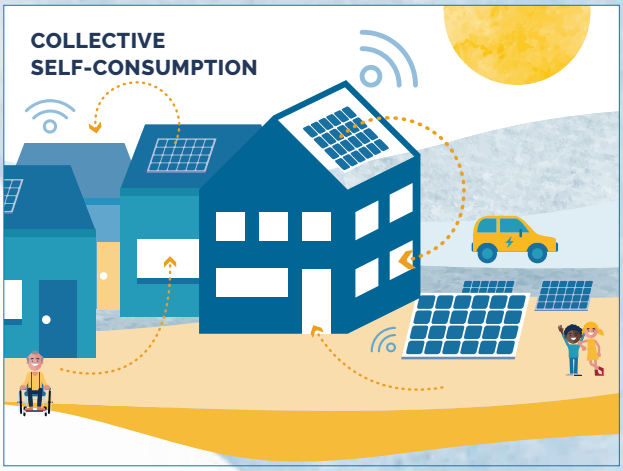
DEMAND-SIDE FLEXIBILITY OFFERS NEW OPPORTUNITIES FOR CONSUMERS

The ability to produce and consume their own electricity is already transforming some consumers into **prosumers** (**pro**ducer + con**sumer**). On top of production, consumers can now also store electricity or actively support the electricity system through demand-side flexibility.[2]

Individual self-consumption: the activity to consume electricity generated within consumers premises, typically with solar PV panels.

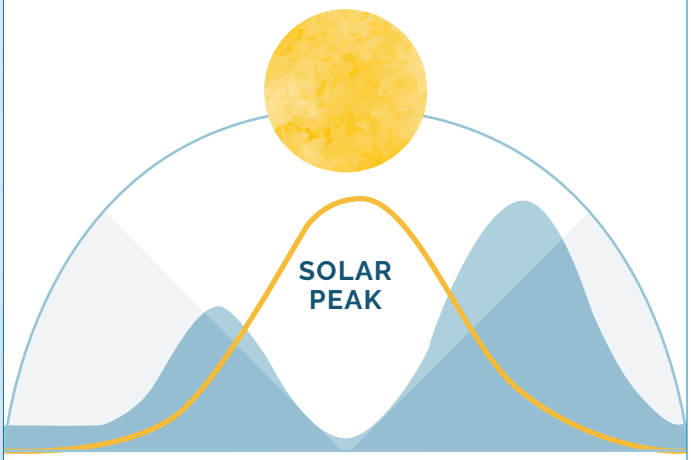


Collective self-consumption: the activity, for a group of consumers, to consume electricity generated in the premises of one or several of them, or in close proximity to where they live.



Demand-side flexibility services can enable citizens to consume more of their self-generated electricity. It helps households or communities to foresee when their energy is produced, consume their energy mostly at the times when this energy is being produced, and through this limit the import of electricity from the system.

FIGURE 4: **SOLAR PEAK GENERATION COMPARED WITH MORNING & EVENING DEMAND** ACCORDING TO BEUC [11]



2 The notion of prosumers is covered in the Clean Energy Package for All Europeans legislative package by the term 'active customers' defined in the article 2.8 of the Electricity Directive [8], including production, storage, demand response and energy efficiency.

AN OVERVIEW OF DEMAND-SIDE FLEXIBILITY SERVICES

Demand-side flexibility can enable consumers to actively support the grid and get a reward for it. Demand-side flexibility can be valorised through a set of key services:

- For its capability to balance the grid, like generation (increasing injections has the same effect as decreasing withdrawals);
- As a tool to manage grid congestion through "peak clipping";
- Or as a key feature of (collective) self-consumption, increasing energy consumed behind-the-meter.

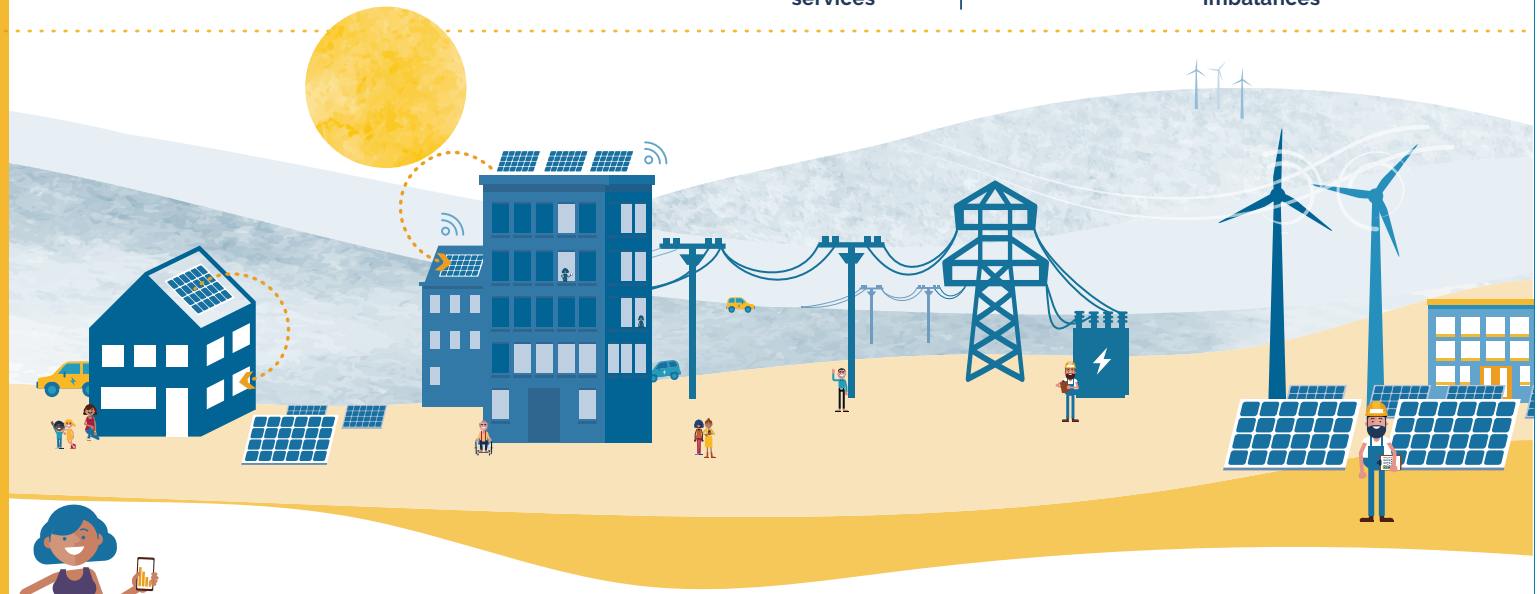
The following diagram illustrates these different services, their related service providers, their users, and the benefits these can bring to citizens.

Through these new services, electricity consumers may become important actors in the new and decentralised energy system. In the following chapters, each of these services will be explained more in detail.

FIGURE 5: OVERVIEW OF DEMAND-SIDE FLEXIBILITY SERVICES

SERVICE PROVIDER

ESCO (ENERGY SERVICE COMPANY)	ESCO (ENERGY SERVICE COMPANY)	AGGREGATOR	BRP/RETAILER (BALANCE RESPONSIBLE PARTIES)
facilitates... SERVICE			
Self-consumption	Collective self-consumption	Congestion management & other ancillary services Frequency & congestion management	• Purchasing on market's cheapest hours • Minimising retailer's imbalances



INDIVIDUAL PROSUMER	CITIZENS COLLECTIVE	DISTRIBUTION SYSTEM OPERATOR / TRANSMISSION SYSTEM OPERATOR	RETAILER
... to whom? MARKET ACTORS			
Local green energy consumed real-time Access to cheaper RES energy	Local green energy consumed real-time Access to cheaper RES energy	Supporting of a RES-based grid Extra revenues from grid services	Green energy consumed real-time Access to cheaper RES energy
.. to achieve? SOCIETY / CITIZEN BENEFITS			

2

DEMAND-SIDE FLEXIBILITY SERVICES

INDIVIDUAL SELF-CONSUMPTION

DESCRIPTION

Individual self-consumption is the ability for a single consumer to consume electricity generated on-site. It involves the capability to generate electricity locally (e.g. solar photovoltaic) and to consume this electricity either by consuming at time of generation, or by using storage.

ROLE OF THE SERVICE PROVIDER

An Energy Service Company (ESCO) can facilitate self-consumption by providing a wide range of services including conception, purchase, installation and maintenance of self-generation equipment. The ESCO may complete its offer with demand-side flexibility services, which consists of installing additional metering equipment, automating appliances and making sure electricity gets consumed whenever it is available, e.g. heating water during the day when the rooftop PV installation generates electricity instead of doing that at night.

SERVICE PROVIDER'S REVENUES

The revenues may come from the maintenance fees paid by the prosumer for the provision of self-consumption as a service.

INTERACTION BETWEEN MARKET ACTORS

The flexibility service directly benefits the consumer by increasing the share of self-consumed electricity. The consumer still needs a contract with a supplier to complement potential additional energy needs on a daily and seasonal basis. Full energy autonomy may not be interesting as it might represent a significant duplication of assets (producing more energy than is collectively needed, important storage needs, etc.) and would isolate these assets from the grid, whereas they can be connected and made useful for the overall system.

BENEFITS TO THE CITIZENS

By installing appropriate equipment and appliances, and by consuming their own self-generated electricity, citizens consume locally produced electricity from renewable resources. Hence, they become actors of the energy transition with a more sustainable lifestyle. Moreover, as the price of renewable-based electricity production and control equipment keeps falling, (collective) self-consumption may provide more and more competitive electricity prices and enable citizens to benefit from cheap renewable energy.

Summer School organised by Som Energia.
© Som Energia

CO-OPERATIVE EXAMPLES

FLEXCoop

SOM ENERGIA / SPAIN

In the frame of the FLEXCoop project, Som Energia experimented with tools aimed at helping its members who own solar PV installations to get the most out of their self-generated electricity.

www.somenergia.coop

Solar PV self-production project in Reimpuls Solar Vallès (Spain) coordinated by Som Energia. © Som Energia

Energent

ENERGENT / BELGIUM

In the cVPP project, Energent equipped homes with PV panels, batteries and a home energy management system developed by EnergieID in order to optimize self-consumption.

www.energent.be
www.energieid.be

Large roof in Ghent (Belgium) with solar panels installed and operated by Energent. © REScoop.eu

COLLECTIVE SELF-CONSUMPTION & ENERGY SHARING

DESCRIPTION

Collective self-consumption is the possibility for a group of consumers to consume electricity generated on-site, or in close proximity to where it is being produced. Collective self-consumption is an emerging concept, and legal frameworks around this vary from one country to the other. Collective self-consumption may take place in multi-tenant buildings, with buildings receiving electricity from the same transformer (medium or low voltage), or even through a "virtual connection", with a remote generation facility located in a given perimeter or area (postcode approach). Collective self-consumption using the main grid is often called "energy sharing". Furthermore, these schemes are substantively different from so called "microgrids" also known as "energy islands".

Microgrids are self-sufficient energy systems which may take place in a Closed Distribution System i.e. a system which distributes electricity within a confined industrial, commercial or shared services site and which does not supply household customers [7] (art. 38). or within the perimeter of an integrated utility (with <100K customers and therefore not subject to unbundling rules).

Microgrid management involves all system operations, including network management, real-time balancing of production and consumption, as well as all ancillary services (like voltage control or black start capability).

Citizen or Renewable Energy Communities do not benefit from specific incentives in the EU regulation to put in place microgrids. Moreover, microgrid management involves a high degree of technical complexity while presenting unclear benefits in a European context.

ROLE OF THE SERVICE PROVIDER

Similar as for individual self-consumption, an ESCO may offer a range of services, from conception to maintenance of the installation and even billing and administrative management. Demand-side flexibility services can support the monitoring and optimisation of such installations. Complexity may vary according to the number of participants, the number and type of assets used, but also the key for repartition of the energy among the different participants involved and the applicable regulation for the different types of collective self-consumption schemes (behind-the-meter optimisation or energy sharing at district level).

SERVICE PROVIDER'S REVENUES

The revenues may come from the maintenance fees paid for by the prosumers for the provision of collective self-consumption as a service, which may include the technical management and the administration of the scheme.

INTERACTION BETWEEN MARKET ACTORS

The flexibility service directly benefits the consumer. The consumer still needs a contract with a supplier to complement potential additional energy needs on a daily and seasonal basis. Full energy autonomy may not be interesting as it might represent a significant duplication of assets (oversized generation, storage, etc.) and would isolate these assets from the grid, whereas they can be used as distributed resources in a decentralised system.

BENEFITS TO THE CITIZENS

By actively installing appropriate equipment and appliances, and consuming their own self-generated electricity, citizens consume locally produced electricity from renewable resources. Hence, they become actors of the energy transition with a more sustainable lifestyle. Moreover, as the price of renewable energy-based electricity production and control equipment keeps falling, (collective) self-consumption may provide more and more competitive electricity and enable citizens to benefit from cheap renewable energy.

CO-OPERATIVE EXAMPLES

ENERGENT / BELGIUM

EnergieID aggregated energy measurements from the Energent pilot site in order to optimize battery performance to improve collective self-consumption.

www.energent.be
www.energieid.be

Energent wants to transform Sint-Amandsberg (Ghent, Belgium) into an energy neighbourhood of the future with a smart electricity network, batteries, smart meters and electric cars. © REScoop.eu

COOPÉRNICO / PORTUGAL

In the context of the Compile project, Coopérnico is setting up a multi-building collective self-consumption scheme in a residential condominium in Portugal.

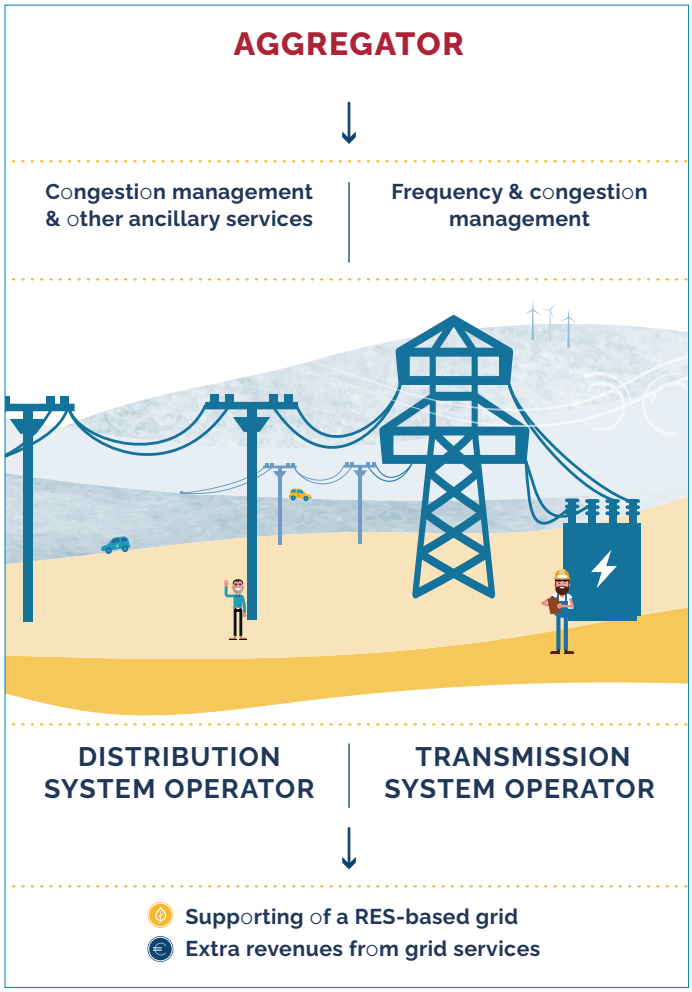
www.coopernico.org

Coopérnico members at their general assembly held in Baguim do Monte, Portugal. © Coopérnico

AGGREGATION FOR SYSTEM OPERATION SERVICES

DESCRIPTION

New communication technologies and coordination among the different actors of the energy system are now allow a series of small connected units (generation, storage, consumption) to operate simultaneously and act as a pooled resource to support the grid. Services to the grid may take place at local grid level managed by the distribution system operator (DSO) or at system level (high voltage grid managed by the transmission system operator).



ROLE OF THE SERVICE PROVIDER

An aggregator is a market actor who combines multiple customer loads (or generated electricity) in order to sell them as one single resource on the electricity market. The aggregator may be different from the retailer.

SERVICE PROVIDER'S REVENUES

The reveneues may come from the services sold to third-parties, i.e. payment from the TSO in contributing to the stabilisation of the grid though participation in balancing reserves; or, in the future, payment of the DSO for helping to resolve local congestions.

INTERACTION BETWEEN MARKET ACTORS

The aggregator is an intermediary between the consumer (the one who owns the flexible resources) and the system operator (who may use consumption flexibility to better manage the grid). The aggregator signs a contract with both parties: bilaterally with the consumer and with the system operator in order to participate in a dedicated scheme. The aggregator may provide the TSO balancing services through participation into balancing reserves. The aggregator may also sign a contract with a DSO through dynamic grid tariffs, emerging bilateral contracts or through a local flexibility market[3] (which exist at experimental level only, see section 3.5.1).

3 See the experience of the Dutch project Gridflex in Heeten. In this pilot, the cooperative Endona jointly operates a PV farm and a set of residential salt batteries. The objective is to minimise the traffic at the local substation level, activity for which the cooperative is offered a reduced grid fee by Enexis, the local DSO. More information is available at: https://gridflex.nl/

BENEFITS TO THE CITIZENS

Participating in flexibility services is an opportunity to actively support the management of the grid, providing the new resources needed to balance a renewable-based electricity system and to help reduce the investment needed into the local grid to support an increasing number of decentralised energy resources.

Moreover, this active participation can be financially valorised and provide additional revenues (or services, depending on the contract with the service provider) to the consumer.

CO-OPERATIVE EXAMPLES

ENERGIE SAMEN & ENDONA / THE NETHERLANDS

In the frame of FLEXCoop pilot, Energie Samen is experimenting the role of aggregator together with their member Endona in Heeten. The flexibility of heat pumps and other devices could be used to participate into the distribution system operation's (Tennet) secondary reserves.

www.energiesamen.nu
www.endona.nl

Wind turbine inauguration in Neer. © Energie Samen

ENERGENT / BELGIUM

Within cVPP, EnergieID monitored the voltage peaks in the distribution grid in Energent's pilot site, and used those peaks to reduce injection in times of overvoltages.

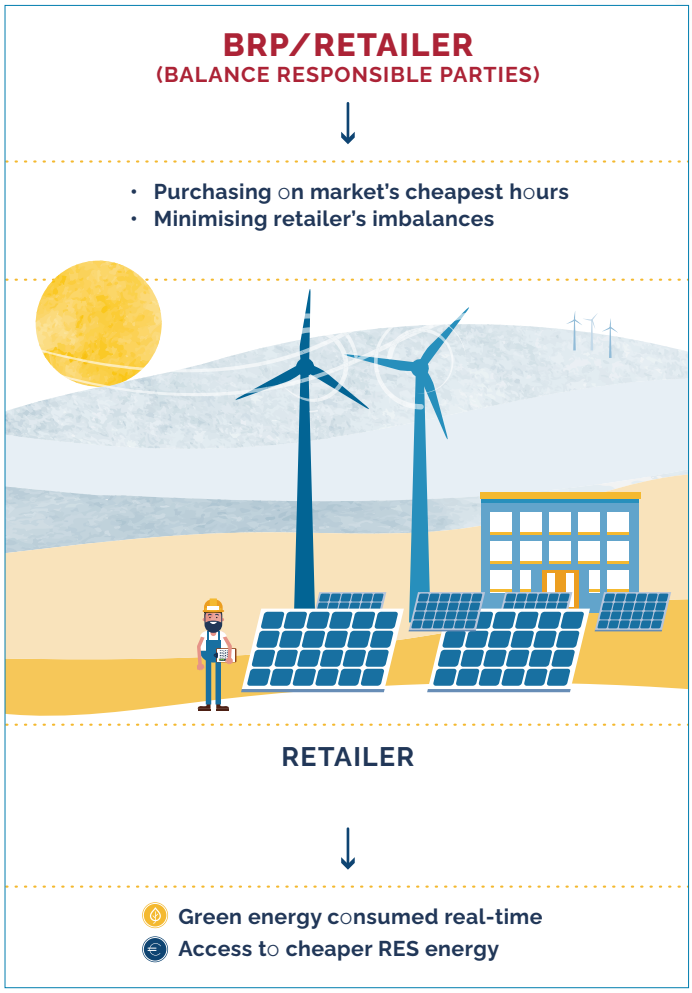
www.energent.be
www.energieid.be

In Ghent, through the cVPP project, Energent tests how residential flexibility managed through an energy management system can help stabilising the grid at the neighborhood level where more and more are putting solar PV on their roofs. © REScoop.eu

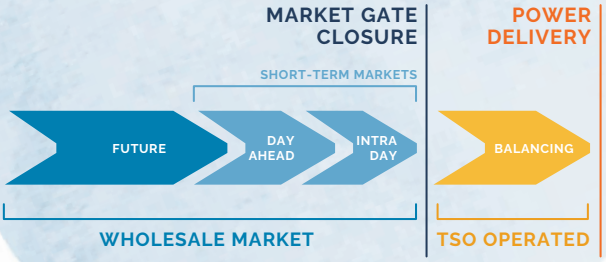
RETAILER-AGGREGATOR

DESCRIPTION

A retailer (or supplier) may buy electricity on the market or take it directly from its own generation portfolio. In both cases, consumer flexibility may be an important tool to use electricity when it is most abundant (and therefore cheapest).



Wholesale market and balancing mechanisms. In a simplified way, the electricity market operations can be divided into the wholesale market which allows the different market actors to exchange different volumes of electricity and a balancing mechanism (imbalance market) managed by the TSO almost in real-time to correct deviations and avoid black-outs.



SERVICE PROVIDER'S REVENUES

for the retailer come from the savings realised on the cheaper electricity purchased on the market thanks to consumption flexibility or avoided balancing costs . In the long run, demand-side flexibility can become a strategic tool to meet balancing needs (matching generation and demand), including taking full responsibility for balancing and thereby becoming financially responsible to the TSO.

ROLE OF THE SERVICE PROVIDER

The retailer is the intermediate between the end-user and the production of electricity. In its supply offer, the retailer may propose the automation of appliances (domestic hot water, heating, ventilation, electric vehicle charging) to facilitate consumption at time of generation. The role of retailer and smart solution provider may be split. In that case, the retailer would only send different price signals for every hour (dynamic pricing) and an ESCO may automate and operate appliances to match the cheapest prices and achieve the highest savings for the consumer.

INTERACTION BETWEEN MARKET ACTORS

The retailer may use flexibility to match upfront the foreseen cheapest hours on the wholesale market by automating appliances in order to consume when prices are forecasted to be the cheapest. The retailer may also use consumption flexibility in order to match its own generation (generation forecast is here needed). Additionally, consumption flexibility may in both cases be used closer to real time operations to prevent imbalances and therefore avoid fines from the TSO which is in charge of the balance of the overall system.

Additional resources could be valorised on the market, e.g. on the imbalance market (schemes run by TSOs close to delivery time in order to incentivise retailers to correct their position) when possible or on the wholesale market. The latter would require scarcity of electricity to be better reflected into wholesale market prices to incentivise flexibility which is not the case yet in European markets.

BENEFITS TO THE CITIZENS

Subscribing to a "flexible" supply offer may be the opportunity to consume electricity when abundant and therefore, also when the most renewable-based electricity is available. Additionally, it is an opportunity to enjoy the cheapest resources and to support the retailer in balancing its portfolio which could be reflected on retail prices or through other rewards.

CO-OPERATIVE EXAMPLES

PARTAGO

PARTAGO / BELGIUM

In the WiseGRID project, Ecopower and Partago experimented peak pricing supported by home batteries and electric vehicles, both avoiding charging during the most expensive hours.

www.ecopower.be
www.partago.be

In Ghent, the e-carsharing cooperative Partago provides access to 74 electric cars to cooperative members aiming to contribute to a healthy and sustainable city. © REScoop.eu

som energia

SOM ENERGIA / SPAIN

In FLEXCoop, Som Energia experimented with the automation of residential appliances such as heating and air conditioning to optimise the purchase of electricity in the Day Ahead market.

www.somenergia.coop

Members of Som Energia are celebrating the purchases of solar panels for self-consumption. © Som Eneria

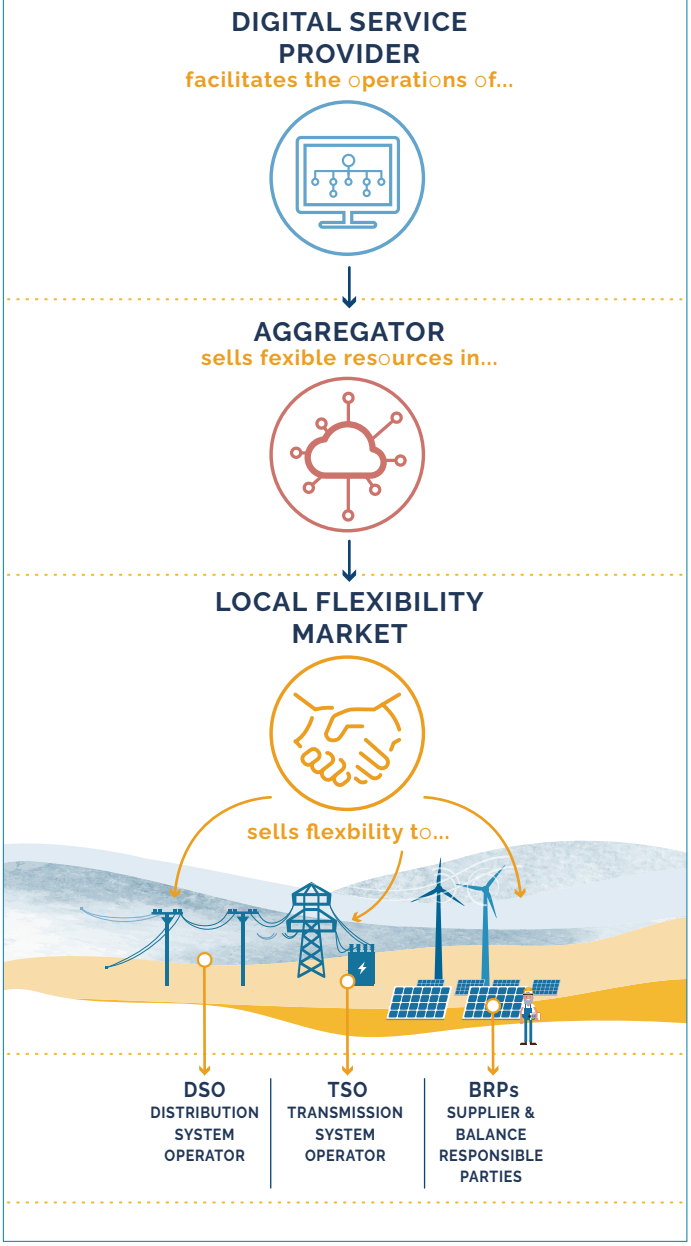
COMPLEMENTARY DIGITAL SERVICES

New service providers are emerging in the energy market. These ICT-based businesses aim to optimise transactions through digital services. The sections below focus on these new intermediaries:

1. **Local flexibility markets** which facilitate the exchange between flexibility providers and flexibility users and
2. **Flexibility solution providers** who support energy companies in becoming flexibility service providers (aggregator or self-consumption facilitator).

Inauguration of solar panels in Auvergne Rhone-Alpes. © Enercoop

FIGURE 6: **RELATIONSHIP BETWEEN DIGITAL SERVICE PROVIDER, AGGREGATOR & LOCAL ENERGY MARKET**



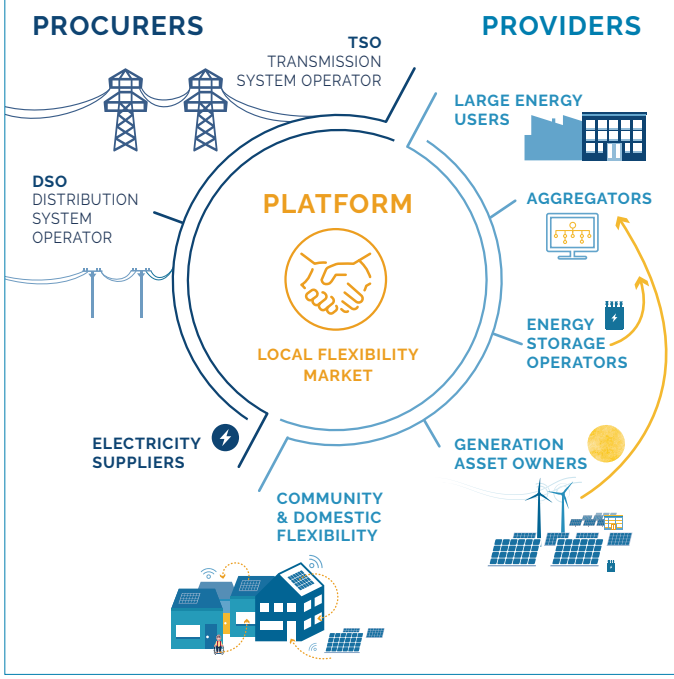
LOCAL FLEXIBILITY MARKETS

As described above, the main third-party users of flexibility may be system operators. Institutional discussions between TSO and DSO are taking place [3], [4] to develop a common approach of flexibility use and management. While this concept is still at an experimental stage, several pilot projects are taking place in Europe.[4]

DESCRIPTION

Local flexibility markets are platforms to enable the provision of local consumption flexibility to support the distribution grid. They are tools to make better use of the (distribution) grid and therefore reduce the needs for grid investments. Flexibility markets are firstly addressed to DSO for congestion management but may include peer-to-peer trading or local markets. The illustration below is proposed by Regen [6].

FIGURE 7: **THE ROLE OF A LOCAL FLEXIBILITY MARKET**
ACCORDING TO REGEN [6]



4 The Florence School of Regulation [5] has reviewed four ongoing experiences in this domain: Piclo Flex (GB), Enera (DE), GOPACS (NL) and NODES (Nordics).

ROLE OF THE SERVICE PROVIDER

In this case the service provider is the platform itself, which ideally is independent from market parties and acts as market facilitator. It provides an interface which may act as a one-stop-shop for flexibility providers and users. It enables the standardisation of flexibility products and may be integrated in the sequence of the electricity market.

SERVICE PROVIDER'S REVENUES

Platforms, as in any other area, may take a share of the transactions and/or request an access fee.

INTERACTION BETWEEN MARKET ACTORS

The platform may address different services and therefore may require the coordination between TSO and DSO for avoiding conflictual order or enabling joint procurements, but also coordination among several DSOs.

BENEFITS TO THE CITIZENS

In the long run these platforms will be essential to run a decentralised energy system with major flows of energy, both withdrawals and injections, at distribution grid level. Making sure that all distributed assets can contribute to the stability of the grid will be key to ensure the transition to renewable energy at an affordable cost. These platforms also represent a new opportunity for citizens to valorise their assets at the local level through the use of the aggregation services.

CO-OPERATIVE EXAMPLES

Local energy markets are the central facilitator of transactions at the local level, no cooperative has yet experimented with such a role.

FLEXIBILITY SOLUTION PROVIDER

DESCRIPTION

ICT plays a key role in flexibility related services where it enables to make close-to-real time decision based on consumption and generation data. Usual service companies may lack skills in this sector and require third-party company to access needed hardware, software and management skills.

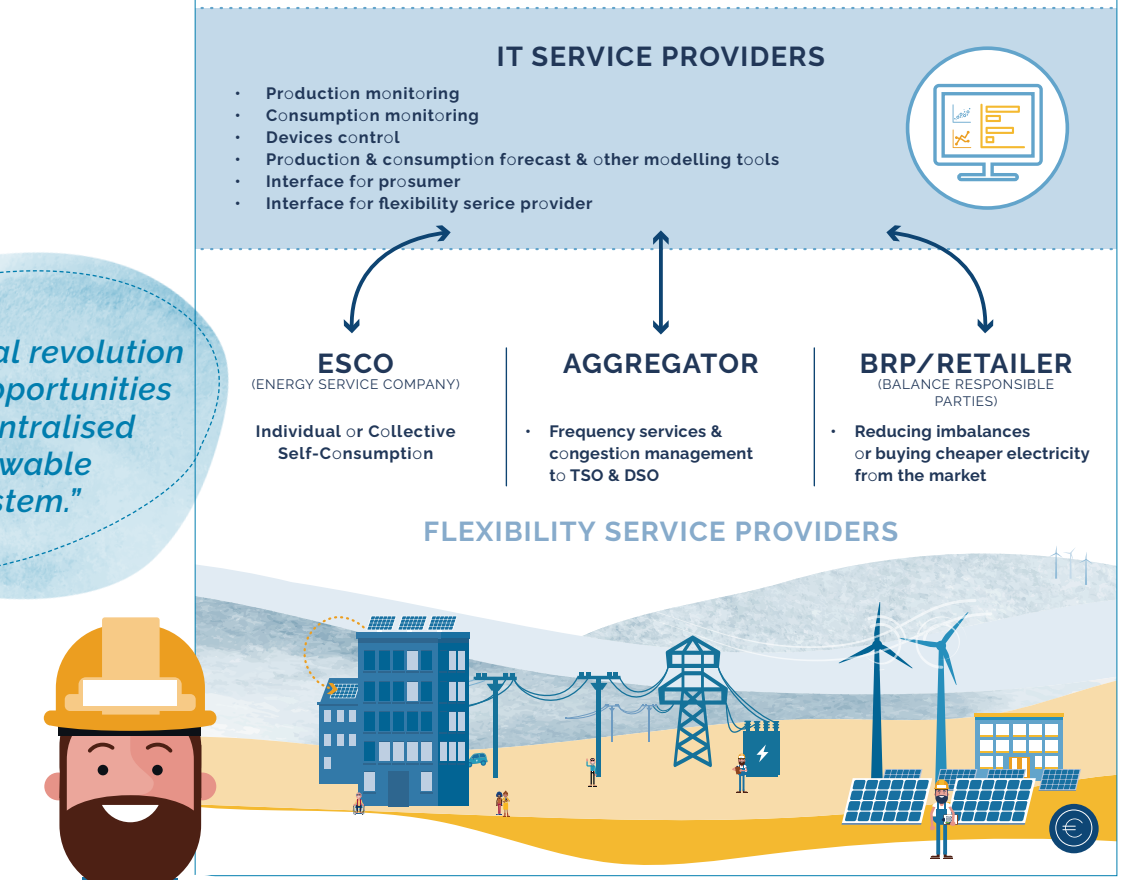
ROLE OF THE SERVICE PROVIDER

ICT companies may provide a more or less complex and complete service enabling energy companies to access and be able to provide flexibility based services, from software/hardware provider to in-house aggregator service provider.

SERVICE PROVIDER'S REVENUES

Depending on the offered service, revenues can be based on software licensing, back-end and support fees, or a share of the energy services benefits.

FIGURE 8: **DIGITAL SERVICES SUPPORTING FLEXIBILITY SERVICE PROVIDERS**



"The digital revolution creates opportunities for a decentralised 100% renewable energy system."

INTERACTION BETWEEN MARKET ACTORS

The flexibility solution provider would act as a service provider to the energy company (should it be a producer, retailer or an ESCO). The terms of the contract are being defined bilaterally.

BENEFITS TO THE CITIZENS

Flexibility solution provider acts complementarily with the energy company and enables them to provide more elaborated services (described above) that are financially beneficial and contribute to the energy transition .

CO-OPERATIVE EXAMPLES

energieID

ENERGIEID / BELGIUM

The cooperative EnergieID is co-building open source analytics and open source home automation system together with the dashboard for aggregator.

www.energieid.be

Employee from EnergieID showing their online energy management platform to follow, analyse and compare energy. © REScoop.eu

RESCOOP VPP

RESCOOPVPP / EU

In REScoopVPP, the cooperatives EnergieID, Carbon Co-op and Enercoop are setting up a demand-side flexibility solution supporting cooperatives who want to develop services related to self-consumption, dynamic pricing and facilitating explicit demand response.

www.carbon.coop
www.enercoop.fr

Installation of PowerShaper for automated demand side response. © Carbon Co-op

ADDED VALUE OF CO-OPERATIVES OR CITIZEN ENERGY COMMUNITIES

3

All of these business models can be performed by cooperatives as well as conventional market actors. The section below provides the many reasons why cooperatives or other citizen energy communities may have an advantage in providing self-consumption or aggregation services.

CITIZEN ENERGY COMMUNITIES & ENERGY COOPERATIVES

Citizen Energy Community is a new legal concept defined in the Electricity Directive [8]. It mirrors the concept of Renewable Energy Community in the Renewable Energy Directive [9] which hold similar features.

This concept shares a lot of common characteristics with energy cooperatives. A Citizen Energy Community is an organisational concept defined according to the way services are provided. Citizen Energy Communities are not service- or technology-specific, and the list of services they may engage in is not restrictive.

Energy cooperatives may be understood as a subset of Citizen Energy Communities with additional requirements.

CITIZEN ENERGY COMMUNITY

"A legal entity that:

(A) is based on **voluntary and open participation** and is **effectively controlled by members** or shareholders that are **natural persons, local authorities, including municipalities, or small enterprises**;

(B) has for its **primary purpose to provide environmental, economic or social community benefits to its members** or shareholders or to the local areas where it operates rather than to generate financial profits; and

(C) **may** engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicle **or provide other energy services to its members or shareholders**."

RENEWABLE ENERGY COOPERATIVE (RESCOOP):

Citizen initiative which is active in the renewable energy or energy efficiency sector and which respects the seven principles of the international cooperative alliance, namely

(I) **open and voluntary membership,**
(II) **democratic member control,**
(III) members' economic participation,
(IV) autonomy and independence,
(V) **education, training, and information,**
(VI) cooperation among cooperatives and
(VII) **concern for community.**

COOPERATIVES & CITIZEN ENERGY COMMUNITIES (CECS) ARE TAILORED TOOLS TO MOBILISE CITIZENS AROUND ETHICAL CONCERNS

Energy transition and sense of community. Many end-users may engage into flexibility services more for ethical reasons such as contributing to the energy transition or improving quality of life in their neighbourhoods rather than for economic reasons. Cooperatives and CECs in general better match this purpose and provide citizens with a concept to work on or a shared social goal rather than financial profit.

Collective action supporting aggregation. An aggregator pools loads from a big number of small participants in order to get sufficient size and to enable participation in the markets. The sense of community and collective efforts are part of the foundations of cooperatives and CECs.

COOPERATIVES & CECS EMPOWER CITIZENS TO ACT ON THEIR ENERGY FUTURE

Independence and control. The CEC offers to the participants a sense of control and power over their energy consumption. Through its democratic governance model, it allows for private consumers to be represented and taken into account while decisions about their environment, community, houses are being taken.

Building infrastructure to support local development. CEC participants may acquire the needed infrastructure to support the desired services rather than source it otherwise. This way, participants are building jointly owned projects in their community that will then be used for a wide range of energy and non-energy related actions, turning itself into a virtuous circle.

COOPERATIVES & CECS CAN BE FACILITATOR OF TECHNICAL SERVICES

Trust. A cooperative or CEC may represent a trusted partner to support the technical and administrative hustles of self-consumption or aggregation. The cooperative also represents a trusted partner to handle consumer data.

Facilitated market interactions. A cooperative or CEC may act as the needed collective body for organising the service when such a body does not exist (e.g. collective self-consumption at neighbourhood level). This is an opportunity to gather several end-users with more resources, more assets and who can then be a higher-scale interlocutor for service and technology providers.

Citizen Energy Communities, and cooperatives in particular are an opportunity to overpass some energy market shortcoming. These initiatives provide the opportunity for collective action with the right scale for decentralised energy projects. Moreover, their non-commercial approach may be a key asset to address the energy transition which is not an individual comfort issue, but rather a collective challenge including future generations.

CASE STUDY 1:
SELF-CONSUMPTION MAXIMISATION & WHOLESALE MARKET SOURCING OPTIMISATION FOR A SPANISH CO-OPERATIVE RETAILER

4

Som Energia is leading one of the two pilots of FLEXCoop. It is a cooperative retailer and self-consumption facilitator (collective purchase of solar PV panels). The flexibility solution enables the cooperative (i) to purchase more resources at hours of cheap electricity on the wholesale market as well as use more energy at peak-generation times from its own renewable energy power plants and (ii) to maximise the consumption of local solar resources for prosumers.

INTRODUCTION TO SOM ENERGIA

Som Energia is the largest energy cooperative retailer in Spain, founded in 2010 in Girona (Spain) with the objective to supply green energy to its members. The cooperative counts more than 65.000 members and handles more than 112.000 contracts.

Som Energia buys electricity on the wholesale market, and also has a growing portfolio mainly made out of solar PV power plants.

Complementarity, Som Energia incentivises self-generation through collective purchases of solar PV installations. Since 2018 Som Energia also provides free energy efficiency advice through personalized seasonal reports.

As a consequence, the members buy less energy from the cooperative. This is in line with the overall mission of Som Energia but it also forces them to rethink their cooperative business model: a retailer cooperative may switch from being a commodity supplier and turn itself into a service provider.

Above: Som Energia's solar park in Alcolea del Rio (Spain) funded by the GenerationkWh collective funding program. © Som Energia

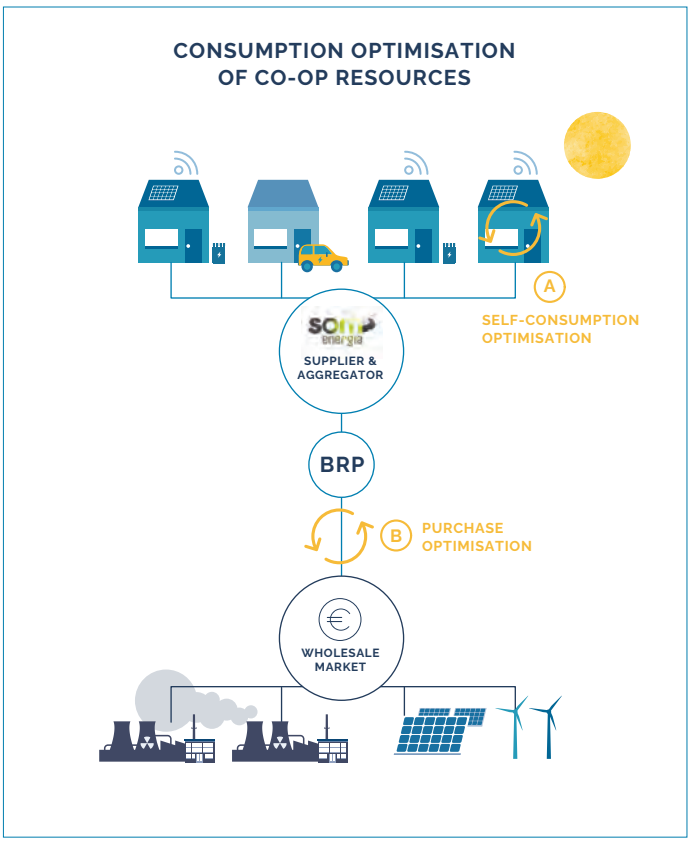
Right: Som Energia's local groups annual meeting (2019) in Barcelona. © Som Energia

FIGURE 9: EXAMPLE OF ENERGY REPORT FOR DOMESTIC USER

SHORT-TERM OPPORTUNITY

1. Som Energia holds a growing number of self-generating members. The cooperative would like to offer services to **help its members consume most of this "local and self-produced energy"**. The recent introduction of a simplified compensation scheme for self-generators in Spain shows a clear economic signal. Indeed, though the prosumer still get remunerated for exported electricity, the price represents only about a third of the retail price and is directly deducted from the bill. The price difference represents a strong incentive to consume as much as possible from this self-produced electricity.

2. And for the vast majority of its members without solar PV, Som Energia is looking for a way to **enable them to consume energy whenever it is available and thus cheap, avoiding peak hours and reduce the costs charged when imbalances occur** in order to better valorise the energy bought on the wholesale market.



COMPLEMENTARY BUSINESS MODEL: COLLECTIVE PURCHASE OF SOLAR PANELS

Som Energia plays the role of collective purchase and installation facilitator with its members.

Why self-consume?

- 100% renewable
- Distributed energy
- Citizens ownership
- It is more efficient: no transport, no distribution, no market
- Economic savings
- Change the energy model

Why a collective purchase?

- Better offer
- Quality guarantee
- Turnkey solution
- Collective action in cooperative spirit

Each joint purchase goes through the same process:

1. A significant number of members of a given area shows interest
2. A Promoting Group is formed among Som Energia's members (1 or more local groups)
3. Som Energia organises a call for engineering where different service providers compete
4. Once the price, materials and engineering of the installations are determined, Som Energia proceeds to open the registration
5. Pre-study and technical/advise visits
6. Executions of work, legalization and commissioning
7. The inverter manufacturer provides monitoring services. The user signs a guarantee with the engineering company.

Why a call for Engineering?

- Dissemination
- Transparency

It allows to adapt to the needs of the promoting group, which may value different parameters: proximity, price, social economic organization...

LONG-TERM VISION

Spain has great potential to cover most of its electricity needs with solar PV, and with growing variable renewable energy projects within its portfolio, their business model is evolving. Being able to manage flexible demand could become a key aspect in their future business model and enable the cooperative to better manage their members (prosumers) and their renewable energy installations while taking balancing responsibility for its assets.

In parallel, TSO's balancing reserves are gradually opening to aggregated smaller resources and demand-side participants. In this context, getting involved into flexibility services for self-consumption optimisation and wholesale market sourcing, will help Som Energia to address these new opportunities once they are available.

Overall, Som Energia should be able to seize the opportunity of the self-production take-off in Spain. The new grid tariff structure and the enabling framework for Energy Communities will enable them to **move from a commodity supplier to a service provider**.

3 QUESTIONS TO EDUARD QUINTANA, HEAD OF ELECTRICITY MARKET AT SOM ENERGIA

What's the key opportunity that demand-side flexibility services represents for you?

The opportunity for Som Energia is to become less dependent from external producers, but also to increase the resilience of the cooperative itself and of its members. In this process, Som Energia might become a reference for prosumers in Spain.

What's the key challenge to offer these services?

Aggregation technologies lack standards and are not broadly accessible yet.
Moreover, Som Energia has to invent a business model with the cooperative values at its core.

What's the longer-term vision for Som Energia?

Our main objective is to change the energy model. Flexibility has revealed to be one of the energy transition corner stones. Som Energia should master these services with a special focus on its members, thus on the domestic sector.

CASE STUDY 2:
PARTICIPATION INTO ANCILLARY SERVICES FOR A DUTCH COOPERATIVE GENERATOR & SERVICE PROVIDER

5

Energie Samen, the Dutch federation of energy cooperatives is leading one of the two pilots of FLEXCoop in close collaboration with Endona and Escozon, two local cooperatives. The flexibility solution would enable Endona to complete its revenues by becoming a Balancing Responsible Party and envisage balancing within its own portfolio as a potential future retailer.

INTRODUCTION TO ENERGIE SAMEN & ITS PARTICIPATING MEMBERS

Energie Samen is the Dutch federation of energy cooperatives. It represents the voice of 600 citizen-based initiatives and provides them with various support services.

The cooperatives involved into FLEXCoop are Endona and Escozon, in the municipality of Heeten. Endona owns a solar PV farm and sells the electricity to Energie Van Ons, a cooperative supplier specialised into local energy projects. Endona is also involved in a national research project, Gridflex, exploring the provision of services to the DSO. Escozon supports Endona with technical and commercial advice.

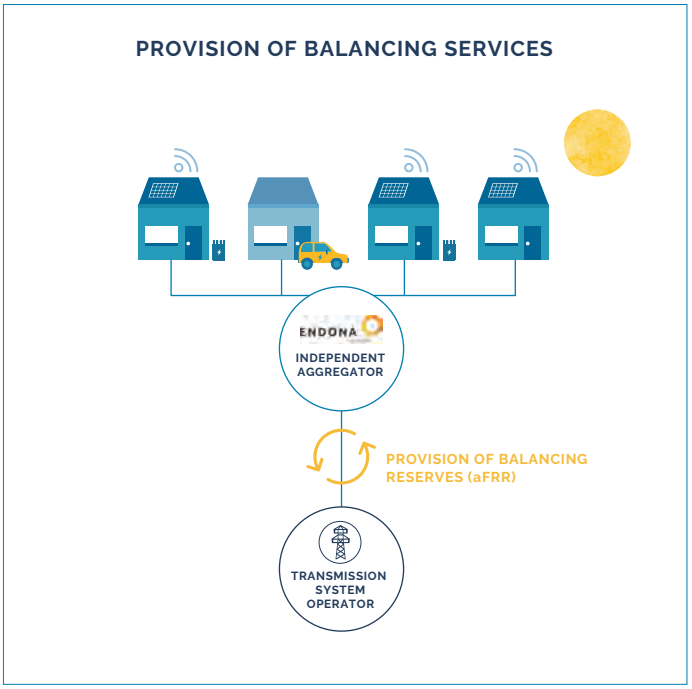
Above: Loeck Tomassen from Endona and Dominique Doedens from Escozon, 2019. © Ronny Te Wechel

Right: The cooperative solar park in Heeten. © Energie Samen

SHORT-TERM OPPORTUNITY

Just like any energy cooperative in the Netherlands, Endona gathers members who embrace the energy transition and who are willing to get actively involved. Setting up an independent aggregator that offers flexibility services is a good way to complete Endona's selling proposition.

Endona aims to gather new revenues out of balancing services that they can offer to the TSO (secondary reserves). Their members can support to the overall stability of the energy system. This active role of citizens and cooperatives adds up to the ongoing debate about the future role of gas and renewable energy as an alternative.



LONGER-TERM OPPORTUNITY

There are two potential tracks for aggregation opportunities through cooperatives in the Netherlands. First, there's the **independent aggregator model**. Beyond the case of Endona, an independent cooperative aggregator could target cooperative members all over the country to build a significant flexibility reserve. This flexibility could be useful to cooperatives, for them to take balance responsibility on their production and provide firm offers to suppliers or traders and sell their energy at a higher rate.

Secondly and in the longer run, **the activity could merge with the ones of a cooperative retailer**. Such a retailer could resell cooperatives' production to their members so they can consume the energy they've participated to produce. Demand-side flexibility could then support the balancing of production and consumption.

"The energy transition will require citizens and cooperatives to take a more and more active role in supporting the stability of the energy system."

3 QUESTIONS TO SIWARD ZOMER, DIRECTOR AT ENERGIE SAMEN

What's the key opportunity that demand-side flexibility services represents for you?

We are a cooperative of cooperatives. We help our members from start to finish. In a few years' time our members will need a whole range of flexibility services.

What's the key challenge to offer these services?

The most difficult part is now to get capital for the investments that are required to build up these services. It is not clear when the markets of flexibility will be viable to ensure profitable business models. Especially as cooperatives that now work mostly on developing their regular businesses round renewable energy production and energy savings, innovative flexibility services still seems far away and not a priority for them to invest in at the moment.

What's the longer-term vision for the Dutch cooperative sector?

Our long term vision is to ensure cooperative ownership throughout the value chain of energy, from production to consumption and everything that lies in between. Flexibility will be an important part in this vision.

Energie Samen members celebrating the installation of solar panels.
© Sander Foederer

LEARNING FROM SUCCESSFUL SMART ENERGY SERVICES COMPANIES

In order to learn from real market actors in Europe, we got in touch with established residential Demand Response players. For the purpose of this report, Tiko and Centrica Business Solutions shed some light on their respective business models. We are very grateful that these two companies agreed to answer a few questions and we want to thank them for that.

INTERVIEW WITH TIKO

Tiko was initially established in 2012 as an independent aggregator, the result of a joint venture between SwissCom (the historical communication company in Switzerland) and Repower (one of the major Swiss utilities). After the successful development of its residential demand response solution and several partnerships with retailers across Europe (like Energie Direct in France or Sonnen in Germany), Tiko was acquired by Engie in 2019 and continues its development throughout Europe. Tiko is today one of the few leading companies in the residential demand response market in Europe.

8 QUESTIONS TO STEFAN DOERIG,
HEAD OF REGULATORY & PUBLIC AFFAIRS, TIKO ENERGY SOLUTIONS AG

YOUR OFFER. Could you introduce your key service and what you are bringing to your customers?

At tiko we understand ourselves as enablers. We enable companies, communities and households to be at the forefront of the energy revolution. For that purpose, we developed a smart Energy Management System for households and combined it with a unique Virtual Power Plant. The Energy Management System helps end-users to save energy, raise awareness and enhance self-consumption without losing comfort in their homes. The Virtual Power Plant allows aggregators to integrate all kind of generation assets and small loads, and to deliver a full spectrum of energy services to grid operators and energy providers.

YOUR CUSTOMERS. Who are your customers and how do you reach out to them? (If your main services are B2B, how do your customers interact with their customers by using your product?)

We are not looking for customers, but for accomplices. We find these among energy providers and grid operators, but also in the housing, e-mobility, or cleantech industries, and in cooperatives. Our flexible and modular technology enables innovative business models to gain money and efficiency, while enabling consumers to gain insight and control over their energy consumption.

8 QUESTIONS TO STEFAN DOERIG,
HEAD OF REGULATORY & PUBLIC AFFAIRS,
TIKO ENERGY SOLUTIONS AG

CONTINUED

Do they need specific equipment?
Which residential equipment is the most valuable through your services?

tiko allows you to connect all types of electrical devices, such as heating systems, coolers, PV installations, batteries, or e-car charging stations, independently of their brand or age. All existing devices, and not only internet-ready ones, can be managed through apps and web-based applications.

RESOURCES. What are the core skills of your company?

At tiko we combine the passion and agility of a start-up with the experience and reliability of an established company. We have always laid a strong focus on cybersecurity. Our technology is fast (< 1 second frequency response), secure and completely versatile.

What are the key resources and partners you rely on? In particular, have you developed your own hardware tools?

Our hardware and software technologies are developed 100% in-house. This enables us to match the highest quality and security standards and to guarantee a robust, seamless operation. The integrated approach also allows us to fully customize our solutions to fit different requirements and to be fully independent of a special brand of appliances.

COSTS AND REVENUES. What are the key market indicators for you? (Wholesale electricity peak prices? "grid parity" e.g. retail prices VS LCOE for rooftop PV? Other?)

The *value* of decentralized flexibility for the system depends on various factors, like the penetration of renewables, grid constraints, electricity prices, etc. The *price* of flexibility however is highly dependent on flexibility markets, their rules and incentives. Market design and regulation matter. Presently, we are confronted with a multitude of barriers, hindering decentralized flexibility to unfold its full potential. Fortunately, the tide has changed with the Clean Energy Package and the future looks much brighter now.

How do you think the market will evolve in the coming 10+ years in terms of costs and revenues?

The massive uptake of electric vehicles, heat pumps and other electric appliances in the coming years will pose tremendous challenges for the networks, especially at distribution level. Relying only on expensive grid investments to cope with this challenge is not an option. Therefore, the demand for local flexibility will grow rapidly, making according business models increasingly attractive.

SOME FIGURES. Please share some company figures with us…

Date of company's creation: 2012
Number of customers: 8,000 connected households in Switzerland, 20 clients B2B worldwide
Number of employees: 62

INTERVIEW WITH CENTRICA BUSINESS SOLUTIONS

REstore was created in 2010 as a Belgian start-up. Specialised in fast-reacting and highly reliable demand response, REstore developed and independent aggregator services for industrial and commercial customers being able to valorise their loads in primary reserves. REstore notably contracted with ArcelorMittal (steel), Praxair (industrial gases), Sappi (paper) and Barclays (bank). REstore successfully expanded in Germany, France and the UK. In parallel it developed an innovative residential demand response solution. REstore was acquired by Centrica, one of the UK major utilities, in November 2017 and became Centrica Business Solutions. The company now benefits from Centrica's worldwide business to continue its expansion.

8 QUESTIONS TO WIM VAASEN, HEAD OF OPTIMISATION NL, CENTRICA BUSINESS SOLUTIONS

centrica Business Solutions

YOUR OFFER. Could you introduce your key service and what you are bringing to your customers?

Creating sustainable, innovative and profitable solutions for customers who face the challenges that come along with the energy transition is our core business. By offering a wide range of specialised technologies such as Demand Side Response (DSR), EV infrastructure, battery storage, LED lighting, heat pumps etc. Centrica Business Solutions helps organisations to adopt the right technology that does the job.

YOUR CUSTOMERS. Who are your customers and how do you reach out to them? (If your main services are B2B, how do your customers interact with their customers by using your product?)

Centrica Business Solutions manages the largest Virtual Power Plant (VPP) in the world consisting mainly of industrial customers. In parallel, vast amounts of R&D flow into our established DSR technology making VPP soon accessible to residential users.

We conclude partnerships with manufacturers who engineer our technology on appliance level so we can connect residential flexibility to our VPP. The benefits of these solutions are captured in the commercial offering from our client to his end users.

Do they need specific equipment?
Which residential equipment is the most valuable through your services?

Our partnerships have focused on residential storage solutions, heat pumps, electric boilers and the EV charging infrastructure. In general, I would say the most valuable equipment for our clients and us is the one that scales very quickly and enjoys a large degree of flexibility in time of use.

RESOURCES. What are the core skills of your company?

Commercial entrepreneurship, advanced data analytics and continued R&D in our technology is a great mix of ingredients that helps us discover and develop such various partnerships in different regions in the field of DSR. Centrica Business Solutions, part of Centrica plc, operates on a global scale and therefore our DSR division is involved in many developments on EU- and worldwide level. Thanks to this, we can move innovative ideas around fast.

8 QUESTIONS TO WIM VAASEN,
HEAD OF OPTIMISATION NL,
CENTRICA BUSINESS SOLUTIONS

CONTINUED

centrica Business Solutions

What are the key resources and partners you rely on? In particular, have you developed your own hardware tools?

In a spirit of co-maker ship, Centrica Business Solutions develops, together with our partnering manufacturers, the relevant tech solutions on device level. Connecting a flexible asset to our VPP is essentially installing a micro-chip or computer device in the appliance (battery, heat pump, e-boiler, etc) with a network connection to our cloud based VPP software. The hardware part is usually engineered by our partners.

COSTS AND REVENUES. What are the key market indicators for you? (Wholesale electricity peak prices? "grid parity" e.g. retail prices VS LCOE for rooftop PV? Other?)

In the first place Centrica Business Solutions is a provider of a technology that enhances residential equipment with DSR capabilities from our VPP platform. The key factors that determine the profitability of our technology on individual appliance level are the prices for TSO ancillary services, congestion management services, electricity wholesale prices and the relative movement of such prices.

How do you think the market will evolve in the coming 10+ years in terms of costs and revenues?

The decentralisation of energy production as well as the increase of renewable electricity production and the electrification of industry and mobility demands more from grid operators. This is costly and puts upward pressure on user tariffs. Technological solutions such as the ones we offer enable market participants to take control of their energy transition in a cost optimal and sustainable manner.

SOME FIGURES. Please share some company figures with us…

Date of company's creation: 2017
Number of customers: 6,070
Number of employees: 12,000

7

CONCLUSION

Demand side flexibility represents a whole set of services that can support many purposes and can be the basis for different business models. It includes purchase optimisation and balancing for retailers/ Balancing Responsible Parties, participation to balancing reserves and other ancillary services as (independent) aggregators or maximisation of (collective) self-consumption for individual prosumers and collectives of citizens.

These different models will become key in the coming years for both cooperatives and any other electricity market actor. They will require cooperatives to develop a new sets of knowhow and technologies which could be a challenge for grassroot organisations. Direct involvement with their members on the other hand also provides them with a key asset and puts them into a unique position to further explore these new business models.

The further development of new technologies, services and related platforms could make the tools that are required to look into such models accessible and affordable. To enhance energy cooperatives in demand side flexibility models, it is important that technology and service providers better understand the ability and dynamics that lays within their cooperative nature. Another challenge lies in making sure that energy cooperatives fully understand the potential of these new business opportunities and the technology that are require to engage in it .

Thanks to its involvement in projects like FLEXCoop, REScoop.eu intends to continue its role of facilitator and engage its members in exploring the new roles cooperatives can play in favour of decarbonised and democratic energy system.

FLEXCoop consortium gathered in Copenhagen in 2018. © REScoop.eu

ANNEXES

ANNEX I: SELF-CONSUMPTION MAXIMISATION & WHOLESALE MARKET SOURCING OPTIMISATION BUSINESS MODEL

The *optimisation of cooperative resources* business models entails a set of services: self-consumption optimisation at individual level (1) and wholesale market sourcing optimisation at cooperative level (2). These two models, experimented by Som Energia in the FLEXCoop project, are developed in the following sub-sections.

1. Self-consumption optimisation at individual level

From a cooperative point-of-view these services require the following elements:

- **Partners:** To access the **hardware and software** needed to support the service, i.e. the FLEXCoop solution or alternative one, including tools for prosumers (smart box, prosumer app), and aggregators tools (VPP formulation).
- **Activities and resources:** To develop self-consumption optimisation services require **PV forecasting skills**, as well as to develop **appliance communication and control skills** (HVAC, DHW, batteries, etc.) This represents a whole field of new know-how and ICT-related activities.
- **Value proposition:** Som Energia will be able to propose to members with PV panels to be able **to consume most of their self-generated electricity** by using thermal storage and without investing into additional storage systems, getting the most benefits from their assets.)
- **Customer segment:** This new offer address the situation of **consumers with PV panels**.
- **Customer relationship and channel:** This offer would entail **a stronger relationship with consumers** through the appliances control and the app, it also requires **specific trust** for consumers to provide control. Generally speaking, it addresses the situation of **tech-friendly consumers** or the ones interested into the **energy transition** and who are able to overcome the barrier of having dedicated tools and services for electricity.

The figure below sums up these additional features into a business model canvas:[5]

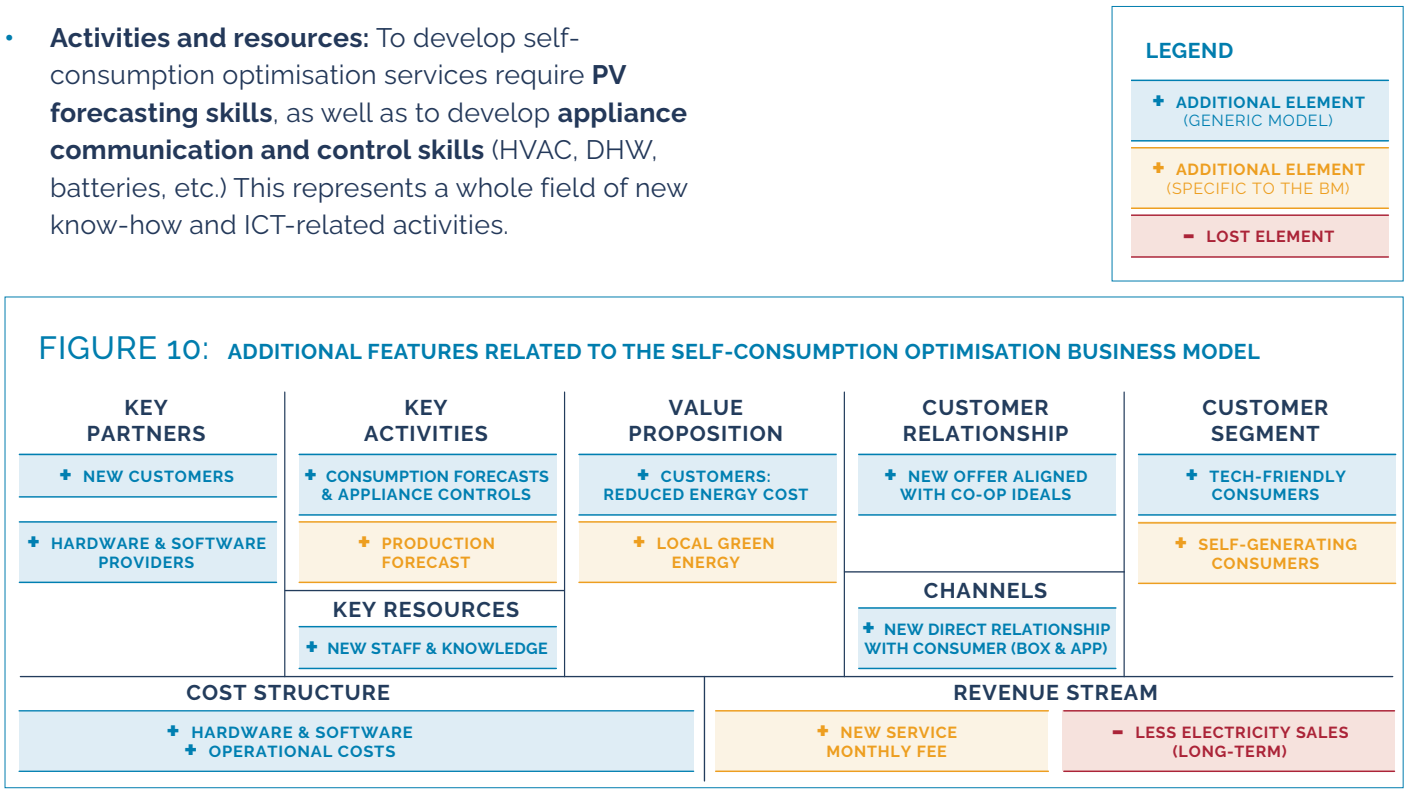


FIGURE 10: ADDITIONAL FEATURES RELATED TO THE SELF-CONSUMPTION OPTIMISATION BUSINESS MODEL

5 This approach was inspired from BestRES [10].

2. Wholesale market sourcing optimisation at cooperative level

From a cooperative point-of-view these services require the following elements:

- **Partners:** To access the **hardware and software** needed to support the service, i.e. the FLEXCoop solution or alternative one, including tools for prosumers (smart box, prosumer app), and aggregators tools (VPP formulation).
- **Activities and resources:** To develop market sourcing optimisation services require **market monitoring and trading skills**, as well as to develop **appliance communication and control skills** (HVAC, DHW, batteries, etc.) This represents a whole field of new know-how and ICT-related activities.
- **Value proposition:** Som Energia will be able to propose to all members to **get cheaper energy and to take part in the transition of the whole system** to renewables.[6]
- **Customer segment:** This new offer address the situation of **all consumers** in a context of increasing competition on "green" and "dynamic" offers.
- **Customer relationship and channel:** This offer would entail a **stronger relationship with consumers** through the appliances control and the app, it also requires **specific trust** for consumers to provide control. Generally speaking, it addresses the situation of **tech-friendly consumers** or the ones interested into the **energy transition** and who are able to overcome the barrier of having dedicated tools and services for electricity

The figure below sums up these additional features into a business model canvas:[7]

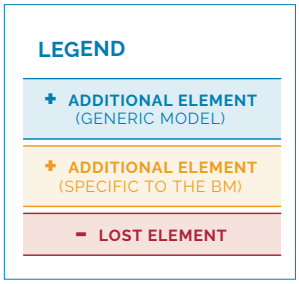


FIGURE 11: ADDITIONAL FEATURES RELATED TO THE WHOLESALE MARKET SOURCING OPTIMISATION BUSINESS MODEL

The ability for Som Energia to embrace these business models depends on many unknowns: the price and the accessibility of the needed resources an partners' services, together with the delta between self-generated electricity and retail electricity prices on one side and volatility of market prices on the other side.

Moreover the relation to consumers and members would require a significant pedagogical effort that may slow down the progression of the adoption process, but this does not a represent a major hassle for cooperatives.

6 Though a bit different in its implementation , a similar outcome might be achieved through implicit demand response tools triggered by dynamic prices.

7 This approach was inspired from BestRES, *D3.2 Improved Business Models of selected aggregators in target countries*, 2017, available at: http://bestres.eu/about-project/results/?res=2

ANNEX II: PARTICIPATION INTO BALANCING RESERVES BUSINESS MODEL

The business model, experimented by Energie Samen and Endona in FLEXCoop, related to participation into balancing and ancillary services requires the new features summarised below.

- **Partners:** To access the **hardware and software** needed to support the service, i.e. the FLEXCoop solution or alternative one, including tools for prosumers (smart box, prosumer app, and aggregators tools).
- **Activities and resources:** To **develop Balancing Service Providers (BSP) activities** and to get into commercial agreement with the TSO, as well as to develop **appliance communication and control skills** (HVAC, DHW, batteries, etc.) This would represent a whole field of new know-how and ICT-related activities.
- **Value proposition:** Endona would be able to propose **new revenues** (if it opted for sharing BSP revenues) or **new energy services** (monitoring or energy efficiency)
- **Customer segment:** This new offer would address the situation of **tech-friendly consumers** or the ones interested into the **energy transition** and who are able to overcome the barrier of having dedicated tools and services for electricity.
- **Customer relationship and channel:** This offer would provide a **stronger relationship with consumers** through the appliances control and the app, it also requires **specific trust** for consumers to provide control over their equipment.

The figure below sum up the additional features related to the independent aggregator business model canvas.

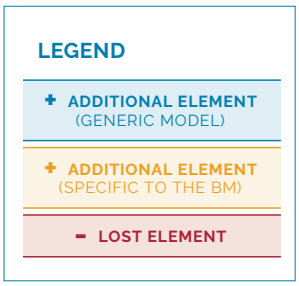
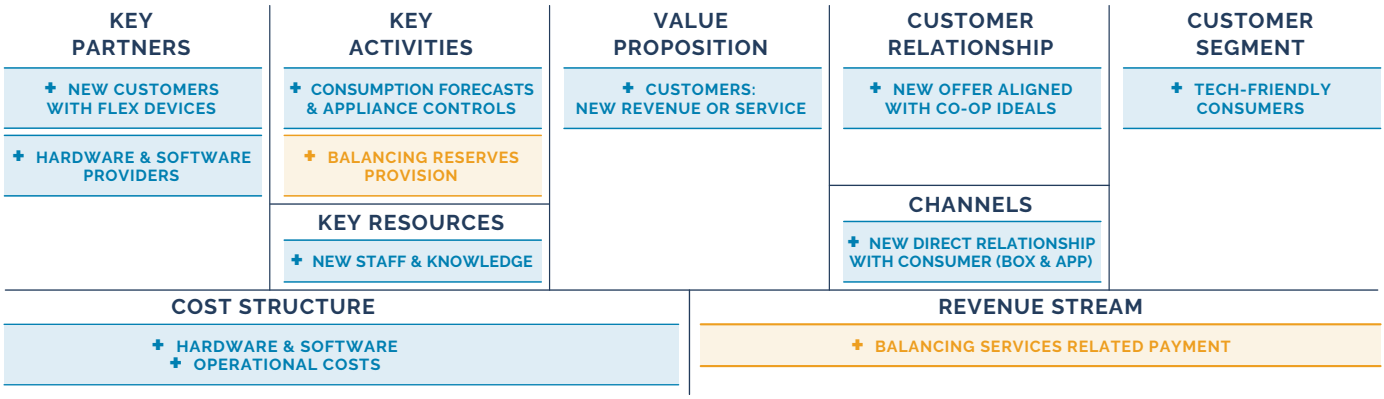


FIGURE 12: **ADDITIONAL FEATURES RELATED TO PARTICIPATION INTO BALANCING RESERVES BUSINESS MODEL**



Integrated retailer VS independent aggregator.
If the service was to be provided as an integrated "supply + aggregation" offer, this would mean:

- a simple value proposition, with no need for 2 different contracts… but a dependency between supply and aggregation offers and higher difficulty for consumer to switch services;
- the possibility for the retailer to use flexibility for its own portfolio balancing… but a significantly bigger business to run where aggregation may become just a side activity;
- less dependency on the new and volatile aggregation market…… but a step into a the highly competitive retail market with small margins.

Market uncertainties. The ability for Endona or other Energie Samen members to embrace this business model depends on many unknowns: the price and the accessibility of the needed resources and partners' services, together with the market prices offered for providing services to the grid.

A key question is the ability to support direct revenues to the users, or choosing alternative value proposition, e.g. proposing monitoring and energy saving services which seems common practice in the market today.

Moreover, the relation to consumers and members would require a significant pedagogical effort that may slow down the progression of the adoption process, but which is not a hard hassle for cooperatives.

ANNEX III: TABLE OF PROJECT REFERENCES

The references of the different projects quoted in the report can be find in the list below.

CIRCULAR SOUTH	Urban Innovation Action, 2018-2020, **https://www.uia-initiative.eu/en/uia-cities/antwerp-call2**
COMPILE	Horizon 2020, 2018-2022, Grant agreement ID: 824424, **https://cordis.europa.eu/project/id/824424**
CVPP	Interreg, 2017-2020, **https://www.nweurope.eu/projects/project-search/cvpp-community-based-virtual-power-plant/**
FLEXCOOP	Horizon 2020 project, 2017-2021, Grant agreement ID: 773909, **https://cordis.europa.eu/project/id/773909**
NOBEL GRID	Horizon 2020, 2015-2018, Grant agreement ID: 646184, **https://cordis.europa.eu/project/id/646184**
RESCOOP VPP	Horizon 2020, 2020-2023, Grant agreement ID: 893240, **https://cordis.europa.eu/project/id/893240**
RE/SOURCED	Urban Innovation Action, 2020-2023, **https://uia-initiative.eu/en/uia-cities/leiedal-intermunicipal-association**
WISEGRID	Horizon 2020, 2016-2020, Grant agreement ID: 731205, **https://cordis.europa.eu/project/id/731205**

ANNEX IV: QUOTED COOPERATIVE ACTORS

Carbon Co-op. Cooperative ESCO (or ESCo-op) facilitating home renovation, providing energy monitoring services and professional trainings, located in Manchester (UK)
www.carboncoop.coop

Coopérnico. Cooperative retailer and citizen solar project facilitator, located in Lisbon (PT).
www.coopernico.org

Ecopower. Cooperative electricity generator (wind), retailer and heat provider (wood pellet) with headquarter in Antwerp (BE).
www.ecopower.be

Endona. is a local cooperative producing solar energy and supplying it to its members in the Salland region thanks to a regulatory sandbox in this area. Endona is involved in several initiatives related to system flexibility. The cooperative is located in Heeten (NL) and is a member of Energie Samen.
www.endona.nl

Enercoop. Cooperative retailer, self-consumption an citizen project facilitator with headquarter in Paris (FR)
www.enercoop.fr

Energent. Cooperative citizen project specialised in RES-electricity production, located in Gent (BE).
www.energent.be

EnergieID. Cooperative ICT solution provider specialised into energy monitoring and support services for energy service companies located in Antwerp (BE).
www.energieid.be

Energie Samen. National federation and service provider for Dutch energy cooperatives, energy communities and local energy companies with headquarter in Utrecht (NL).
www.energiesamen.nu

Escozon. is a cooperative Energy Service Company (ESCO) providing technical expertise and market intelligence to other cooperative initiatives in the Netherlands. Escozon is located in Heeten (NL) and is a member of Energie Samen.
www.escozon.nl

Partago. Electric car sharing cooperative with headquarter in Gent (BE).
www.partago.be

Som Energia. Cooperative retailer and self-consumption facilitator with headquarter in Girona (ES).
www.somenergia.coop

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9. Directive (EU) 2018/2001 of the European Parliament and the European Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast), available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018L2001
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11. BEUC, *Fact sheet, Electricity aggregator,* March 2018, available at: https://www.beuc.eu/publications/beuc-x-2018-025_electricity_aggregators_factsheet.pdf

WWW.FLEXCOOP.EU

RESCOOP.EU

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