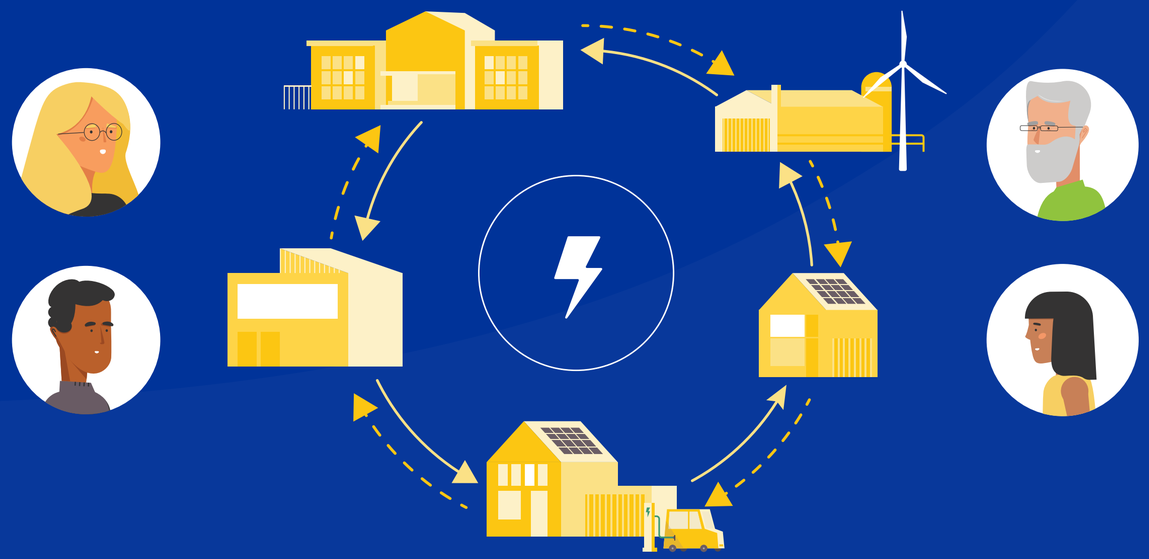
Interreg
EUROPEAN UNION
North-West Europe
cVPP
European Regional Development Fund

Starter's guide

Community-based Virtual Power Plant



What if you could generate and manage your own renewable energy? And what if you could do this together with other citizens like you?

Discover the community-based virtual power plant!

Watch the animation video

Or continue to the starter's guide.

For whom is this starter's guide?

This Starter's Guide is intended to help process moderators who support **energy communities** to start a community-based Virtual Power Plant (cVPP).

Who are the process moderators?

- Active members of an energy cooperative or other initiative;
- Pioneers in the neighbourhood;
- Other enthusiasts who invest time and energy in building an energy community;
- Sustainability officials in a municipality;
- In other words: everyone.

What is the goal?

- Involve all members of the energy community and support community initiatives.
- Ensure that, over time, all members of the energy community understand the complexity of the energy transition, and their own role in it.

Created for

Energy Communities (EC)

...with the aim to...

inspire, inform, engage and empower them, so that they are ready to participate in the energy transition,

used by

process moderators.

Navigate through the starter's guide by clicking on the chapters.

How to use this starter's guide?

The cVPP Starter's Guide consists of three parts:

KNOWLEDGE PROCESS TOOLS

These three parts are interconnected, but you can choose what is important to you. Browse through them and see what is applicable to your situation.

In this starter's guide you will not find a step-by-step plan to involve all members of the community. However, we do offer tools to help you take the first steps in that direction.

Contents

COLOPHON

KNOWLEDGE

PROCESS

TOOLS

Documents, that can be filled in as part of the co-creation process, to enable you to contextualise the cVPP options for your community.

Legend


More info


Insight


Example


Assignment


Link to video


Case


Did you know that?

Internal link

Internal link to a crash course or other chapter in the starter's guide.

Tool |

Internal link to a tool within the starter's guide.

External link

Link to an external website, pdf or video.

Disclaimer

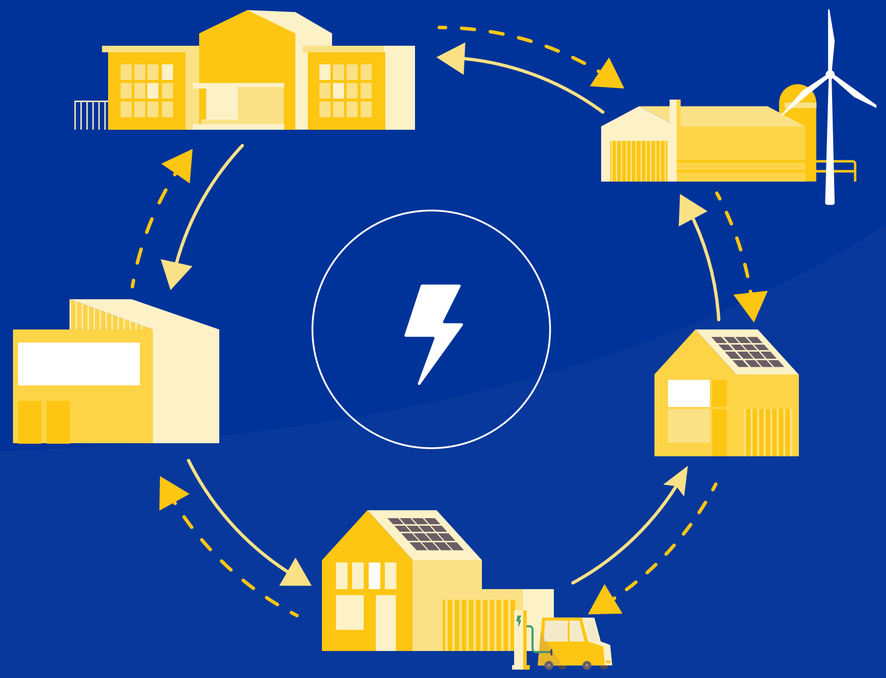
Policies and market opportunities for cVPPs are constantly changing. We are doing our best to keep this starter guide as up to date as possible.

To anticipate future changes, we have included in section two elements and activities that are not yet permitted or feasible (for example, due to regulations or technology in its infancy). The relevance of this list will change as the energy market is constantly evolving. There are also differences between (EU) countries.

In order to initiate a discussion among participants about what a common energy project can mean, this list of activities is still useful. It gives an idea of what an energy community is all about: generating and saving energy, using energy more efficiently, storing energy, increasing own consumption, peer-to-peer exchange and supporting the stability of the electricity grid.

Chapter 1

Why cVPP?



Introduction

cVPP stands for community-based Virtual Power Plant. The project belongs to the Interreg North-West Europe program, led by Eindhoven University of Technology. Eight Belgian, Dutch and Irish partners are participating.

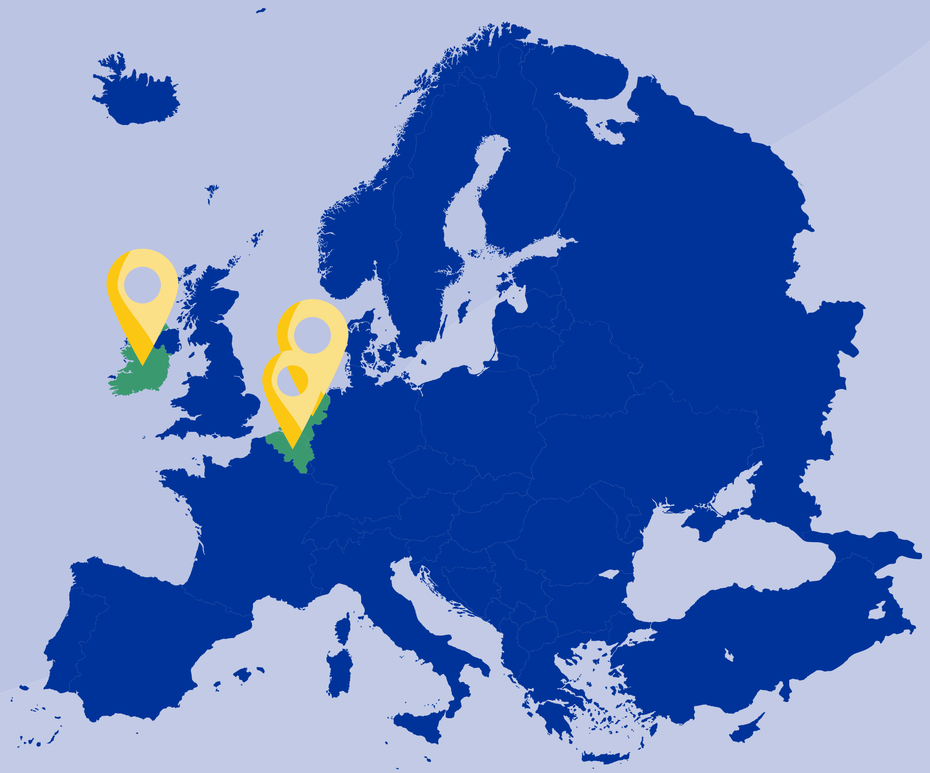
The essence of this project is a sociotechnical innovation based on:

- away from fossil fuels, dominated by large companies;
- towards distributed energy generation in which citizens and communities play an important role.

The new EU Energy Directive, once transposed into national legislation in 2020-2021, will bring environmental and economic benefits, as well as opportunities for prosumers and energy communities.

The cVPP project aims to prepare citizens' energy communities for that moment. In addition to providing knowledge, it aims to help clarify the actions and interventions needed to take the first steps towards a democratic energy future.

In this starter's guide you will find a working model for energy communities. It goes beyond energy saving, efficiency and sustainable energy generation. With this guide you take a new step towards a sustainable energy transition. It is a guide for everyone who is **active, engaged** and **interested**.

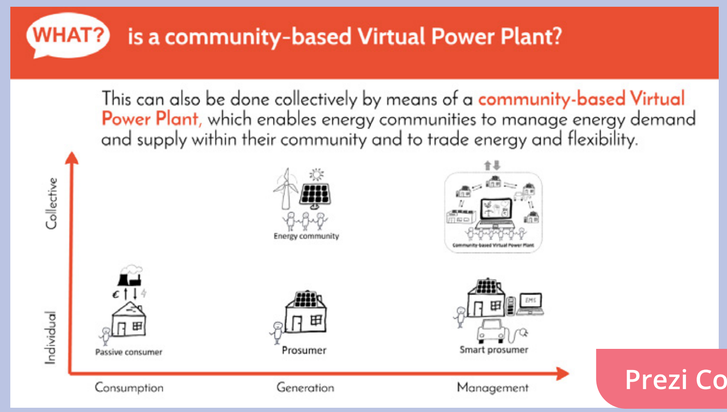


Partners

cVPP-project | INTERREG NWE

TU/e Technische Universiteit Eindhoven University of Technology
Tipperary energy AGENCY
DPL
Energent
Apeldoorn
KAMP C duurzaam bouwen
CRES Community Renewable Energy Supply
Community Power Electricity Supplier
Comhairle Contae Thiobraid Árann Tipperary County Council
DuneWorks

Pitch for community-based Virtual Power Plant



Prezi Community Energy 2.0

The role of citizens in the energy market is evolving. Until recently, their role was that of **passive consumers**, who consumed electricity bought from suppliers.

These passive consumers are now increasingly becoming prosumers. **Prosumers** invest in renewable energy themselves and thus become the owners of renewable energy: either individually or collectively as part of an energy community.

Thanks to new energy technologies such as batteries and energy management systems, prosumers in turn become **smart prosumers**. In this way, they manage the electricity supply and demand within their own household.

You can also organize this process collectively with a **community-based Virtual Power Plant (cVPP)**. Thanks to such a virtual power plant, you manage the supply and demand of energy within the community and trade energy and flexibility.

INSIGHT | To which questions does a cVPP offer an answer?

- Help, the sun doesn't shine and the wind is not blowing! Where will our energy come from now?
- We want to use the renewable energy we generate ourselves and thus be more independent of multinationals. How can we keep the self-generated renewable energy within our community?
- The energy transition is not easy. How can we support the matching of supply and demand? What role can the community play?
- My solar panels generate surplus energy. Can I share or sell this surplus to my neighbours?
- What if our community generates more energy than we need ourselves? Can we sell this surplus?
- How do we support the balance of the energy network so that renewable energy remains in our own country or region?
- How can we contribute to a more sustainable and just energy system?
- Is it possible for households without investment power and/or without a suitable roof to participate in our community energy initiative?

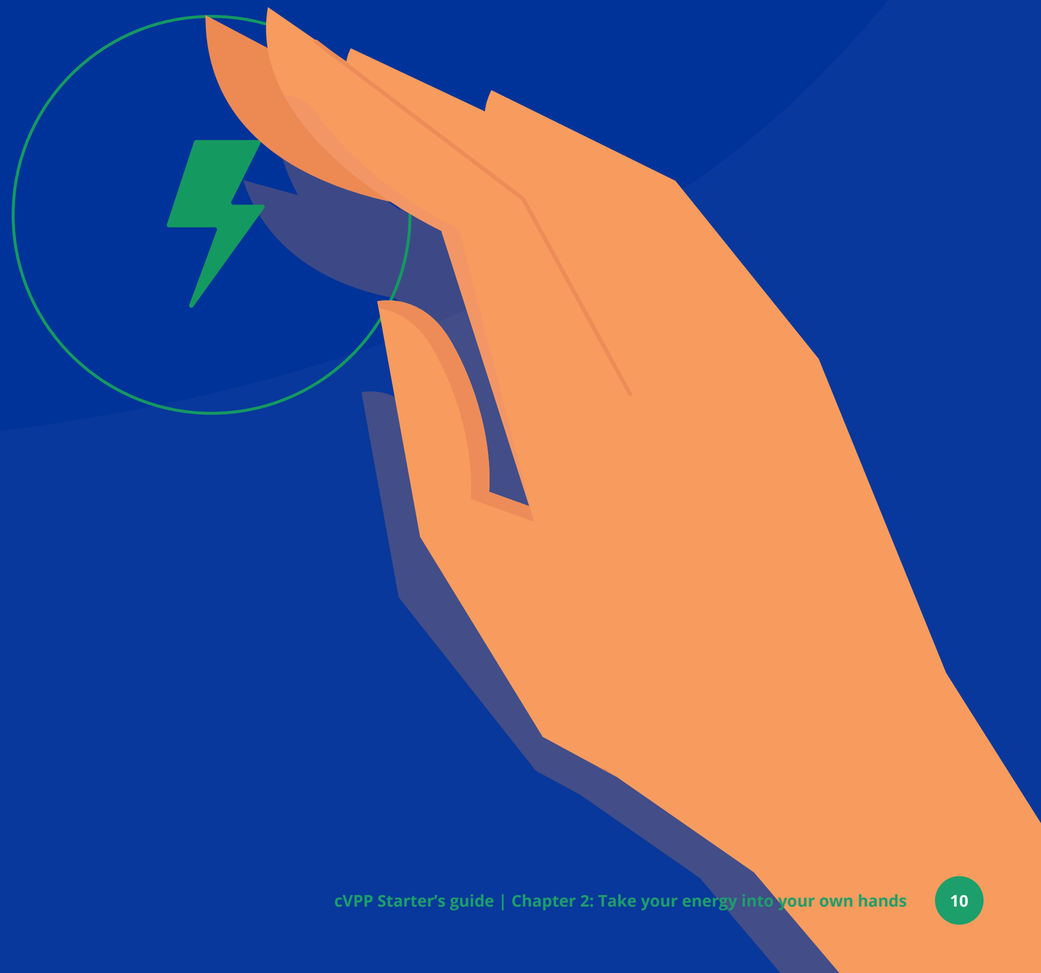
The answer to all these questions?

A community-based Virtual Power Plant: a virtual power plant for and by the community.

Chapter 2

Take your energy into your own hands

From passive consumer to cVPP



Chapter 2 | Take your energy into your own hands

From passive consumer to cVPP

- Passive consumer
- From passive consumer to active prosumer?
- From prosumer to smart prosumer
- Energy Community | Energy Cooperative
- From Energy Community to cVPP

Inspiring examples

- Energy cooperative Klimaan | Belgium
- Energy Cooperative Loenen | Netherlands
- Aran Islands Energy Co-op | Ireland

“We want to generate the energy needed to live and work, sustainably and locally… and preferably together!”

From passive consumer to cVPP

Passive consumer

Nowadays, choosing renewable energy is self-evident. But how do you do that? Should you wait for the government to decide? Or do you roll up your sleeves yourself?

Are you a passive consumer?

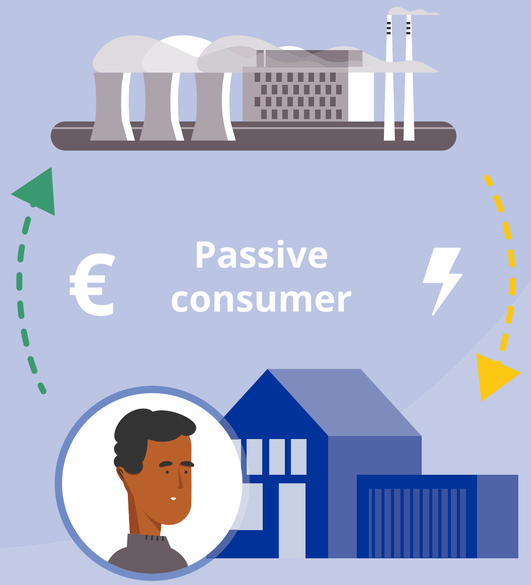
At home you use energy to heat your home and for hot water. In addition, you need electricity for light and for your appliances. You pay your energy bill every month. But where does our energy come from? Do you know? We plug in our appliances or the heating goes on, but we are not really aware of what happens behind the electricity meter.

Even as a consumer you can also have a major impact

You can do a lot yourself to save energy by reducing your energy consumption and by making your home energy efficient. Insulating your home is a start, but efficient heating, energy efficient appliances and LED lighting also have a big impact.

Want to know more? Get started yourself!

kampc.be



"The most inexpensive and green energy is the energy you do not use."

Take your own energy bill and compare. You will learn a lot from this.

Heating and hot water

The average consumption for heating and hot water in a home in Flanders is 15,000 kWh to 22,000 kWh. **In an ideal world,** that is a **maximum of 5,000 kWh to 10,000 kWh per home.** (1m³ gas = 1lt fuel oil = 10kWh).

Electricity

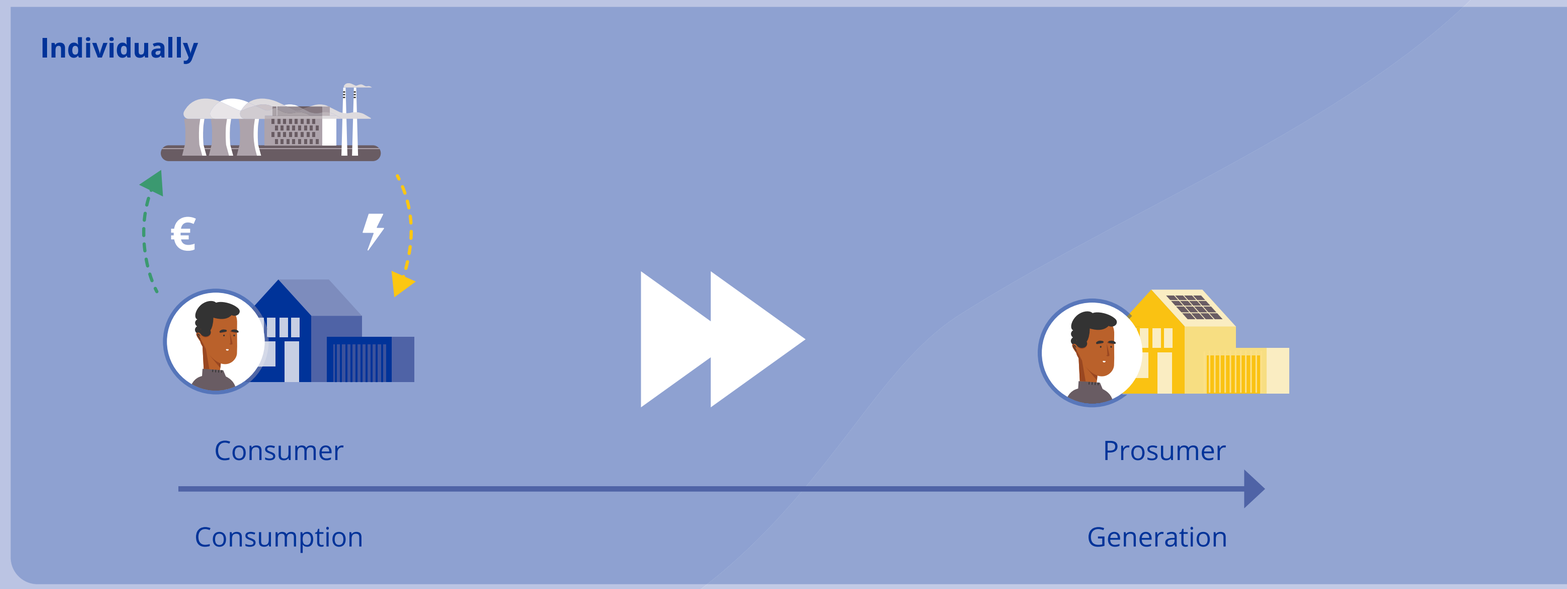
The average consumption of electricity in a home in Flanders is 3,600 kWh. A good target is **1,000 kWh per year**, plus 500 kWh per person. For example, a family of four people would achieve 1,000 kWh, plus 4 times 500 kWh. Together this gives **an ideal consumption of 3,000 kWh**. Here you count the actual energy consumption, i.e. both what you take off the grid and what you generate yourself.

From passive consumer to active prosumer?

A prosumer is someone who not only consumes energy but also generates it himself. As a prosumer (producer + consumer) you go one step further than the consumer. In addition to a well-insulated house, you generate your own renewable energy by, for example, placing solar panels on the roof.

Why?

- Financial: you use your own energy and you receive compensation for feeding it back into the electricity grid.
- CO2 reduction: you contribute to the fight against global warming and ensure the future of our planet and children.
- Autonomy and control: you are less dependent on the electricity grid and large companies.



Energy thanks to the sun

On the Zonnekaart Vlaanderen (Solar Map of Flanders) you can see, based on an address, whether a roof is suitable for solar panels. And you can calculate whether it is interesting for you to install solar panels. You get an estimate of the cost price of an installation, payback time and the profit per year.

Zonnekaart

In Belgium

Since 2015, green certificates have been abolished for small installations (houses). From 1st January 2021, the system of reverse meters will also be abolished. Analogue meters will be replaced by digital meters.

“If you want to change the world, start with yourself.”

It is not possible for everyone to generate renewable energy. For example, if you live in an apartment block, if you don't have the money to invest, if you rent a house, if the orientation of the roof is unsuitable or there is too much shadow falling on it, ...

Residents in St. Amandsberg choose solar panels

The goals of the research project Buurzame Stroom in St. Amandsberg in Ghent are:

1. Generating as much solar energy as possible in the district
2. Letting everyone in the neighbourhood join in on the proceeds
3. Keeping the grid stable

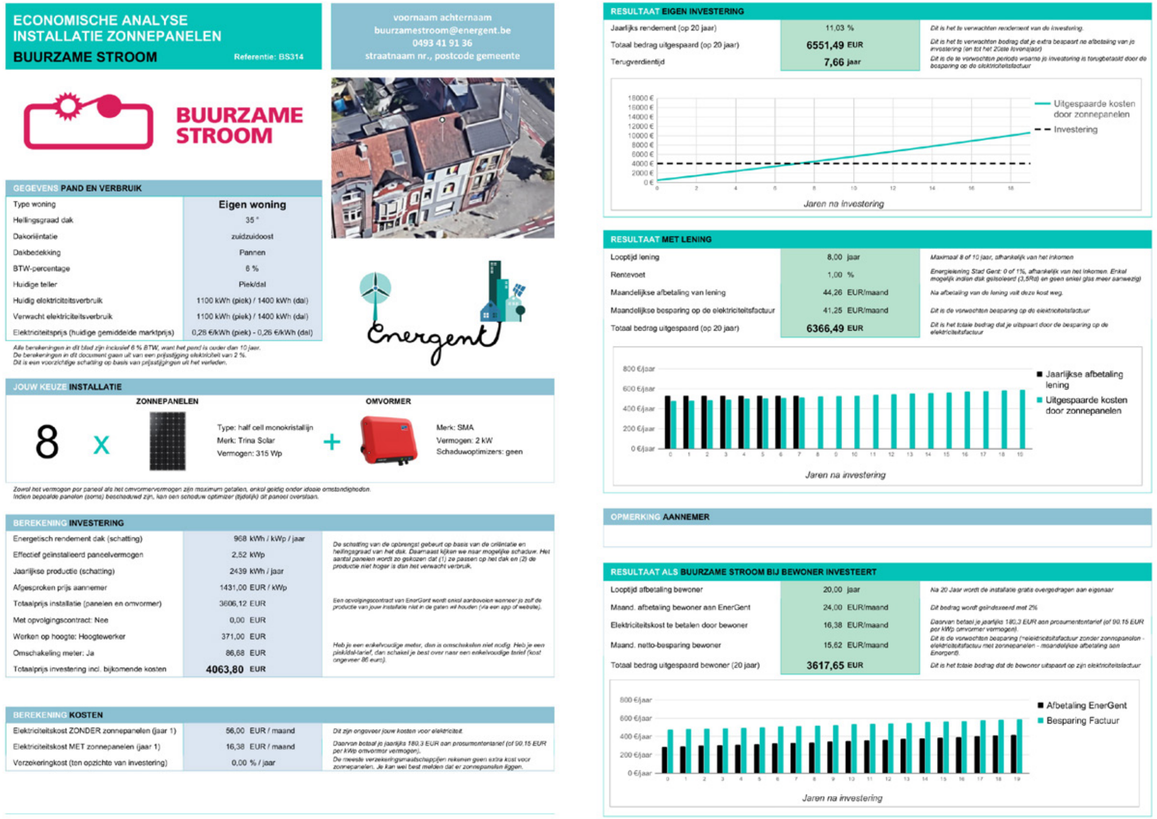
Residents interested in solar panels in St. Amandsberg in Ghent received clear information from the energy cooperative EnerGent via an information folder. (see example)

Information folder Buurzame Stroom

At a single glance you can tell how many solar panels you can install, how much it will cost and how long it will take you to earn back the investment. Buurzame Stroom offers several options, depending on the financial means of the owner.

More information about the research project Buurzame Stroom itself:

Final report Buurzame Stroom


ECONOMISCHE ANALYSE
INSTALLATIE ZONNEPANELEN
BUURZAME STROOM
Referentie: BS314

voornaam achternaam
buurzamestroom@energent.be
0493 41 91 36
straatnaam nr., postcode gemeente

BUURZAME STROOM

GEGEVENS PAND EN VERBRUIK

	Eigen woning
Type woning	
Hellingsgraad dak	35 °
Dakoriëntatie	zuidzuidoost
Dakbedekking	Pannen
BTW-percentage	6 %
Huidige teller	Piek/dal
Huidig elektriciteitsverbruik	1100 kWh (piek) / 1400 kWh (dal)
Verwacht elektriciteitsverbruik	1100 kWh (piek) / 1400 kWh (dal)
Elektriciteitsprijs (huidige gemiddelde marktprijs)	0,28 €/kWh (piek) - 0,26 €/kWh (dal)

Alle berekeningen in dit blad zijn inclusief 6 % BTW, want het pand is ouder dan 10 jaar.
De berekeningen in dit document gaan uit van een prijsstijging elektriciteit van 2 %.
Dit is een voorzichtige schatting op basis van prijsstijgingen uit het verleden.

JOUW KEUZE: INSTALLATIE

ZONNEPANELEN: 8 x — Type: half cell monokristallijn; Merk: Trina Solar; Vermogen: 315 Wp

OMVORMER: + — Merk: SMA; Vermogen: 2 kW; Schaduwoptimizers: geen

Zowel het vermogen per paneel als het omvormervermogen zijn maximum getallen, enkel geldig onder ideale omstandigheden.
Indien bepaalde panelen (some) beschaduwd zijn, kan een schaduw optimizer (bijdalij) dit paneel overslaan.

BEREKENING INVESTERING

Energetisch rendement dak (schatting)	968 kWh / kWp / jaar	
Effectief geïnstalleerd paneelvermogen	2,52 kWp	
Jaarlijkse productie (schatting)	2439 kWh / jaar	De schatting van de opbrengst gebeurt op basis van de oriëntatie en hellingsgraad van het dak. Daarnaast kijken we naar mogelijke schaduw. Het aantal panelen wordt zo gekozen dat (1) ze passen op het dak en (2) de productie niet hoger is dan het verwacht verbruik.
Afgesproken prijs aannemer	1431,00 EUR / kWp	
Totaalprijs installatie (panelen en omvormer)	3606,12 EUR	Een opvolgingscontract van EnerGent wordt sterk aanbevolen wanneer je zelf de productie van jouw installatie niet in de gaten wil houden (via een app of website).
Met opvolgingscontract: Nee	0,00 EUR	
Werken op hoogte: Hoogtewerker	371,00 EUR	
Omschakeling meter: Ja	86,68 EUR	Heb je een enkelvoudige meter, dan is omschakelen niet nodig. Heb je een (dal)tarief, dan schakel je best over naar een enkelvoudige tarief (kost ongeveer 80 euro).
Totaalprijs investering incl. bijkomende kosten	**4063,80 EUR**	

BEREKENING KOSTEN

Elektriciteitskost ZONDER zonnepanelen (jaar 1)	56,00 EUR / maand	Dit zijn ongeveer jouw kosten voor elektriciteit.
Elektriciteitskost MET zonnepanelen (jaar 1)	16,38 EUR / maand	Daarvan betaal je jaarlijks 180,3 EUR aan prosumententarief (of 90.15 EUR per kWp omvormer vermogen).
Verzekeringkost (ten opzichte van investering)	0,00 % / jaar	De nieuwe verzekeringsmaatschappijen rekenen geen extra kost voor zonnepanelen. Je kan wel best melden dat er zonnepanelen liggen.

RESULTAAT EIGEN INVESTERING

Jaarlijks rendement (op 20 jaar)	11,03 %	Dit is het te verwachten rendement van de investering.
Totaal bedrag uitgespaard (op 20 jaar)	6551,49 EUR	Dit is het te verwachten bedrag dat je extra bespaart na afbetaling van je investering (en tot het 20ste levensjaar)
Terugverdientijd	7,66 jaar	Dit is de te verwachten periode waarna je investering is terugbetaald door de besparing op de elektriciteitsfactuur

Uitgespaarde kosten door zonnepanelen
Investering
Jaren na investering

RESULTAAT MET LENING

Looptijd lening	8,00 jaar	Maximaal 8 of 10 jaar, afhankelijk van het inkomen
Rentevoet	1,00 %	Energiesalmij Stad Gent: 0 of 1%, afhankelijk van het inkomen. Enkel mogelijk indien dak geïsoleerd (3,5Rd) en geen enkel glas meer aanwezig)
Maandelijkse afbetaling van lening	44,26 EUR/maand	Na afbetaling van de lening, valt deze kost weg.
Maandelijkse besparing op de elektriciteitsfactuur	41,25 EUR/maand	Dit is de verwachten besparing op de elektriciteitsfactuur
Totaal bedrag uitgespaard (op 20 jaar)	6366,49 EUR	Dit is het totale bedrag dat je uitspaart door de besparing op de elektriciteitsfactuur

Jaarlijkse afbetaling lening
Uitgespaarde kosten door zonnepanelen
Jaren na investering

OPMERKING AANNEMER

RESULTAAT ALS BUURZAME STROOM BIJ BEWONER INVESTEERT

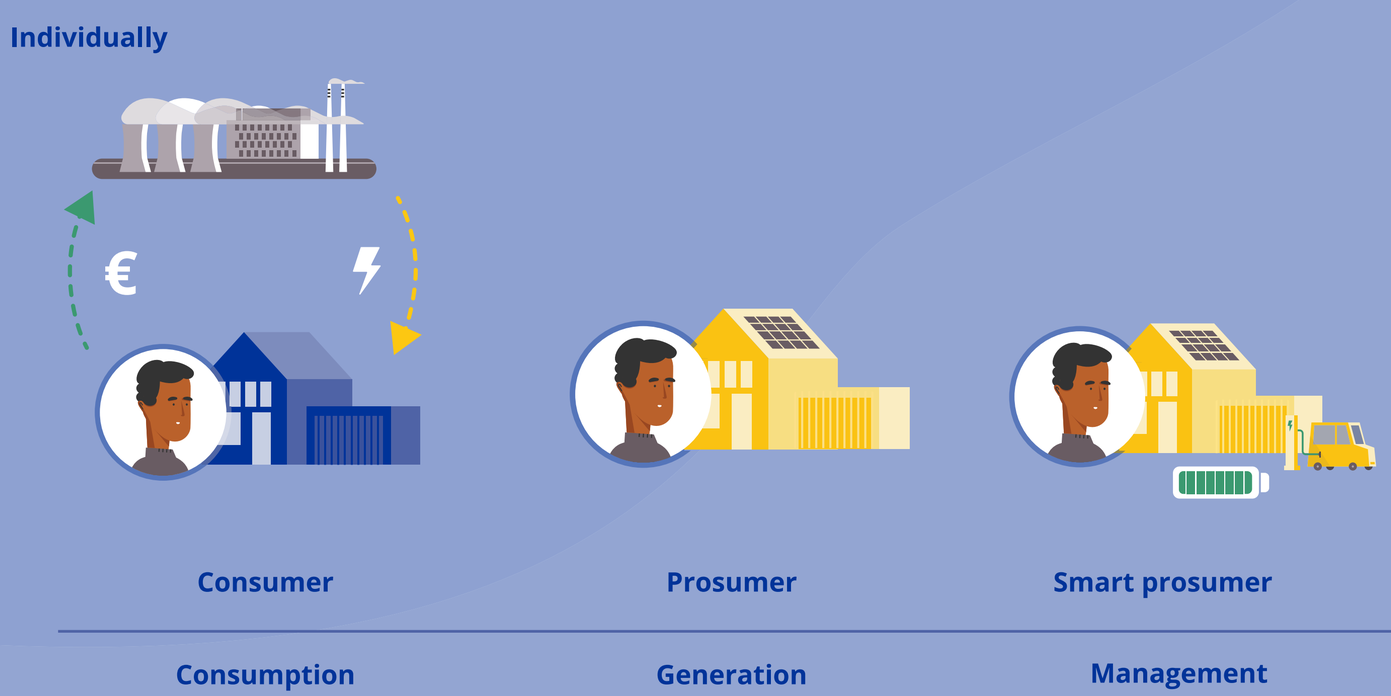
Looptijd afbetaling bewoner	20,00 jaar	Na 20 Jaar wordt de installatie gratis overgedragen aan eigenaar
Maand. afbetaling bewoner aan EnerGent	24,00 EUR/maand	Dit bedrag wordt geïndexeerd met 2%
Elektriciteitskost te betalen door bewoner	16,38 EUR/maand	Daarvan betaal je jaarlijks 180,3 EUR aan prosumententarief (of 90.15 EUR per kWp omvormer vermogen).
Maand. netto-besparing bewoner	15,62 EUR/maand	Dit is de verwachten besparing (=elektriciteitsfactuur zonder zonnepanelen - elektriciteitsfactuu met zonnepanelen - maandelijkse afbetaling aan Energent).
Totaal bedrag uitgespaard bewoner (20 jaar)	3617,65 EUR	Dit is het totale bedrag dat de bewoner uitspaart op zijn elektriciteitsfactuur

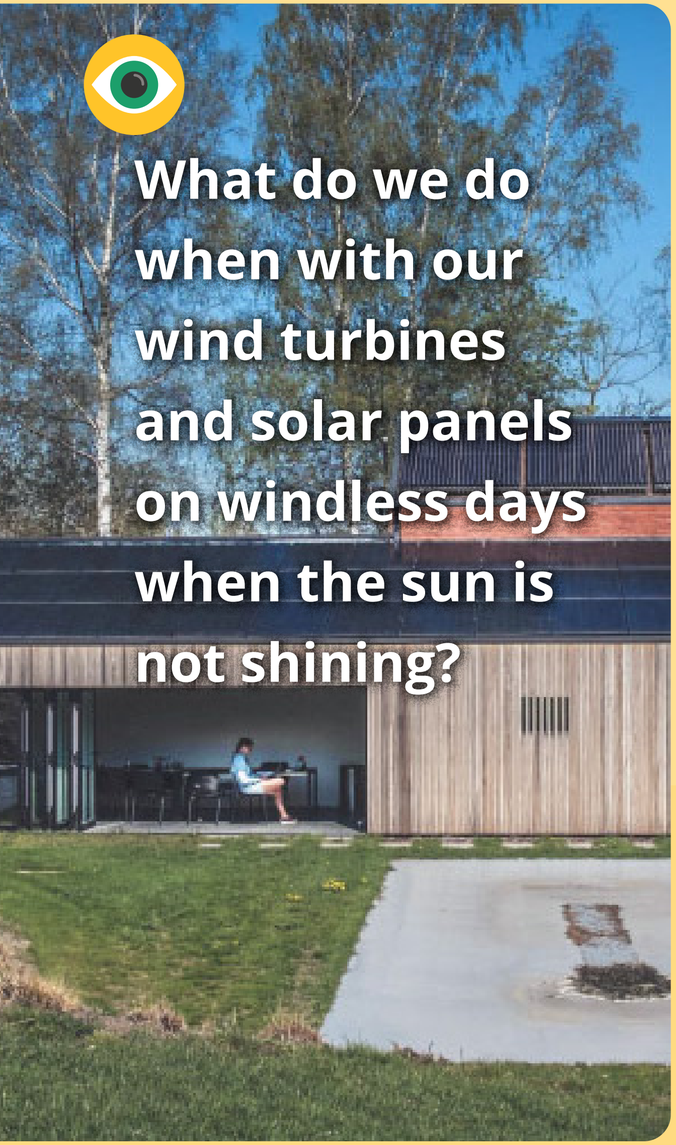
Afbetaling EnerGent
Besparing Factuur
Jaren na investering

From prosumer to smart prosumer

"Storing your energy so that you can use it during times of energy shortage, that's smart!"

Through smart equipment and adjusting behaviour, you control whether you use, store, buy or sell energy. If there is too much renewable energy, for example, your washing machine will turn on or your electric car will charge. Too much energy is stored as hot water in the boiler and the excess electricity in the salt water battery. If there is an energy demand, the energy management system will arrange for the stored energy to be used first. As a smart prosumer, you are self-sufficient, energy-neutral and CO2-neutral. At the moment, it is a considerable financial investment, so unfortunately not everyone can afford it.





“A month off the grid? For us, that’s a sport”

Leen Peeters, the founder of Th!nk E

From De Tijd, author: Tobe Steel, 15 May 2019

In Oud-Heverlee, entrepreneur Leen Peeters is looking for technological solutions to the energy problem, ranging from hydrogen panels to the first Flemish neighbourhood battery.

In 2011, she set up her own engineering firm, Th!nk E, which now employs seven people. She bought a dilapidated farmhouse in Oud-Heverlee and as an experiment, she converted it into a self-sufficient home and office building. The former cowshed became a test lab for the develop all kinds of sustainable technologies in a real life environment.

The 41-year-old entrepreneur considers meeting her own energy needs, a sport. In the garage she installed a series of batteries that store enough power to last three days. With vacuum solar collectors on the roof, she heats up water all year round, which is stored in two insulated tanks underground.

By the end of summer, she installed a ‘heat battery’ of 24,000 litres of water at 90 degrees Celsius, enough to last a third of the winter.

Yet she does not advocate radical changes in behaviour. ‘We are a family of engineers and we do something like this for fun. But in the energy transition you can’t ask people to drastically change their lifestyle. People don’t just eat hot food when the sun is shining, it doesn’t work that way. They do and will charge their electric car at the most convenient time by means of smart steering.’

Hot swimming pool

There are solar panels on a second roof. To increase their efficiency, Peeters built a cooling installation behind the panels. With water from the pond and swimming pool, the thermal solar panels are cooled down, increasing their efficiency by up to 36 percent. The effect? More power yield, but also an outdoor swimming pool whose temperature can reach 40 degrees in the summer.

‘Our efficiency is much higher than we initially dared to dream of and we now have surplus heat that we have to get rid of. This is certainly not the most efficient solution for an ordinary home, but for a public swimming pool, for example, cooled solar panels are ideal for providing both electricity and heat’, says Peeters.

Together with her husband, daughter and son, she once went off the grid for 35 days just for sport, and disconnected from the public electricity grid. ‘If there were two cloudy days, we adjusted our menu. I calculated it then: grilling a chicken in the oven costs 2.02 kilowatt hours, Dr Oetker pizzas 0.707 kilowatt hours. It turned out to be tomato mozzarella’, the businesswoman laughs.

Yet she does not advocate radical changes in behaviour. ‘We are a family of engineers

and we do something like this for fun. But in the energy transition you can't ask people to drastically change their lifestyle. People don't just eat hot food when the sun is shining, it doesn't work that way. Through smart steering, however, they will charge their electric car at the most convenient time.'

Energy transition

Peeters advises the European Commission on the energy transition and offers governments and companies the opportunity to test new technologies in a realistic living environment. During the summer of 2019, for example, the first three hydrogen panels were installed in the garden.

The technology, developed by KU Leuven, filters water from the air and converts it into hydrogen using a solar panel and electrolysis. Unlike batteries, hydrogen is suitable for storing solar energy in the summer months for the winter. By 2020, up to 20 of the panels in Oud-Heverlee will have been installed. These will produce enough hydrogen to heat a well-insulated house for a whole winter.

Together with her neighbours in Oud-Heverlee, she is building the first smart electricity grid in Flanders.

Peeters is also involving local residents in her experimental projects. She lives in a street with forty houses and together with her neighbours she is building a local energy community with a smart electricity grid. 'The grid was built here 50 years ago when there were three farms, but it has was not designed for what it should be able to cope with now,' says Peeters.

'A quarter of the homes here are heated by a heat pump, we now have five electric cars, three hybrids and quite a few families have solar panels. On a sunny day, solar panels sometimes have to be switched off because the grid would otherwise be overloaded. Our aim is to provide more flexibility with batteries, flexible consumption and the ability to exchange excess power directly with the neighbours'.

The Ophemstraat in Oud-Heverlee is the first in Flanders to have a local battery. The local residents store 90 kilowatt hours of electricity there, enough to supply nine families with electricity for one day. The battery, which was financed with European funds, should help to balance the grid. The electricity generated by solar panels during the day is used by local residents when they come home from work in the evening.

As an experiment, in 2020 there will also be five electric cars in the street that will not only charge at the plug, but that will use their batteries at peak times to inject extra power into the grid. By ensuring a local balance, you avoid congestion on the grid and we avoid having to make the power cable in the street enormously heavier,' says Peeters. 'Think of the work here as a testing ground that shows the direction our energy system can take in the future. No technology is entirely satisfying, but we are proving here that a lot is possible if you dare to jump'.

Short summary

What can you do yourself?

- Generation of renewable energy
- Cooling for higher efficiency
- Storage in the ground
- Battery storage
- Off-grid: become independent of the grid
- Smart management
- Electric vehicle
- New technologies
- Solar panels and electrolysis for hydrogen generation

What can you do together?

- Smart electricity grid with a neighbourhood battery

Energy Community

What is an Energy Community?

A social network of people (and organisations) collectively engaged in initiatives and projects related to energy. Ranging from renewable energy generation, energy savings and efficiency to energy management. These networks are often site-specific but can also be virtual or sectoral. In addition to citizens, municipalities and (local) companies can also participate.

Some examples of possible **energy communities:**

- apartment building
- cohousing or cohabitation project
- Citizens' cooperative or association.
- a group of people linked by a common goal (cultural, religious, sporting, etc.).
- district, neighbourhood, village, municipality or town
- energy cooperative

Sometimes an energy community is based **on an existing community** that wants to play a more active role in the energy market. For example, the inhabitants of an apartment building or a cohousing project. Citizens live there and already have some sort of organisation. If they organise themselves to become a player in the field of energy, they become an energy community.

Often the primary goal is climate related. This is usually the case for cities, towns or villages. **The municipality** may decide to organise itself on the basis of energy. In this way it can play a role in the energy market and become more independent in terms of energy supply.

Many citizens want to take their energy into their own hands. They become an energy community through collective investment in sustainable energy or the provision of their own services. This requires more organisation, in energy cooperatives which exist throughout the EU as REScoops. (explained further)

Relationship between energy communities

Citizens can be part of several energy communities. Each of these energy communities may fulfil different values within the energy system and they may also overlap.

For example, as a citizen, you can become a member of **an energy cooperative** that supplies energy and allows you to sell your surplus energy to the cooperative. The energy cooperative may be part of a larger federation **RESCOOP** that is also able to pay for the flexibility you provide. At the same time, you can live in a flat where you and your neighbours decide to install solar panels on your roof. Your village has decided to organise the grid itself. So you are part of 3 (or even 4) energy communities.

Course AGORIA | Energy communities (in Dutch)

Two European examples of solar projects, in which you can participate as a citizen:

1. **Solar sharing (Zonnedelen) |** | In Belgium, you can support solar projects or start up your own. opstarten

Take your energy into your own hands! ▶ Solar guide (Zonnegids) ▶

2. **Balancing** (Salderen) earning from electricity from a distance | Postcode roos, in The Netherlands

In Belgium, you are still advised not to install more solar panels than you use annually, because you are not allowed to sell electricity. In the Netherlands, however, there is the so-called Postcode scheme, which allows you to balance remotely. You invest individually on someone else's roof and you acquire the electricity. With this scheme, as a members of a cooperative you will receive an energy tax discount on your energy bill for locally and sustainably generated electricity.

More information about the Postcode roos ▶

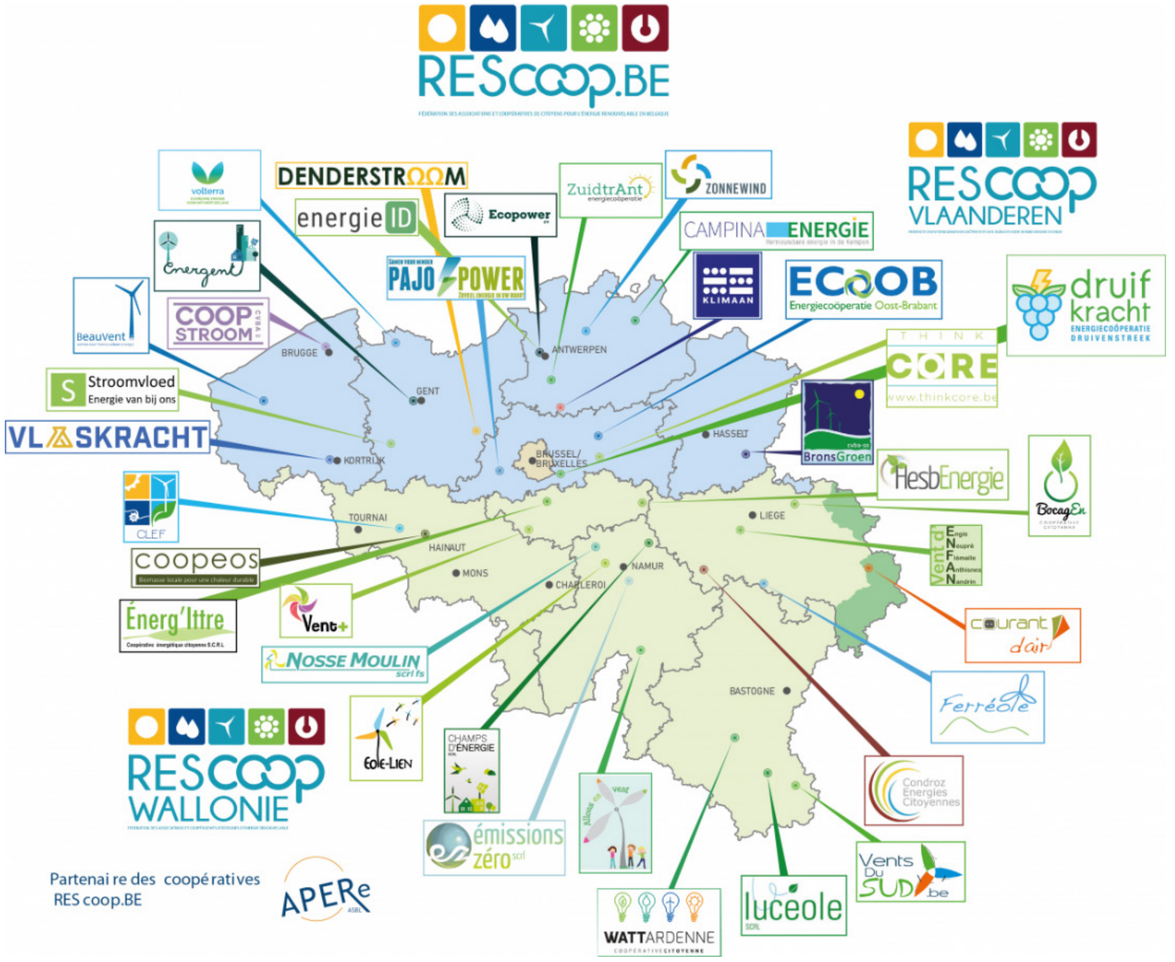
Energy cooperative

A cooperative is an autonomous organisation of individuals who unite voluntarily to represent their common economic, social and cultural needs and aspirations through an enterprise which they jointly own and which they democratically control.

The cooperative spirit rests on three core ideas:

- **Collective entrepreneurship.** The cooperative is based on a common need and the desire of people to create added value by doing business together. The added value can also be social. Together, the community determines the goal they will go for.
- **Ownership.** The cooperative is not purely profit-driven. The members jointly own the cooperative. In other words: a cooperative does not strive for profit maximisation but for goal maximisation.
- **Autonomy and control.** The cooperative is autonomous and its management is carried out in a democratic manner.

The most important characteristics are the variable number of partners (and therefore capital) and the great freedom in the statutory field. At least three founders are required to establish a cooperative.

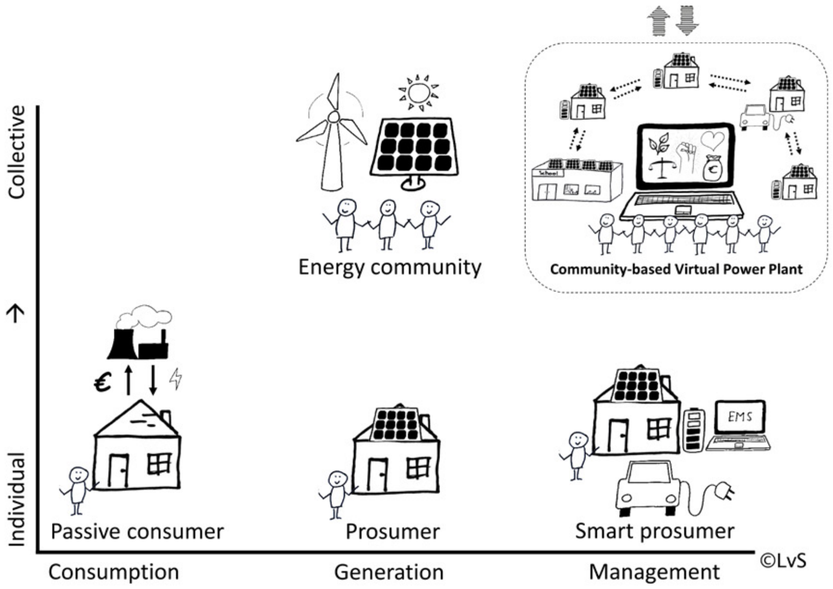


The three core ideas reflect the fundamental values of the cooperative movement: self-reliance, responsibility, democracy, equality, fairness and solidarity. To concretely realise these values, the **International Cooperative Alliance** formulated seven cooperative principles (the 7 ICA principles).

1. Voluntary and Open Membership
2. Democratic Member Control
3. Member Economic Participation
4. Autonomy and Independence
5. Education, Training and Information
6. Cooperation among cooperatives
7. Concern for Community

More information: rescoopv.be

From Energy Community to cVPP



Most energy communities focus on renewable energy. That is a good basis on which to develop into a cVPP. A virtual power plant, for the energy community and by the energy community, which not only generates renewable energy but also shares and trades it. You do this under own management and you charge fair prices for green electricity or heat.

"Your energy in your own hands: a tangible future dream!"

Did you know that?

There are four energy cooperatives in the province of Antwerp: Campina Energie, Klimaan, Zonnewind and ZuidtrAnt.

Did you know that?

The Netherlands has a total of 582 energy cooperatives. You can find them in all provinces, regions and almost every municipality. The number of members and/or participants in projects is about 85,000 people, with an impact on at least 250,000 people. 80% of the cooperatives develop solar projects, 24% wind projects and an increasing number are involved in heat, mobility and other innovative energy projects. Every year, the organisation **HIER opgewekt** publishes a **Local Energy Monitor**, a report and analysis of the developments of civil energy initiatives in the Netherlands.

More info on

Energy Monitor ▶

Hieropgewekt ▶

Inspirational examples

In the Interreg NWE project cVPP, several communities have taken the first step towards a cVPP, with the support and expertise of the cVPP project partners.

Energy cooperative Klimaan | Belgium

Klimaan cvso is a new and enthusiastic cooperative from the region Mechelen with a large support base from its non-profit organisation, founded on 20 May 2019. Klimaan cvso originated from the citizens' movement Klimaan vzw in order to realise concrete, profitable and sustainable projects with 100% direct citizens' participation. An important part of its activities is located within the locally anchored non-profit organisations. They work hard to engage and unite all citizens, regardless of background or socio-economic situation, around sustainability and a socially just energy transition. This is also literally stated in the statutes.

The citizens' movement is organised around four so-called commons: land, air, water and energy. In a year and a half, the movement has built up a membership of 200 members, 80 of whom are active volunteers. Klimaan cvso is a "real" citizens' cooperative. They follow the principles of the "International Cooperative Alliance", or ICA for short, which lays down the ground rules at European level for cooperative citizens' initiatives.

Klimaan cvso is an active and respected member of REScoop Vlaanderen, the umbrella organisation of energy cooperatives in Flanders, in other words their 'brothers and sisters'.

Follow Klimaan's story and what steps they are taking towards a cVPP!

Energy cooperative Klimaan

More info Klimaan.be

Energy cooperative Loenen | The Netherlands

The Energy Cooperative Loenen was established on 9 May 2019 with the aim of stimulating the use of sustainable energy in Loenen to make the village energy-neutral. The starting point is that all inhabitants of Loenen are allowed to participate. People with low income, tenants or residents of a house with an unsuitable roof for solar panels, as well as owners of solar panels.

Initiator André Zeijseink says: "It is a member cooperative of and for all inhabitants of Loenen. The members jointly own the cooperative. As a member, you can think along, discuss and have a say in the decisions. In this way we want to involve as many Loenen residents as possible in the energy transition in order to prevent a new division arising around this issue". "By joining forces, we are keeping the initiative in Loenen and are not at the mercy of large international energy groups that install their solar panels or wind turbines and allow the income to flow abroad. By taking action ourselves, the proceeds can benefit all the residents of Loenen".

How does a cooperative work?

A cooperative works very simply. A cooperative has members and anyone in Loenen can become a member.
The members determine the policy. In addition, the cooperative has customers. Customers purchase electricity, heat and/or gas. Solar projects are carried out with the cooperative's income. Via the members' council, the members decide which investments are made. In order to be able to invest, money is of course needed. As a member, you can co-invest in projects with an attractive yield.
The cooperative also helps residents with questions and products in the field of energy and energy saving. The cooperative could also provide an electric shared car.

André Zeijseink: "To supply the power generated by the cooperative to our members, we have to use an energy supplier with a supply permit. The choice of energy supplier has not yet been made but the board is in discussion with a number of parties."

Neighbourhood ... in Apeldoorn | The Netherlands

Aran Islands Energy Co-op | Ireland

There are several energy cooperatives in Ireland. A good example is the Aran Islands in Ireland. The islanders, a close-knit community, own the Aran Islands Energy Co-op and work together to achieve their goal: to be self-sufficient in locally generated renewable energy by 2022 and free from oil, coal and gas.

Aran Islands: "We are now (2020) almost eight years into our 10-year project to free the Aran Islands from fossil fuels. If we can do it, any local community across Ireland can do it! "It is a bottom-up approach, where we, the energy in the local community, literally take power into our own hands. This is an opportunity we should seize as long as we have it. All this energy is available to us locally, and if we harness it for our own needs, we will create a civil revolution where power returns locally to the community, away from the big business. In this process, we will create sustainable communities, clean up our planet and combat climate change".

Aran Islands Energy Co-op works in three different areas:

1. In the field of **heating**, they are slowly improving all 500 homes and other buildings on the islands. These include external wall insulation on older homes, heat pumps for hot water and heating, solar panels on the roof.
2. In the field of **transport**, they bought several electric vehicles (EVs), more than 1000 electric bicycles and horse-drawn carriages.
3. In terms of **energy generation**, about 50 houses (10%) are equipped with air-water heat pumps, and with 2 kW of solar panels on their roofs. There are also about 10 houses with geothermal heating and about 100 houses with solar panels for hot water. Some buildings are equipped with batteries for storage.

Aran Islands: "We are also planning a new wind turbine for Árainn, big enough to meet all our needs. The location will be far away from tourist routes, houses and from the most picturesque areas. Gradually, our dependence on fossil fuels is decreasing. We keep track of this through the administration of our freighter, which is responsible for transporting all fossil fuels to the islands".

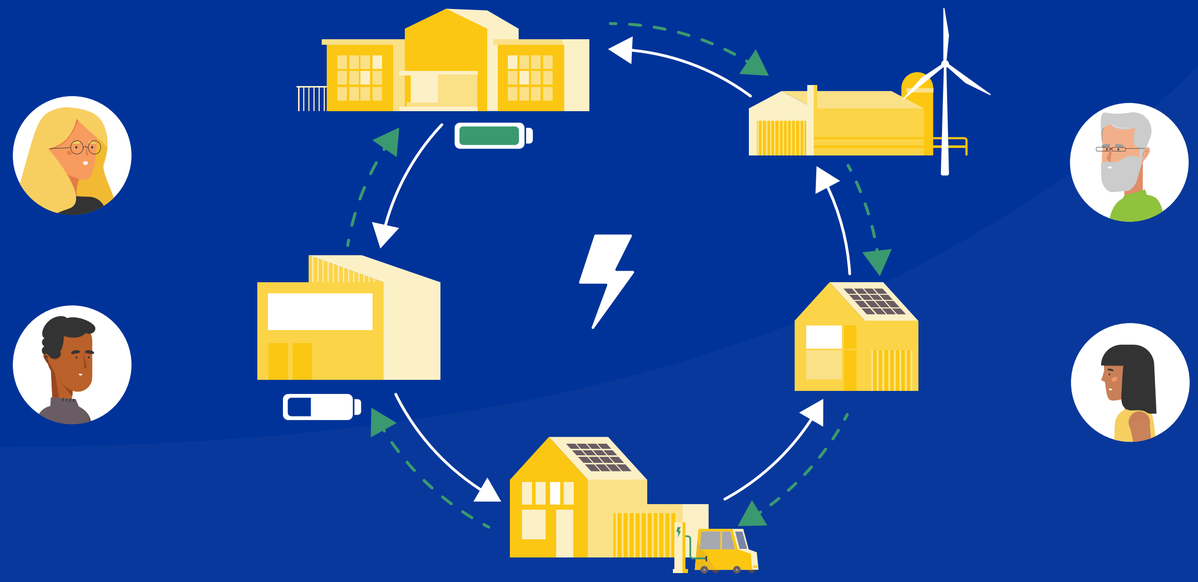
Aran Islands is a member of **Community Power**, one of the cVPP partners in Ireland. Community Power is the first Irish electricity supplier owned by the community. They join forces with energy communities working towards a sustainable energy future for Ireland. It is based at the first wind farm in Ireland (Templederry Wind Farm in Co Tipperary) and now they are working with Irish communities to develop more people-owned renewable energy projects.

Aran Islands Energy co-op

Chapter 3

What is a cVPP?

... and what can it mean for energy communities?



Chapter 3 | What is a cVPP?

Defining cVPP

What is a VPP?

What makes a cVPP community-based?

- Community engagement
- Community-logic

What can cVPP mean for energy communities?

Crash courses

- see Crash course 1 | What is a cVPP?
- see Crash course 6 | Community engagement practices

Defining cVPP

A community-based Virtual Power Plant (cVPP) is a portfolio of renewable energy sources (e.g. solar panels on your roof), controllable appliances (e.g. home appliances) and energy storage systems aggregated and coordinated by an ICT-based control architecture.

This portfolio is adopted by a (place-and/or interest-based) network of people who collectively perform a certain role in the energy system.

Source: Van Summeren et al., 2019

"cVPP accelerates the energy transition towards a sustainable and just future".

-dr.ir. Anna J. Wieczorek, TU Eindhoven | Lead Partner cVPP project

What makes it community-based is not only the involvement of a community, but also the community-logic under which it operates. This implies, among other things that:

- The initiative is driven by community needs, motivations and values.
- The community owns the various assets and the ICT-platform.
- Members decide collectively and choose how they organise themselves.

Two important elements:

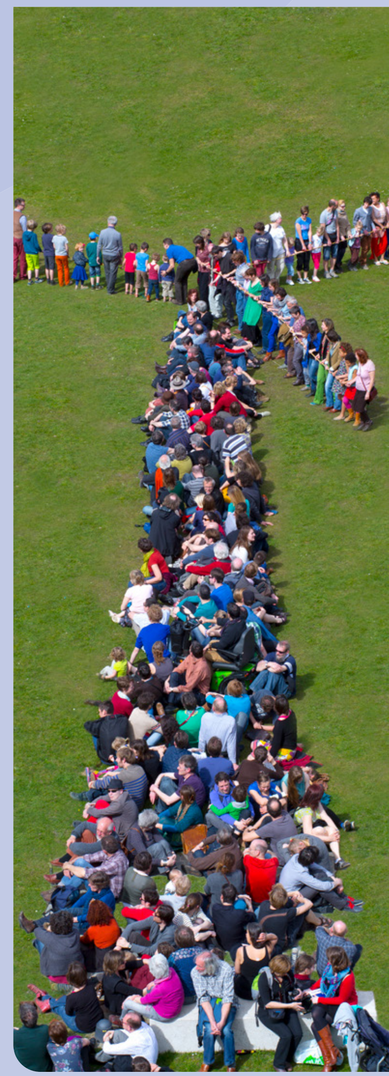
- A cVPP is organised for and by a community.
- The ICT-platform responds to changing prices, energy flows and weather conditions.

A cVPP can help its members participate in the energy market: they can decide when and how much of their electricity or flexibility is sold to whom and at what price and how they distribute the costs and benefits. cVPP thereby empowers prosumers and contributes to the democratisation of the energy system.

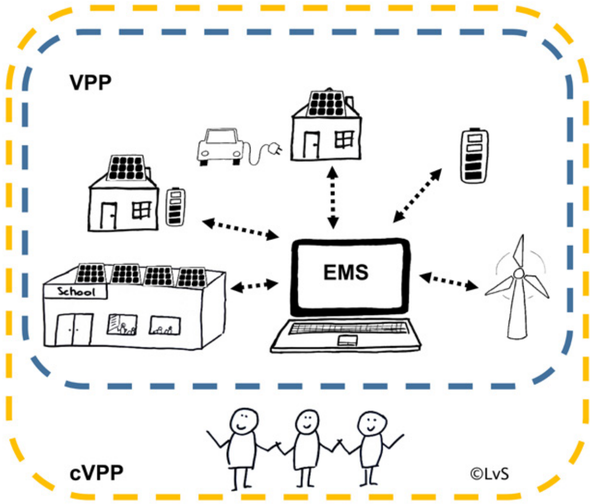
Crash course 1 | What is a cVPP?

cVPP | academic paper

cVPP EUSEW2020



What is a VPP?



A **Virtual Power Plant (VPP)** can serve different functions in the energy system. There is a distinction between technical-VPPs (aimed at providing grid support services to grid operators) and commercial-VPPs (aimed at trading energy on wholesale energy markets). Many existing VPPs and other similar smart grid experiments combine both functions. They usually serve the needs of utilities and incumbents in the current energy system.

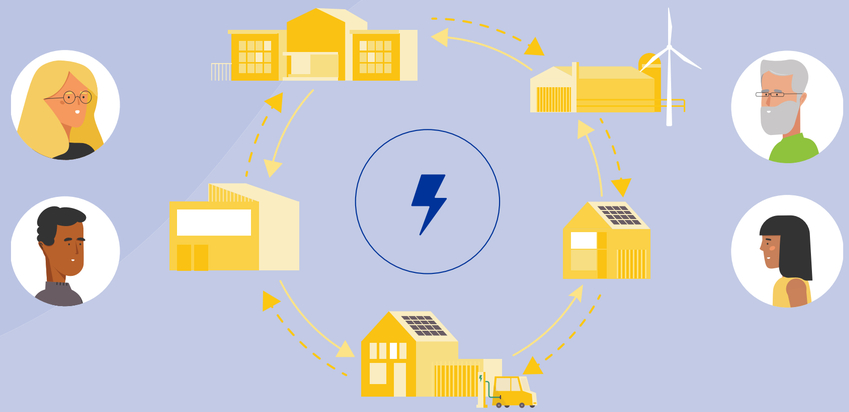
The core of the VPP is an ICT platform called an **Energy Management System** (EMS), which controls and coordinates a portfolio of:

- Renewable energy sources (e.g. solar panels, wind turbines)
- Controllable appliances which can be turned on/off using ICT (e.g. heat pump, smart dishwasher)
- Energy storage systems (e.g. batteries, electric vehicles)

A **VPP** operates as one single entity, similar to a conventional power plant.

The **EMS** enables energy management within the community based on:

- Information about renewable energy sources , controllable appliances, storage systems
- Expected demand and production
- Weather forecasts
- Energy prices



The aim is therefore to create a VPP for the community and by the community.

“In a cVPP, the community is the starting point.”

What makes a cVPP community-based?

What makes a cVPP community-based and distinguishes itself from commercial projects such as the VPP is not only the involvement of a community with its needs and motivations, but also the logic under which it operates.

This logic means that:

1. The initiative comes from the community.
2. The community owns the various resources and the ICT platform.
3. The members decide collectively and choose how they organise themselves.

This requires a great deal of commitment from people right from the start.

Crash course 6 | Community engagement practices ▶

By involving the community you achieve ecological, social and economic results through a fair co-creation process that improves interrelationships, trust and the well-being for the community.

A distinction can be made between a **community of place** (e.g. neighbourhood, village, region) and a **community of interest** (e.g. shared interests in energy or sustainability).

A community-based VPP aims at **value creation** for and by the community. This is only possible if the community is involved.

Values

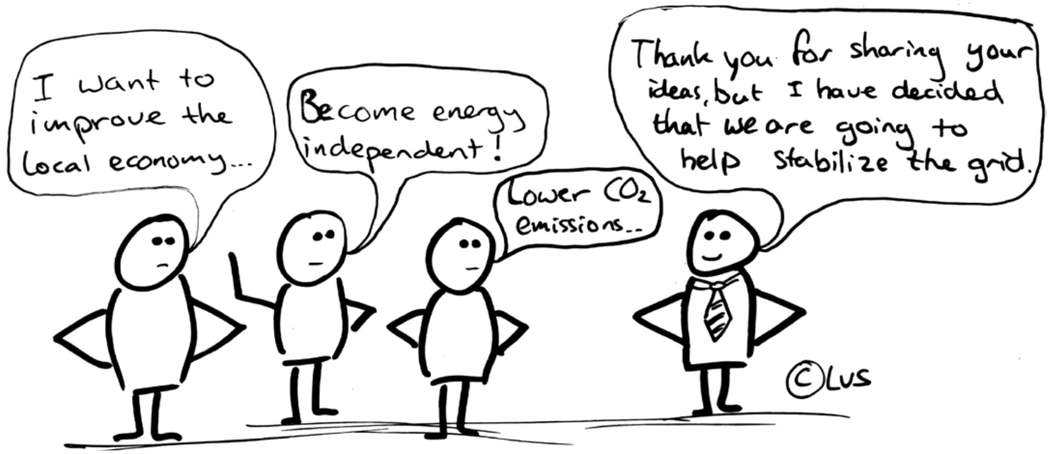
Social value creation related to the community

Economic value creation for the community

Environmental value and decarbonisation of our energy system

Community Logic

1



Cartoons © Luc Van Summeren

Seven ingredients for a successful energy community

Community-based logic consists of seven elements. However, rather than deciding in advance which or how many of these should be present for a project or initiative to be considered community-based, it is the community members who collectively decide which of the elements are relevant for them.

The aim of this approach is not only to inform and raise awareness among community members about the challenges of the energy transition. The aim is to create a story about cVPP that relates to their own questions, needs, ambitions and intended role in the energy transition.

Source: Van Summeren et al., 2019

Energy initiatives are driven by the needs, motivations and values of the community.

The needs and values often go beyond monetary interests and energy supply.

They include, for example:

- Financial (e.g. lower energy bills)
- Environment (e.g. reduction of CO2 emissions)
- Social (e.g. community building)
- Institutional (e.g. influencing energy policy)
- Technical or infrastructural (e.g. energy independence)

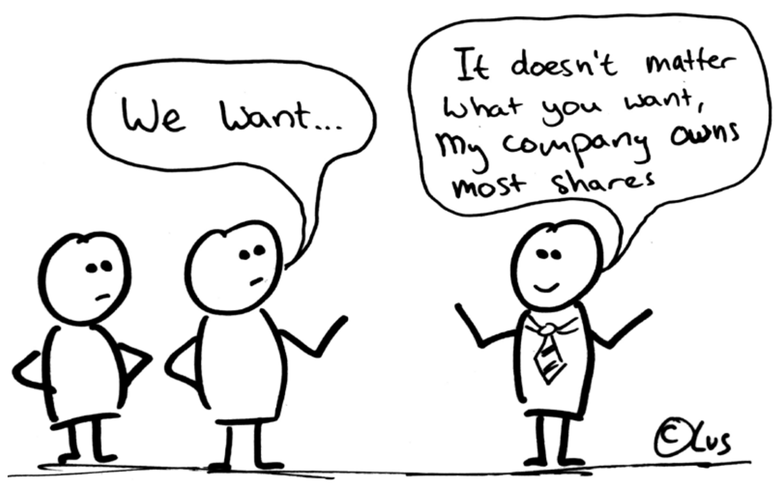
Defining cVPP ▶

2

The community owns the project.

There are different models of community ownership, ranging from co-ownership to 100% community owned. The most commonly used ownership model is the cooperative model, in which all members own one share of the entity (e.g. an energy cooperative). Other models are possible if the community so decides.

3

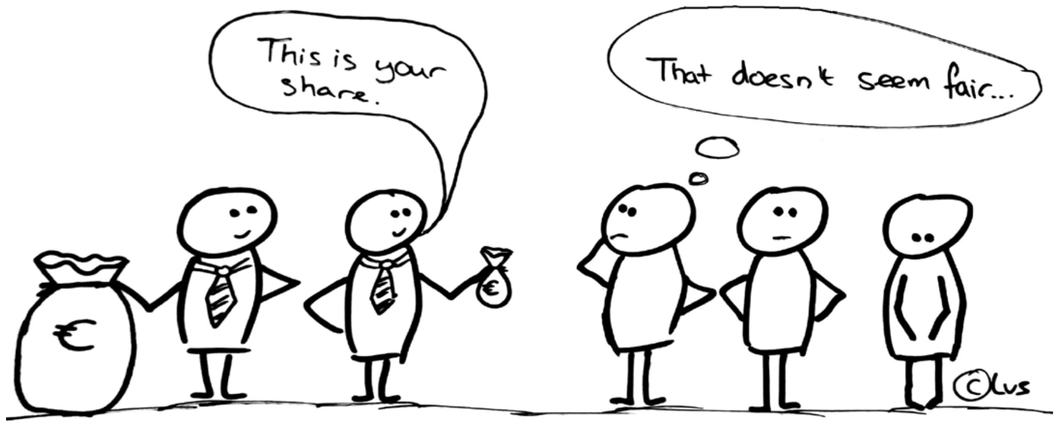


As owners of the project, the community collectively make the decisions.

The decision-making process depends on the ownership model. In the cooperative model mentioned above, each member has one vote. There are also representatives who take care of the day-to-day operation.

Cartoons © Luc Van Summeren

4



Community-based projects aim at a fair distribution of benefits, costs and risks among the members of the community.

In line with the needs and values of the community, these outcomes need not be financial or energy related. The members of the community decide what a fair distribution is for them.

5

Community-based projects involve all members of the community in planning and decision-making, in accordance with the wishes, needs and capacities of the members of the community.

If some members of the community feel excluded, an energy community project may become controversial.

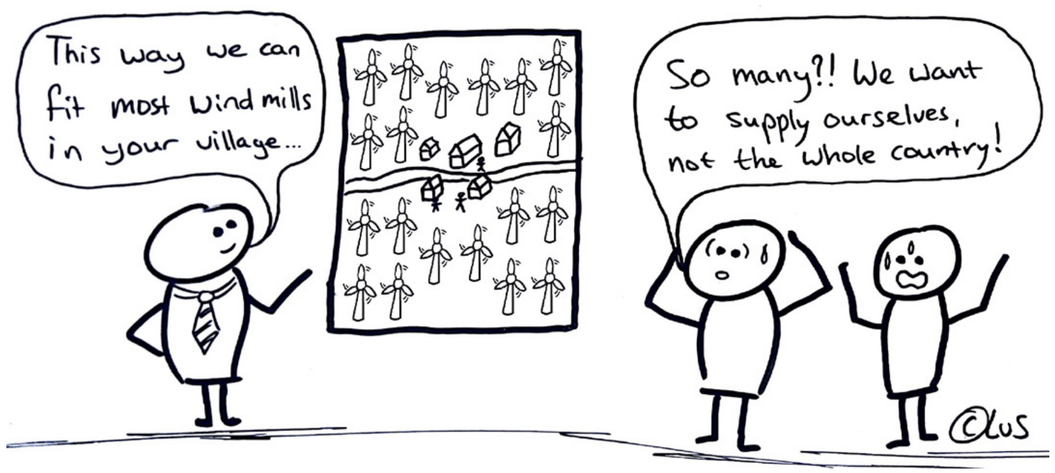
Cartoons © Luc Van Summeren

6

The community-based projects are open to the whole community, regardless of status and resources.

Involvement can range from informed to active participation. The 'energy community' label creates expectations of commitment throughout the process, from development to implementation (and possibly beyond).

7



Cartoons © Luc Van Summeren

The scale of the project and the technologies fit the needs and motivations of the community.

Rather than maximising economic benefits, the community's energy projects often link the size of the energy technology to their own needs and motivations, such as self-sufficiency. In addition, an important motivation for communities is to gain control over both the scale and location of renewable energy generation in their environment.

What can cVPP mean for energy communities?

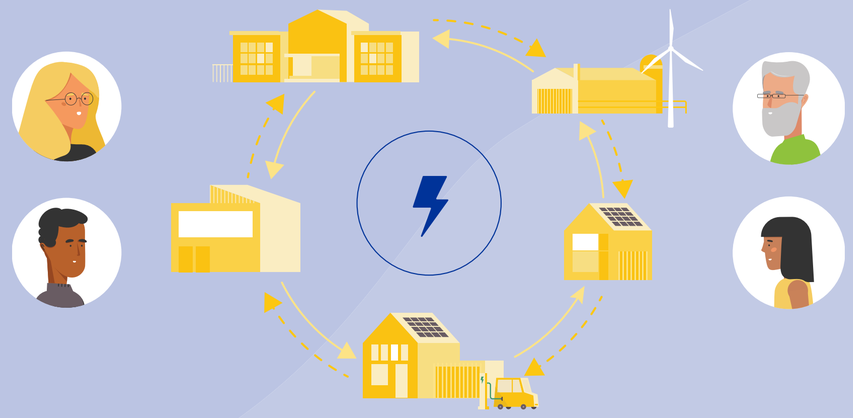
Working towards a cVPP can provide an opportunity for energy communities to take up new activities to work towards their environmental, economic and social goals. It also enables them to work together with other parties (e.g. TSO, DSO) and to participate in existing energy markets.
Developing a cVPP is a long-term process in which choices made at the outset affect future possibilities. For example, to enable a cVPP in the future, todays choices regarding e.g. heat pumps, charging poles for electric vehicles and batteries must take into account that they need to be controllable by a future EMS. It is important to engage community members at the outset so that they become aware of these issues to enable them to make choices of no-regret.

Which activities can an energy community undertake thanks to a cVPP?

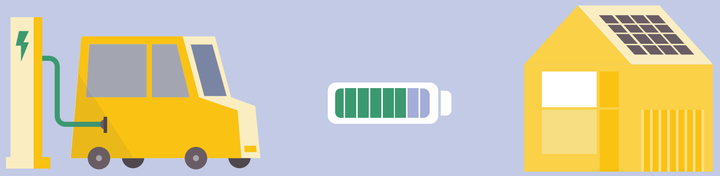
- Buying energy from the community and selling it back to community members and/or selling it on the energy market (as a licensed energy supplier)
- Actively collecting, aggregating and selling flexibility from renewable energy sources (RES), controllable appliances and storage (bundling this with flex from other communities, as an aggregator) (at distribution or transmission level)
- Peer-to-peer energy trading between community members.
- Collective sale of generated renewable energy (RE) by community members to a third supplier.

cVPP | academic paper

Tool | Goals & Activities



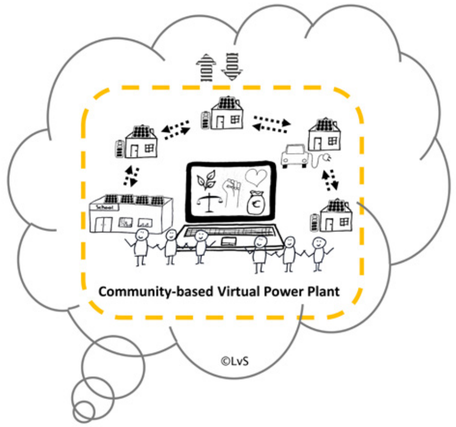
“The future is bright for energy communities.”



INSIGHT cVPP | Vision BM Gummaar Cohousing

Gummaar's vision for the future in 2026: "cVPP fits nicely in our cohousing project!"

It is 26th March 2026 and in their courtyard Gummaar cohousing is celebrating with a barbecue the fact that they are becoming more and more an example of sustainable living. Special attention is paid to their cVPP success story.



Social | Ecologic | Economic

"cVPP and cohousing reinforce each other!"

Resident and initiator Xaveer Moortgat: "The sustainability values we consider important are strengthened: CO2 reduction, local autonomy for our community, and lowering the energy bill. cVPP is actually very holistic: you don't just look at sustainable generation and savings, but also at storage, energy exchange and interactions of our small energy system with the larger energy system."

Cohousing is also co-energy management

Xaveer Moortgat: "The Association of Owners structure still works fine as an organisational structure in 2026, but we are also going to set up a cooperative if we want to develop even more cVPP activities in the future."

Gummaar has gained more and more insight into household and collective energy consumption patterns and how to play with them. And with this insight, the willingness to change existing practices has also increased. Within Gummaar as much energy as possible is self-generated, stored and exchanged; but with attention to energy saving, CO2 reduction and saving on the energy bill where possible.

Gummaar with a cVPP towards a mini-grid

Deep geothermal energy formed the basis for the mini heat network and the cVPP. Each dwelling has a heat pump so that the geothermal heat from the mini heat network can be used for one's own home. The solar panels and storage facilities (charging stations and a collective battery) allow energy to be stored and/or exchanged.

Xaveer Moortgat: "With the individual smart meters and collective EMSs we have a good insight into our usage and

"Gummaar has grown up."

production patterns. The collective EMS shows what possibilities there are for self-consumption of the collectively generated solar power. This means that the self-generated solar power is also used for collective facilities: the shared washing machines, lighting in public areas, electric shared cars and the electric shared cargo bikes."

At last: the policy context appreciates innovative projects such as Gummaar

Gummaar is such a success in 2026 because it was able to participate as a demonstration project in a European subsidy scheme. In exchange for participation, Gummaar received guidance in the development and implementation of the cVPP. Part of the system - namely the EMS, the smart meters - was also funded from that project.

Xaveer Moortgat: "The current policy context in 2026 is much more favourable. Now much more is possible than we had hoped for in 2020. Think of peer-to-peer, dynamic prices and energy sharing."

The financial returns and savings have helped to recuperate the start-up investments. And a favourable loan from the municipality has helped to shorten the payback period a little, especially for families that are strapped for cash.

Xaveer Moortgat: "Gummaar has been able to build up a solid network over the past 6 years. And because we are now a successful and super-innovative demonstration project ourselves, all kinds of initiatives are coming to visit us who also want to work with cVPP in their cohousing project."

Gummaar now has a lot of knowledge and insight into how a cVPP can become part of a cohousing project. They like to share that knowledge with others.

Xaveer Moortgat: "And so we enjoy the spring sun during our barbecue and look back a bit pityingly to that strange year 2020, a year of corona crisis but also a year of good ideas and a new impetus."

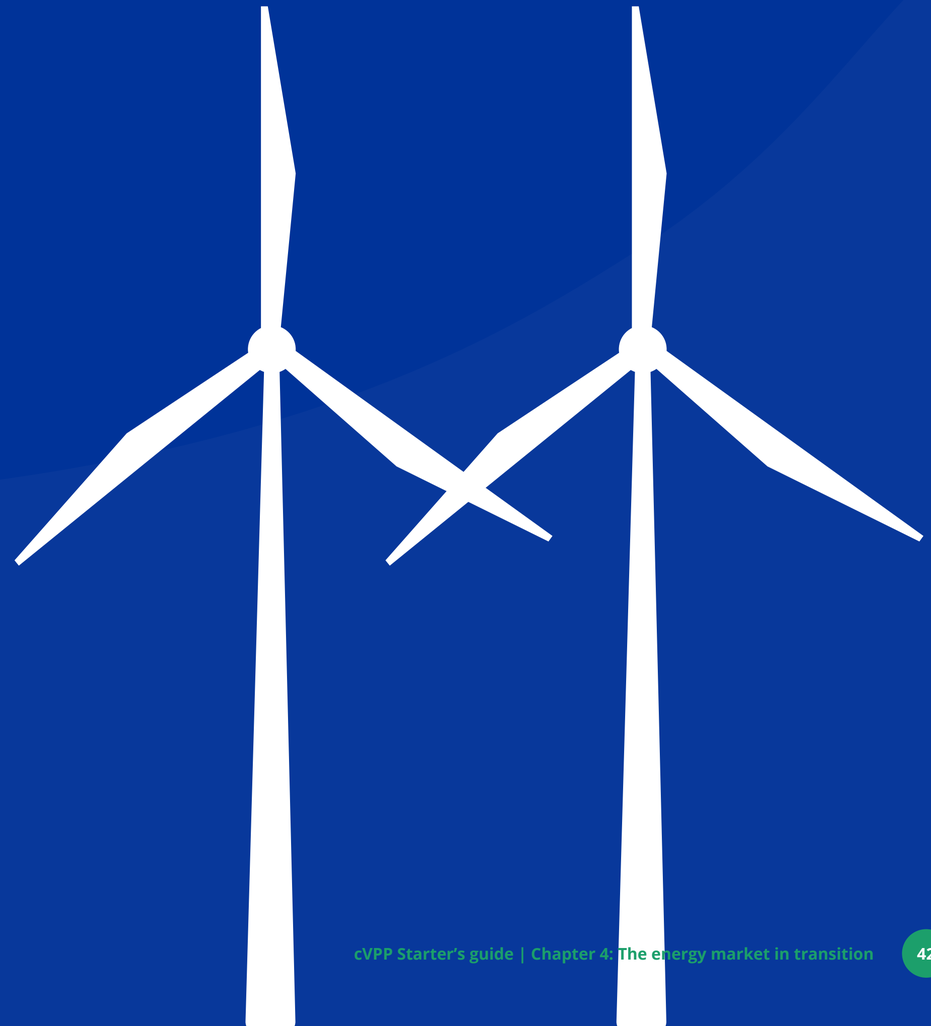
Follow the guide to learn more about the Energy Market, the Energy Transition and what Flexibility can mean for energy communities | or go directly to CH6 to get started yourself.

H6 | Je toekomstige configuratie ▶

Chapter 4

The energy market in transition

... and the future for energy communities?



Chapter 4 | The energy market in transition

The Energy market is already in transition

From a VPP to a cVPP

EU as an ally of energy communities

Crash courses

- Crash course 2 | History of the energy market
- Crash course 3 | EU Energy Policy

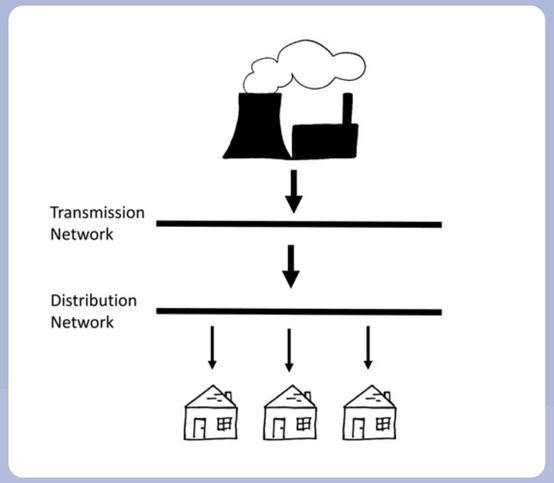
The Energy market is already in transition

The sustainable generation of renewable energy in the hands of citizens and communities is increasing. The major players in the energy market are seeing their share shrink and are trying to regain control of it. But the transition is unstoppable.

"cVPP wants to change the logic of the current energy system."

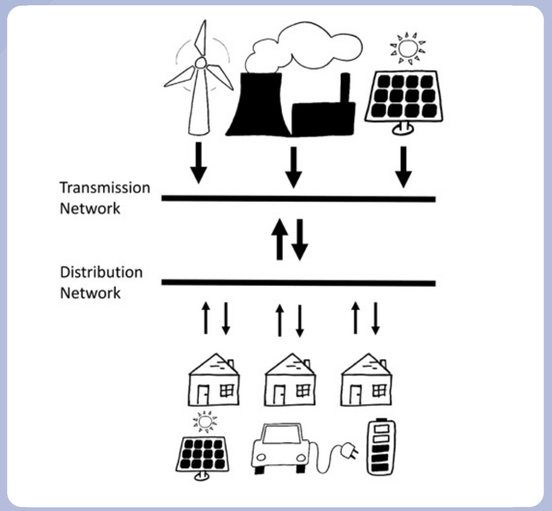
Let us take a step back. How does the energy market work?

Now most energy is generated with fossil fuels or nuclear energy. It is transferred via a transmission network to the distribution network and that's how it gets to you.



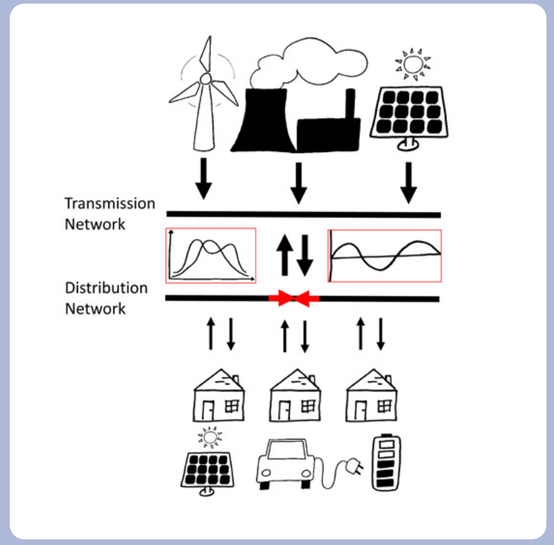
More and more **renewable energy** is connected to the grid, so the energy from households goes back to the distribution grid.

- This renewable energy is weather-dependent, so when the sun is shining we have solar energy and when there is wind we have wind energy.
- In addition, the number of electric cars, heat pumps and other electrical equipment is increasing.
- Energy is also increasingly being stored.



Crash course 2 | History of the energy market ▶

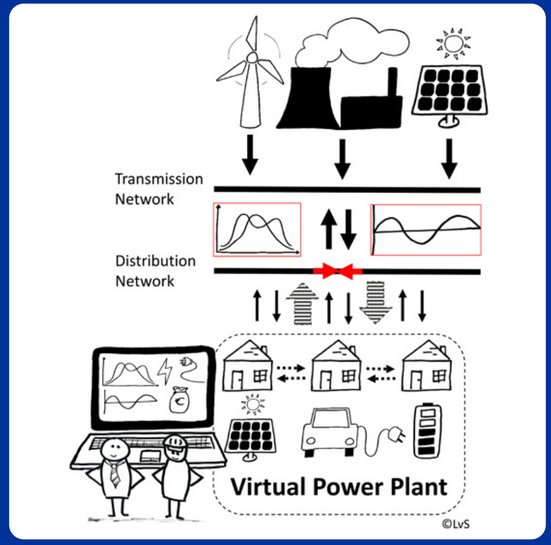
These developments are causing problems on the net. It is becoming increasingly difficult to match supply and demand and to **balance** the grid. The **frequency** is changing. Sometimes there is too much energy on the grid which causes the grid to become overloaded and at other times there is a shortage of energy. Energy companies use complicated systems to deliver the right amount of energy to the grid. Matching the supply of energy to the demand is an ever-increasing challenge, with more sustainable energy being installed in the grid. This has resulted in perverse situations where wind farms are switched off at night because there is no demand, while the wind is blowing. Another example is the street lighting that lights up in broad daylight because the grid generates too much electricity. The overproduction of renewable resources during peak hours also leads to astonishing financial transactions: energy companies paying renewable energy systems not to produce

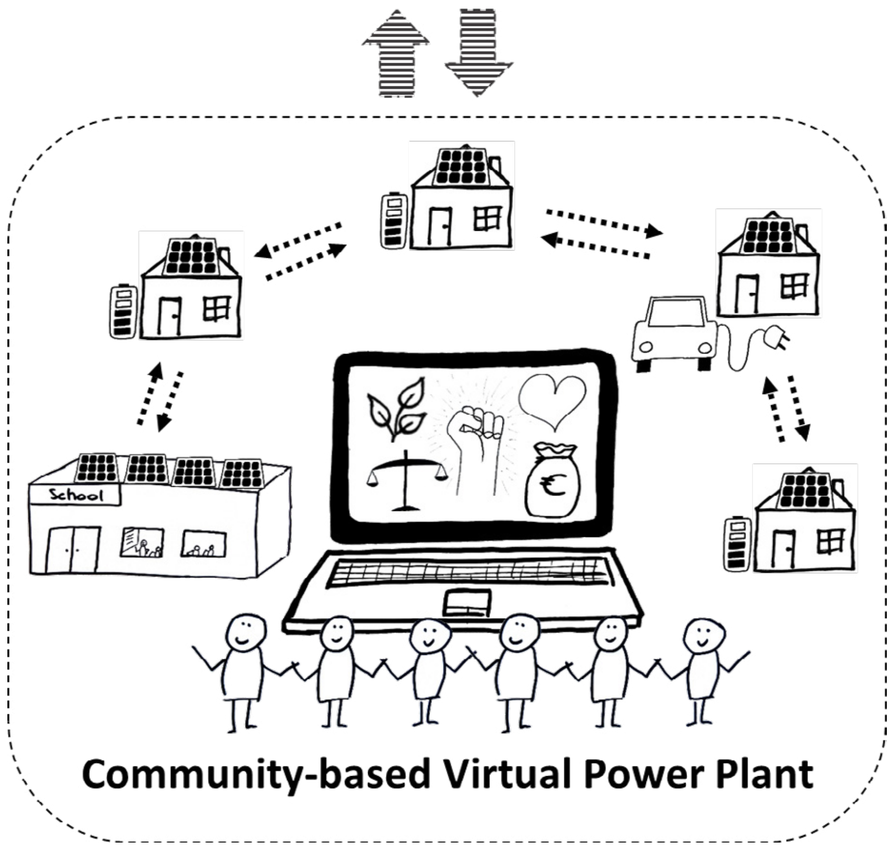


energy. The non-constant production of renewable energy has increased the risk of imbalance and accumulation on the grid. Grid operators have therefore started looking for capacities that are flexible and help to balance the power supply in the electricity system.

A possible solution to this is a virtual power plant.

A virtual power plant is an ICT platform. The platform controls solar panels, electric cars, heat pumps, batteries, in some cases a wind turbine or solar farm, and lets them work together as if they were one power plant. A VPP, for example, regulates energy consumption by charging electric vehicles (storage) when energy production is at its highest. Alternatively, VPPs allow energy communities access to offer their generated renewable energy when the system needs additional electricity. You can match supply and demand and participate in the energy market.



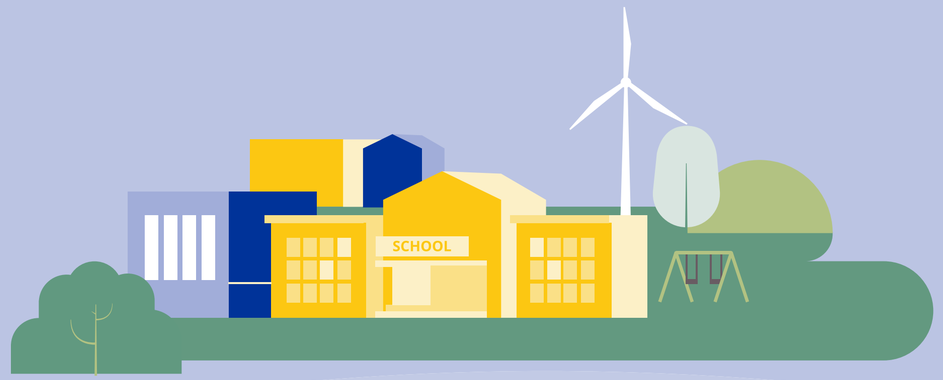


Cartoons © Luc Van Summeren

From a VPP to a cVPP

VPPs are promising but not (yet) a game changer in the fair energy transition.

A community-based Virtual Power Plant is driven by the **needs** of the community. It wants to strengthen the community and change the logic underlying the organisation of the current energy system. VPPs are developed primarily to meet the needs of established players, which means there is no connection with the needs and requirements of local energy communities. Establishing a VPP to keep the grid in balance is a very technical objective that we as individual prosumers or communities do not think of in the first place when we start a bottom-up energy project together. Prosumers are of course involved in such classic VPPs, and sometimes they appreciate the fact that they do not have to concern themselves with the operation of a difficult electricity system. But apart from the fact that they have a day and night tariff choice, they have no influence on how their energy and flexibility is used and traded. This logic is changing by adding 'community-based' to the VPP, and by arguing for more space and a level playing field for prosumers and communities. In this way not only the **technical system needs** are met, but also the **social needs** of the communities: such as local self-consumption, local trade, energy independence, development of social cohesion in the community or support for the local economy..



INSIGHT | What role can the community play in the energy transition?

Energy communities can play an important role in increasing the share of renewable energy (RE) and in the adjusting of the electricity demand (demand-side flexibility). A cVPP can help organize this by enabling communities to take up new activities.

Examples of such activities are:

- Actively collecting flexibility from RE, controllable appliances and storage and sell this through a third-party aggregator (at distribution or transmission level).
- Actively collecting, aggregating and selling flexibility from RE, controllable appliances and storage (bundling this with flex from other communities, as an aggregator) (at distribution or transmission level).
- Use flexibility provided by storage and household appliances to minimise the peak power usage (and peak of energy fed back to the distribution network) within households to lower the capacity tariff of households (tariff depending on size of connection with the network).
- Use community-level flexibility provided by storage and household appliances to balance demand and supply in line with physical availability of RE on the transmission network.

Crash course 2 | History of the energy market

EU as an ally of energy communities

The 'European Green Deal'
Europe and the whole world are facing the challenges of climate change. The European Union wants the Member States to create a new regulatory framework that will allow citizens, as a community, to participate more actively in the electricity market.

This is part of the European Clean Energy Package (CEP). It aims to bring environmental, social and economic benefits to citizens through the creation of energy communities. There will be room for new entities, centred around the citizen.

More specifically, it is possible for an energy community to:

- produce electricity;
- to consume as much of its own produced electricity as possible;
- trade electricity (whether or not within the community) or share it.

There are 2 types of communities:
- REC, a renewable energy community;
- CEC, a citizens energy community.

The conditions overlap with regard to autonomy, free participation and self-monitoring. However, there are differences in the requirement for proximity of participants, absorption of heat (in addition to electricity) and autonomy, which are more specific to a REC. Also, a REC only consists of citizens, local authorities and SMEs. In addition, a CEC can also have large companies as members.

rescoop.eu

INSIGHT | What does this European policy mean for the energy communities?

The new EU policy (Electricity Directive and Renewable Energy Directive) aims to enable energy communities to carry out activities which go beyond energy generation, efficiency and saving and which are not currently allowed or possible.

Examples of such activities are:

- Enabling local energy trading through peer-to-peer electricity trading or through a community energy market.
- Buying energy from the community and selling it back to members of the community and/or selling energy on the energy market.
- Selling of the collectively generated renewable energy to a third party supplier.
- Actively collecting, aggregating and selling renewable energy flexibility, controllable devices and storage.
- Active collection of flexibility in renewable, controllable devices and storage (to make money) and to sell it through a third party.

Further information about CEC and REC can be found on www.rescoop.eu.

Tool | Value-Goal-Activity

Crash course 3 | EU Energy policy

What does REScoop EU do?

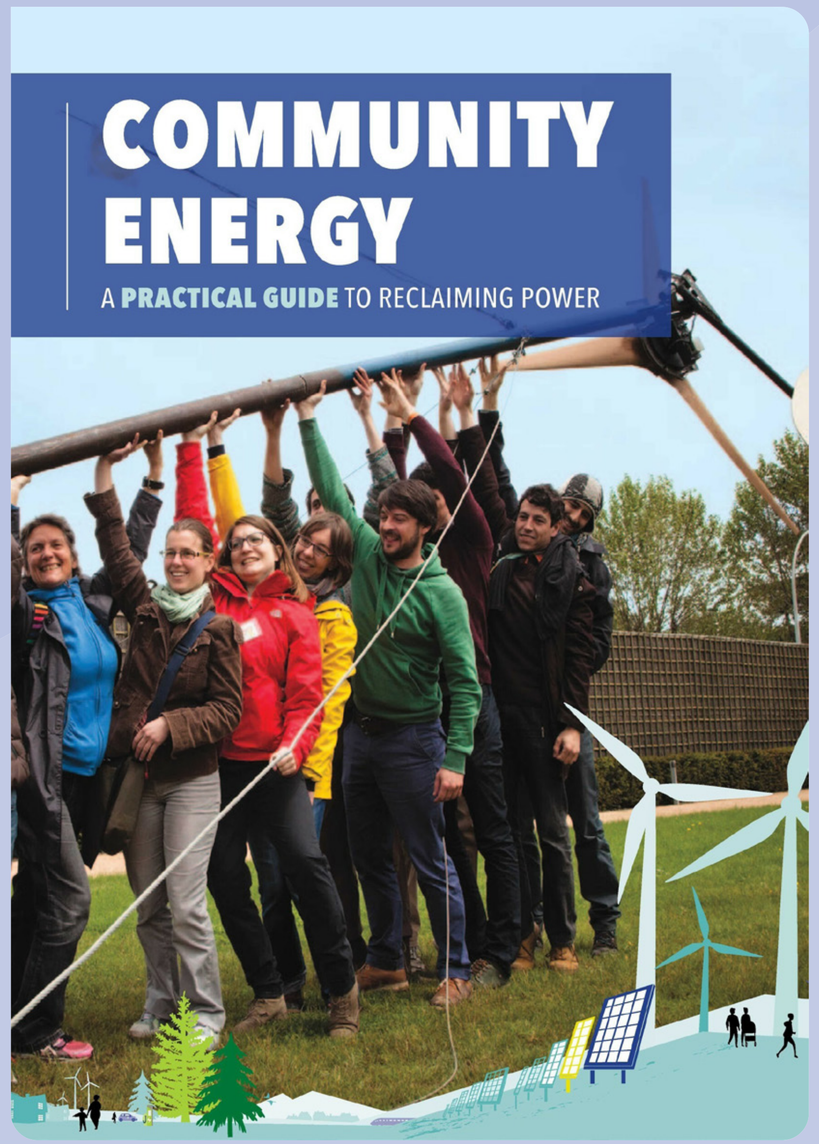
- Advocacy and lobbying for the democratisation of the energy market (see EU policy fast track course).
- Support energy cooperatives and energy communities.

Interesting links from REScoop:

Rescoop.eu

Community Energy practical guide

Energy Democracy



What does Buurzame Stroom think about EU policy? (Ghent | BE)

Jeroen Baets: "At Buurzame Stroom, we interpret EU policy as creating new opportunities to get the masses on board in the energy transition."

This creates new opportunities for target groups who are not yet able to invest in renewable energy, such as flat owners and tenants or families with unsuitable roofs. They can be part of a community that invests together. In addition, the new guidelines also offer opportunities to fill more roofs, including those of schools and businesses, with solar panels.

Buurzame Stroom, however, also sees some pitfalls.

Jeroen Baets: "Buurzame Sroom showed that there is a great deal of ignorance about the current, relatively simple, legislative framework surrounding solar panels. A new framework for energy communities actually constitutes an additional complexity, on top of the legislative framework for solar panels for individual households, which will also change as of 1 January 2021."

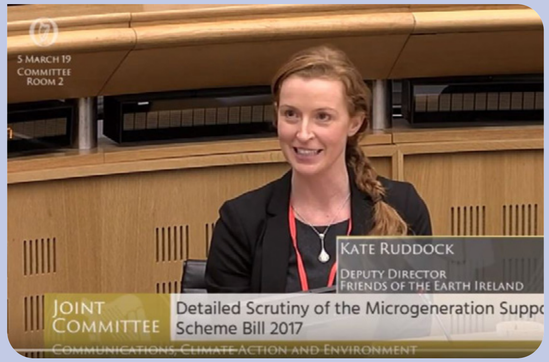
Conclusion?
"A new framework around energy communities must be simple and accessible if it is to achieve the objective for which it was created: to help the citizen along."

FOEI and Community Power: a successful case from Ireland

In Ireland, Friends of the Earth, together with Community Power, have been working to change national policies for communities wishing to play a role in the energy market. And with success!

Kate Ruddock of Friends of the Earth talked to the Oireachtas Commission for Communication Climate Action and Environment (5 March 2019) about Microgeneration and why Friends of the Earth support the bill to to allow micro-generators to get paid for the power they export to the grid.

Kate Ruddock: "Community Power is an excellent approach to stimulate the use of decentralised energy, bringing many electricity producers together in one 'energy supplier' for trading in the electricity market. Although there are several examples of VPP, the Community aspect of this is new, allowing even small generators to sell as part of a larger whole. Many regions encourage decentralised energy generation and community projects, and this is a very interesting practice that we can adopt in other markets, where a particular barrier for small producers continues to hamper access to the grid and electricity markets."



Friends of the Earth Ireland

Good news from Ireland | Renewable electricity auction now open to communities.

Green light for renewable technologies (wind, solar) and community energy, as the EU approves the Irish renewable electricity support scheme. The Minister for Climate Action and Environment, Eamon Ryan TD, has announced that Ireland has received state aid from the European Union for the new renewable electricity support scheme (RESS) until 2025.

Minister Ryan said: "As Minister for Climate Action, I welcome this announcement from the European Commission. It endorses the Government's commitment to the Green Deal and launches a revolution for renewable energy in Ireland. The RESS will provide us with a platform for the rapid deployment of onshore and offshore wind and solar farms to replace fossil fuels on our energy network. It will also allow communities to produce their own energy and share ownership of the Irish energy revolution."

"We are committed to reducing overall greenhouse gas emissions by an average of 7% per annum from 2021 to 2030. That is a 51% reduction over the decade. By 2050 we want to achieve zero net emissions."

Find out more:

communitypower.ie

COMMUNITY POWER

Chapter 5

Energy Flexibility

... and what role can an energy community play?

Chapter 5 | Energy Flexibility

Energy Flexibility

- What is energy flexibility?
- How can flexibility be provided by energy communities?
- Flexibility through storage
- Small | How does flexibility work for households?
- Medium | How does flexibility work for a district, village or municipality?
- Large | How does flexibility work for the grid operator?

Roles for an energy community in the energy market of the future

- What roles can you take on as a community?

Crash courses

- see Crash course 4 | Energy flexibility
- see Crash course 5 | Energy market roles

“Grid operators are busy searching for solutions for the grid. But what’s in it for us?”

Energy flexibility

What is energy flexibility?

Flexibility means being able to adapt. But flexibility in the energy market, what does that actually mean?

There are two types of flexibility:

1. **Supply-side flexibility:**
Changing the moment at which energy is generated and supplied.

► You cannot decide for yourself when the sun shines or the wind blows. As a result, renewable energy systems often lack control. The exception is decoupling renewable energy systems, but this leads to a loss of renewable energy.

2. **Demand-side flexibility**
Changing the timing a household consumes energy.

► You use appliances at a different time.

We focus here on **demand-side flexibility**, because it best suits the capabilities of energy communities.

Why?

To guarantee a safe and reliable electricity system, electricity supply and demand must be equal at all times. But:

- Renewable energy sources that generate electricity, such as solar and wind energy, cannot always deliver.
- Households use electricity when they need it, even when there is no sun and wind.

Therefore, in order to balance supply and demand **flexibility** is needed.

INSIGHT | Energy flexibility

Supply-side flexibility is usually provided by power plants: more was generated when there was a higher demand for electricity. This is not sustainable with weather-dependent renewable energy sources (solar panels and wind turbines).

Energy flexibility by energy communities is a solution: by providing balance to the local grid and by matching production to consumption.

Energy flexibility offers your energy community an opportunity to play a role in the energy market. It allows you to choose when to offer renewable energy and at what price. This gives the community access to cheaper, local energy.

Crash course 4 | Energy Flexibility ▶

Demand-side flexibility

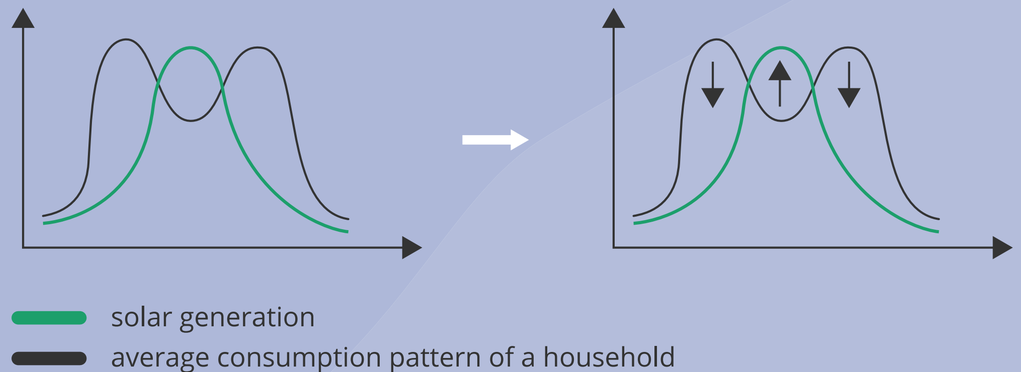
The graphs illustrate how demand-side flexibility can be used to balance demand and supply. They present an example of solar generation (green line) and an average household consumption pattern (black line) over the timespan of a day.

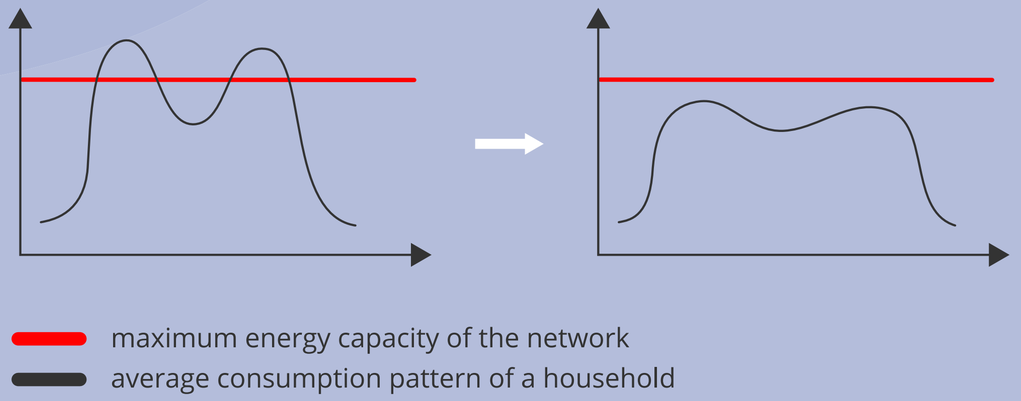
You can 'match' supply and demand by:

- using fewer appliances at times when there is no renewable energy available,
- using more appliances when renewable energy is available.

Distribution and transmission networks have a maximum capacity of energy that can flow safely through their cables. This is the red line in the figure.

- Demand and supply of energy have to adhere to this maximum. In case capacity is insufficient to meet demand or supply, networks need to be upgraded, which is costly.
- Here too, flexibility can be a solution: by shifting the time of energy demand away from the peak moments, network enlargement can be prevented.





INSIGHT | Why is flexibility interesting for energy communities?

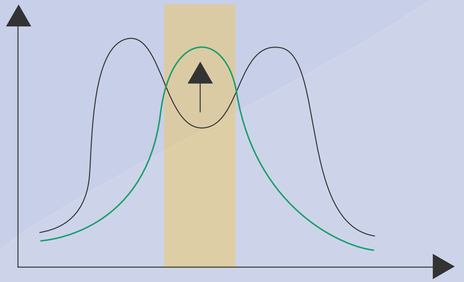
- There may be a financial reward for providing flexibility and contributing to solving balancing and capacity issues.
- More flexibility can contribute to the connection of more renewable energy sources (RES) to the electricity network.
- Flexibility offers an opportunity to maximise the use of self-generated renewable electricity, by balancing demand and supply within the community and as a result minimising the amount of electricity to be bought from third party suppliers.

Flexibility through storage

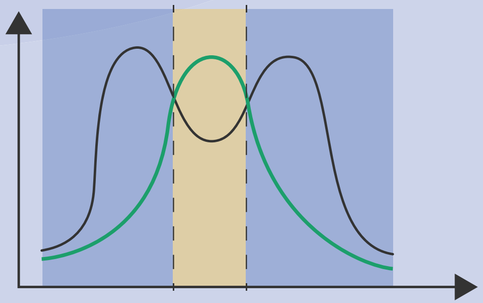
Storage, such as a battery, can also offer flexibility. Energy storage can influence the demand for electricity (like other appliances), but can also influence the supply of electricity.

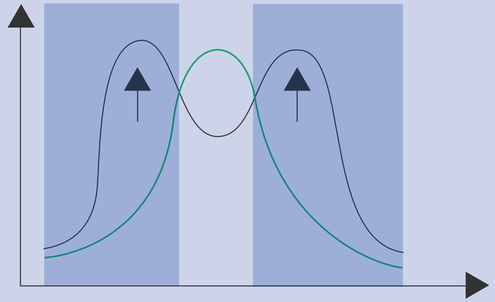
A storage device can work in two modes:

- **Charging mode:** acts as a 'normal' appliance by demanding energy.
- **Discharging mode:** acts as an energy source by supplying energy.



*During yellow moments (more supply than demand) the storage device can be set to **charging** mode. This will result in an increase of demand.*





*During blue moments (more demand than supply) the storage device can be set to **discharging** mode. This will result in an increase of supply.*

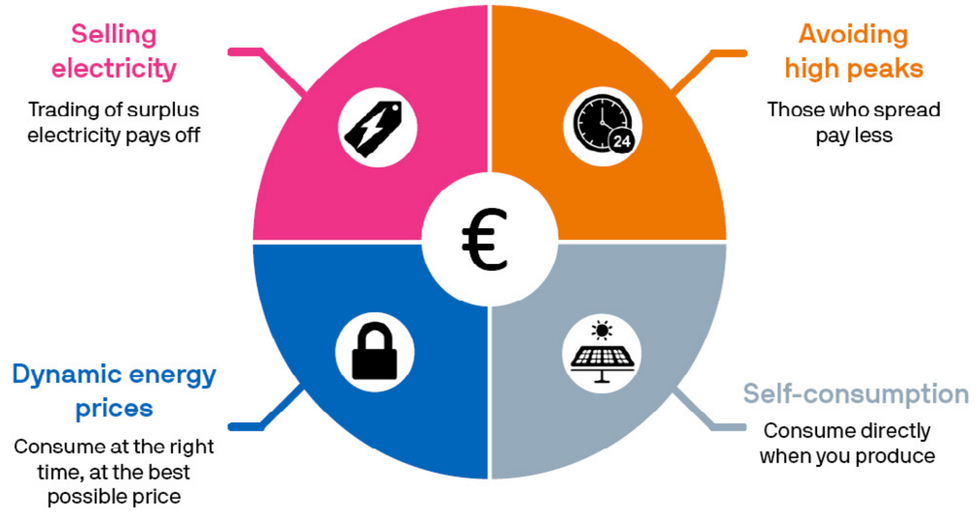
Small | How does flexibility work for households?

Demand-side flexibility for a household means:

"Changing the moment you use electricity."

Households can offer demand-side flexibility in two ways:

- Changing behaviour and routines, to reduce or shift energy consumption at specific times. For example, choosing the right time to use your washing machine.
- Devices are controlled by ICT to reduce grid demand, for example energy is stored in batteries at times when production exceeds demand.

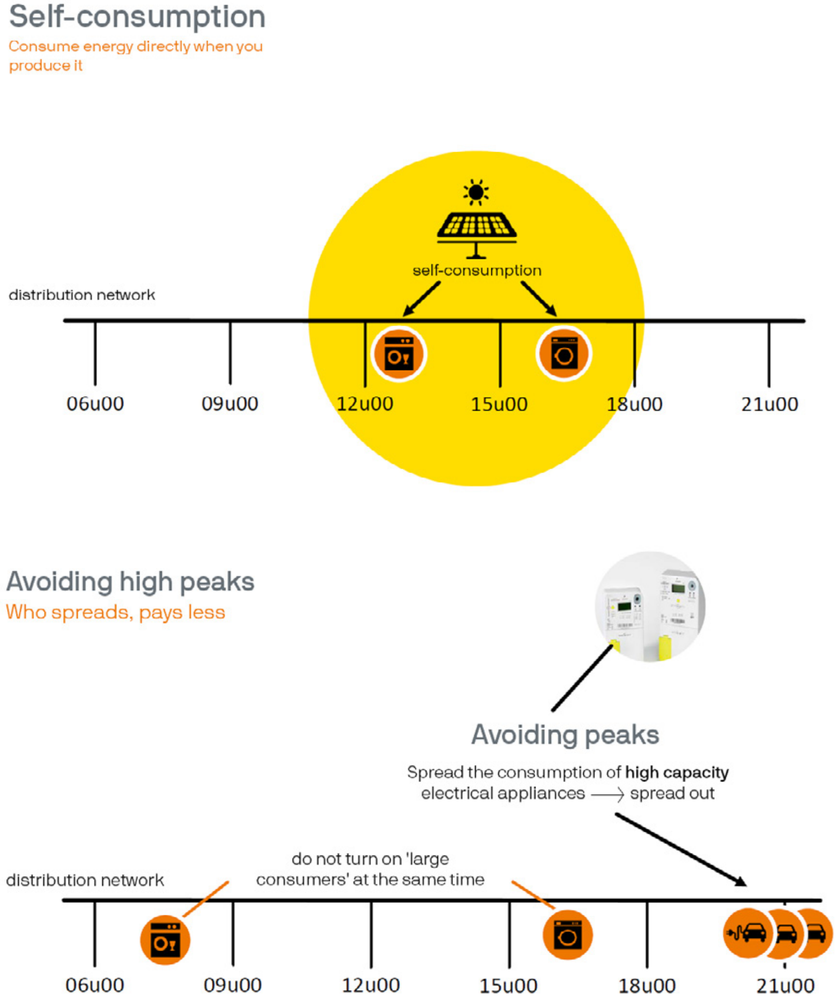


Source: VREG

Self-consumption
By using your energy directly, for example by running your washing machine when the sun shines and when the solar panels generate electricity, you use your own cheap energy.

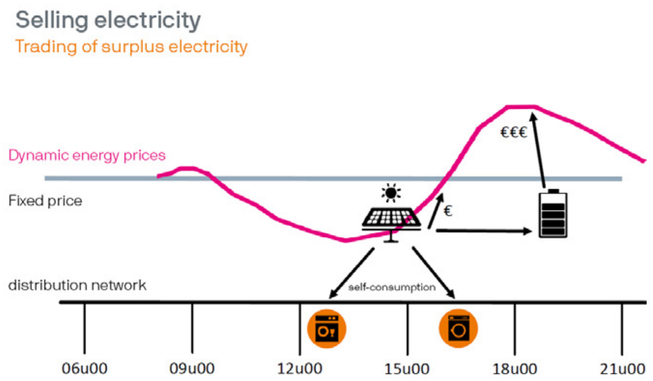
Avoiding high peaks
Around 18 o'clock people come home, the electric car is charged, the lights go on, the phone is getting charged, the television is turned on, … This is a peak, where suddenly a lot of electricity has to be supplied. Demand is high, price is high. By spreading out, the demand will decrease and the price will be lower.

In a cVPP **flexibility is aggregated collectively by connecting all households to one Energy Management System (EMS)**. This EMS not only regulates the generation of energy, the controllable devices and the storage systems in the households, but potentially also the collective sources (e.g. wind turbine, solar farm, neighbourhood battery).

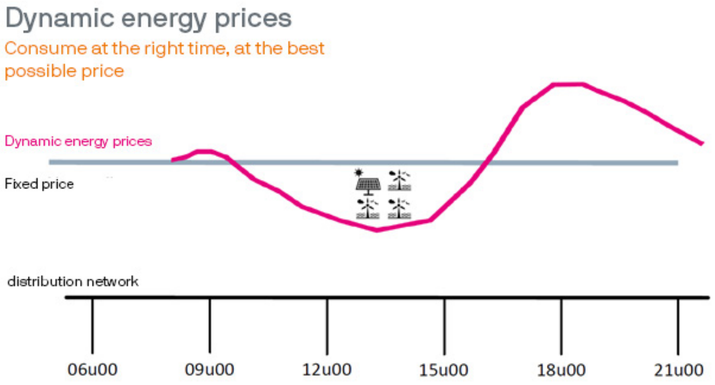


Source: VREG

By being smart with your self-generated energy, through self-consumption, smart consumption and storage, you can sell energy on the market, if the price is favourable.



There are dynamic prices. The energy price is high when there is a shortage, for example at 6pm when everyone comes home, and low around 1pm when there is a lot of sunshine available.



How can the energy market be made flexible?

It is still uncertain for individual households and energy communities what the future market for flexibility will look like.

There is a distinction between two categories, each with its own financial incentives for demand-side flexibility:

- **Explicit demand-response:** The community has a contract with an aggregator or directly with an actor interested in flexibility, e.g. a Distribution System Operator (DSO) or a Transmission System Operator (TSO). Where flexibility is needed, the community will be obliged to provide the amount of flexibility for a specified period of time, as agreed in the contract. Non-compliance will lead to a penalty.
- **Implicit demand-response:** Energy prices are dynamic and reflect the imbalance between supply and demand and/or the available capacity of the network. This creates a financial incentive for households and communities to shift demand for energy to times when prices are low. The community can be assisted by an Energy Service Company (ESCo) to maximise the value of their flexibility.

ELIA (TSO)| The evolution of the electricity market

"Smart Energy testing-ground Energy Changers in Heerhugowaard"
How can we improve the matching of energy supply and demand?

DID YOU KNOW THAT?

In Belgium, **24%** of your bill is charges for electricity, the rest are charges for:

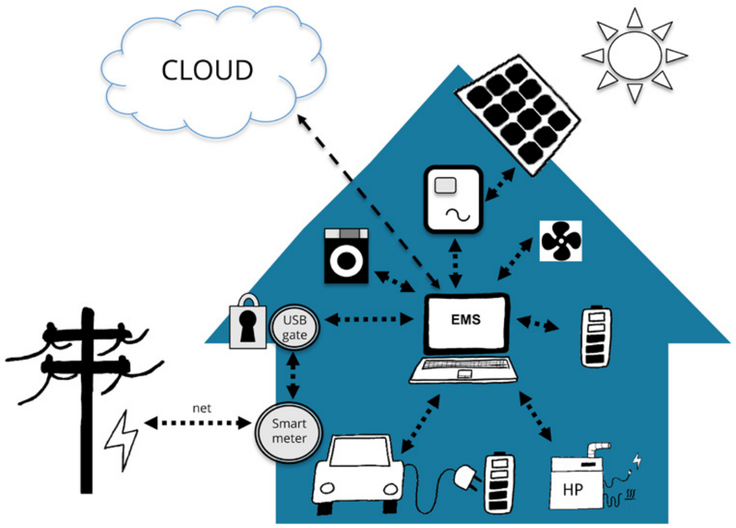
- electricity network costs **28%**
- levies **31%**
- VAT **17%**

INSIGHT | What does flexibility mean for energy communities?

Participation in flexibility activities offers opportunities for individual households and energy communities to work towards their environmental, social and economic goals.

Examples of such activities are:

- Use flexibility provided by storage and household appliances to change household energy demand and/or supply in response to dynamic prices (e.g. lowering energy demand when prices are high).
- Use flexibility provided by storage and household appliances to balance demand and supply at the community level.
- Use household- or community-level flexibility provided by storage and household appliances to balance household energy demand and supply in line with physical availability of renewable energy (RE), on the transmission network.
- Use flexibility provided by storage and household appliances to minimise the peak power usage (and peak of energy fed back to the distribution network) within households to lower the capacity tariff of households (tariff depending on size of connection with the network).
- Actively collecting, aggregating and selling flexibility from renewable energy (RE), controllable appliances and storage (bundling this with flex from other communities, as an aggregator) (at distribution or transmission level).
- Actively collecting flexibility from renewable energy (RE), controllable appliances and storage and sell this through a third-party aggregator (at distribution or transmission level).



1. Production | Generation

- solar panels for electricity
- solar panels for hot water
- heat pump
- heat network
- biomass
- (wind turbines)

2. Flexible consuming appliances

- controllable electrical equipment | computer, washing machine, freezer, ...
- lighting
- heating and cooling | heat pump
- boiler (hot water)
- electric vehicle

3. Storage

- battery
- electric vehicle
- boiler (converting electricity into heat - hot water: excess electricity is fed into the electricity grid)
- hydrogen, compressed air, flywheel

4. Regulation

- digital meter
- green meter
- monitoring and control of solar panels
- software: energy consumption manager
- (mini EMS)
- hardware: mini-computer

A little more explanation about the hardware set-up:

1. Digital meter, but not a smart meter (yet)

In Belgium, new energy projects, such as solar panels on your roof, which come into force on 1st January 2021 will be connected to a digital meter. This will expose prosumers to variable energy or network tariffs (e.g. Time-of-Use (ToU) tariffs).

The most important applications of a digital meter:

- Remote meter readings for correct billing.
- Choice for prosumers, when using their own generated renewable energy or feeding it into the grid.
- Digital budget meter.
- Accurate data | quarter-hourly data (every 15 min) for third parties and suppliers.
- Make data for smart applications locally available to customers.

The digital meter is not a smart meter (yet), but the two user gates on the digital meter allow detailed consumer feedback and control of household appliances. By extending the meter with energy consumption managers, you can, among other things, monitor your own energy consumption in real time via an app on your smartphone or via another display in the house. Or you can start using energy when the electricity is cheapest.

Vlaanderen.be | the digital energy meter

Only before the meter

The Atrias data platform, which the Belgian network operators are developing together and which is intended to make the digital meter really smart, has been in a state of disarray for some time now. According to the Flemish energy regulator VREG, a new date for the system would not be brought forward until 2020, probably not before 2023. As a result, you will not be able to make full use of the possibilities of the digital meter for some time yet. After all, without Atrias, there will be no smart tariffs and prosumers will not be able to sell their surplus electricity.

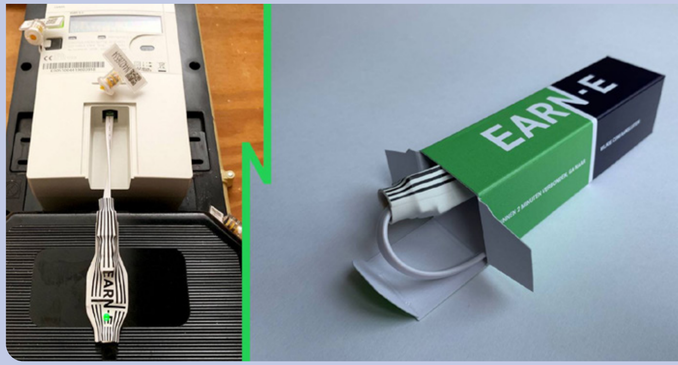
Source | testaankoop.be

2. Energy consumption manager and mini-computer

Just like your current meter, the digital meter only shows the current meter readings.

The energy consumption manager or monitor is connected to all devices in your home and shows the consumption and amount of energy generated by the devices individually.

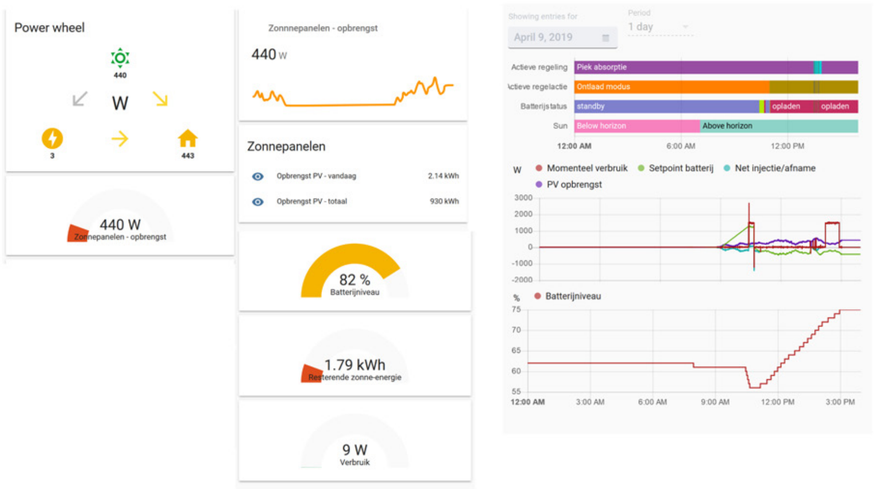
To read all this data, the energy consumption manager is linked to a mini-computer. This is done via a gateway and/or cloud.



An **online tool** allows participants to monitor the injection and consumption of electricity on the grid both individually and collectively.

Wisegrid in Ghent (NL/EN)

Monitoring platform



Medium | How does flexibility work for a district, village or municipality?

Generating, consuming, storing and sharing energy together.

In Loenen, they are developing their own virtual power plant.

How does it work?

A **virtual power plant** consists of a large number of small power plants (the solar panels on the roofs of Loenen) that are connected to each other via the power grid. As a resident of Loenen, with solar panels you not only become a buyer of electricity but also a producer. As an active participant in the energy market, you can thus save on the costs of electricity or possibly even make a return on investment.

The virtual power plant, a computer system connected to your smart meter, brings supply and demand for electricity together in Loenen. Especially in the summer there are times during the day when solar panels produce more electricity than is required. In winter, and in the evening, there are times when more energy is required than is produced. A lot of power is then taken from the grid. A surplus of self-generated electricity is not yet a problem for a private individual because you can set off the excess against your own consumption, called **offsetting (salderen)**. However, this scheme will not continue to exist for long.

In the future, it may be the case that you get little or nothing for the electricity that you feed back into the grid or that you even have to pay charges for using the grid with your excess electricity. It will then be advantageous if you can sell that electricity within Loenen to households or companies that need electricity at that time. Loenen is are also looking at storing this energy in **neighbourhood batteries** or, for example, in the batteries of electric cars. **Smart devices** that switch themselves on when the sun shines and switch themselves off when the sun doesn't shine also help **to prevent peaks in the power grid**. By preventing large differences in supply and demand on the electricity network (grid), the risk of blackouts is reduced. This is better for everyone. Network operator Liander already invests €2 to €3 billion a year in improving the electricity network. Due to the increase in the number of solar panels, wind turbines and other sustainable energy generation, the costs for the electricity network will continue to rise if smart schemes are not put in place. Loenen sees these costs reflected in the energy bill as a fixed amount.

Local power

The virtual power plant forms the basis for trading in electricity between the inhabitants of Loenen, if the regulations allow it at a later date. If you don't have any solar panels but want solar energy, you can buy it from a member of the village with panels on his roof who has electricity left over. The computer system ensures that the electricity finds its way, as it were, between the supplier and the customer and that payments are made between them.

Adjustable and controllable energy

In Belgium, just as in Sweden or Austria, the energy companies start working with variable tariffs for electricity. Heat pumps can cleverly anticipate these differences and thus reduce your energy costs.

Heat pump

An online climate management system provides up-to-date information on hourly electricity prices. Simply put, your heat pump works a little harder when the price of electricity is low and a little less when the price of electricity is high. This allows you to take maximum advantage of price fluctuations and immediately reduce the consumption costs on your energy bill.

Examples are controllable heat pumps:
The Nibe heat pump can be equipped with the Smart Grid Ready and Smart Price Adaption functions. They are controlled via the cloud: water booster on. Only the storage of hot water is heated.

The Mitsubishi heat pump can be controlled by a **gateway solution**. This makes it possible to control not only the hot water, but also the temperature of the heating.

Control of electrical equipment

Several companies already offer a connection to control electrical equipment, such as a washing machine, boiler...

Charging station for electric cars

Cars can serve as 'batteries' and be charged at times when there is a surplus of generated renewable energy. At times when there is too little electricity, you can choose whether you get your electricity from the car or from the grid.

Inverters of solar panels can be monitored. They can also be controlled via the cloud, but for the time being this seems too expensive.

The EMS system | with the hardware comes the software

In order to realise a cVPP concept together with a community, an Energy Management System (EMS) is necessary. This is a software platform to which production (such as solar panels) and consumers (such as batteries, heat pumps and electric vehicles) are linked.

Algorithms form the intelligence and are programmable. You will need the following data:

- consumption data
- production data
- forecast data (weather)
- cost data, CO2 data, market data, ...
- control options, load shift, time shift, containment

The EMS system must be placed for and by the citizens (cVPP). By opting for a high degree of open source, it remains accessible to all.

The user interface (household consumption data) will be linked to the **open source platform** and an open source minicomputer will be used for local intelligence. In order to ensure privacy and process security, a combination of **central control** and **local control** can be chosen.

It is an intelligent system, with the intention of coordinating the production, consumption and supply of electricity. On the scale of the household, community, with the grid.

Example | Buurzame Stroom pilot project in Ghent

In the context of the cVPP project Buurzame Stroom, an EMS system was developed to which several residential and larger solar panel installations are connected, as well as larger residential consumers such as home batteries (13 times 6.6 kWh), larger batteries (1 x 20 kWh) and heat pumps.

This is why the architecture of the EMS system was very important. It had to become a system for and by citizens.

- The aim was to achieve the highest possible degree of open source.
- The user interface was linked to the open source platform Home Assistant. For local intelligence, a raspberry pi mini-computer was used (an open structure). For the sake of privacy and process security, a combination of central control and local control (via the raspberry pi mini-computer) was chosen.

The developed EMS system has already successfully demonstrated that it is possible for neighbours to contribute to voltage control, to maximise their own consumption at neighbourhood level and to reduce the peak load on the grid. This project, if further developed, could lead to an open EMS system accessible to energy cooperatives and other energy communities wishing to actively participate in the market.

The mini-computer drives the batteries and solar panels. With this online tool the participants can follow up their installation and EMS system.

The cVPP project does identify a number of risks for which the Flemish, but certainly also the European government, may be able to offer a solution.

There is currently very little standardisation with regard to open communication protocols through which you can adjust certain parameters of battery management systems and/or inverters. We also see that various players (energy suppliers, but also brands of inverters and heat pumps) are working on their own energy management systems.

EnerGent expect energy suppliers to work more and more with their own hardware and proprietary software. This could make it more difficult to change energy suppliers, which is also a fear of the consumer organisation Test-aankoop.

energieID

Buurzame Stroom

Large | How does flexibility work for the grid operator?

The Netherlands is becoming more sustainable. Consumers and companies are investing in solar panels to generate their own sustainable energy and become energy-neutral. This is positive, but it can lead to peak loads on the electricity grid, which is a problem. Martijn Bongaerts, Innovation Manager Energy Transition at Liander explains why this is not just a problem for grid managers but for all of us.

"At this moment we are laying grids in residential areas with a connection to the home that makes it possible to turn on the microwave, TV and hoover at the same time. But if you arrange with the whole street to vacuum at the same time, the power grid will go out. Your home can handle a lot of appliances, but we assume that it is rare for everyone to vacuum or charge their car at the same time."

In the **energy transition**, all kinds of new technologies are emerging, such as solar panels, electric cars and heat pumps to replace central heating boilers. According to Bongaerts, these devices can cause a peak load on the grid. "For example, if an entire village lays solar panels. These solar panels will all supply power at the same time. This can be so large that a considerably higher capacity of the grid is required than we are used to."

"You might think: I use the electricity from solar panels myself, don't I? That's possible, but when the sun shines at noon and the solar panels are on, **a large part of the neighbourhood** is at work. During the summer holidays, the solar panels provide most of the electricity and then there's actually very little electricity consumption. So we are installing grids that can also handle this situation."

According to Bongaerts, if everyone were to fill their roofs with solar panels, we would have to make the grid three to five times as heavy. "That costs a lot of social money and it also causes inconvenience if the street has to be opened up. Now there is one transformer cabinet in every neighbourhood, this would have to become three or four. That's a waste of public space and money. That is what we are trying to prevent with smart solutions."

Are there alternatives?

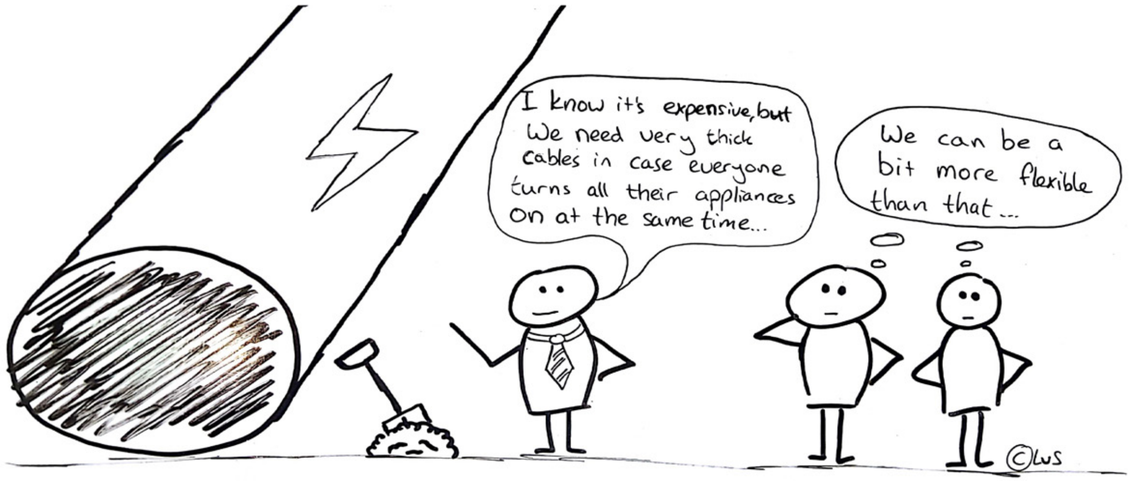
"Storage of solar energy can make a significant difference to the cost of the grid. Tests are being done with neighbourhood batteries and converting solar power into hydrogen using electrolysis. You can put hydrogen into the gas grid, cars can drive on it and if necessary it can be turned back into electricity.

According to Bongaerts, **a Virtual PowerPlant** (VPP) such as the one being set up in **Loenen**, in which supply and demand of solar energy are matched as much as possible, is also a possible solution. Liander (DSO) has to ensure that peaks in the supply of electricity are absorbed, the question is whether they should ensure for the surplus of electricity. "On a beautiful sunny day there is a surplus of electricity at noon. The economic value of that electricity is not that high because there is no demand at that time. Is it socially profitable to build expensive networks for this purpose? Moreover, really large peaks do not occur very often. Suppose you have panels on your roof with a capacity of an X number of kilowatts. It doesn't happen very often that you actually generate these quantities. Perhaps we should say: I am going to build a network for 70% of the peak, that will save us 30% and the

amount of solar energy that will not be able to be transported is relatively low."

Six-lane road to the sea

In order to make the problem clearer, Bongaerts makes a comparison with the road network. "On a beautiful summer's day, there are hours of traffic jams on the roads leading to the sea. The question is whether you need to build a six-lane road to the sea to avoid traffic jams on those days. As the network operator, we will be obliged to build that six-lane motorway. You can discuss whether that is the best way to spend your euros." Peak load on the network is often seen as a technical story and problem. The real question we have to ask ourselves is: what are we spending our money on?



Cartoons © Luc Van Summeren

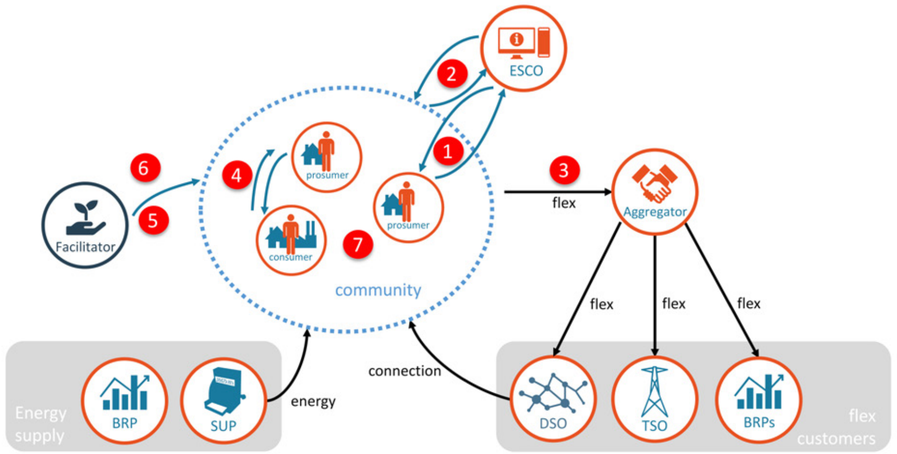
Roles of the Energy Community in the energy market of the future

In contrast to the current energy community projects, which until now have focused on collective ownership of power generation technology, joint procurement, energy efficiency and energy savings, a cVPP allows a community to become involved in the **management**, **distribution** and **trading** of energy. This means that the community can play one or a combination of (new) roles in the electricity system.

In order to identify the possible roles, the **USEF Framework** of Van der Veen et al (2018) has been adopted because it largely reflects the logic of the current centralised electricity system, with the exception of the two new roles: Energy Service Company (ESCo) and Aggregator.

In the short term it can be expected that the organisation of the energy system will not change radically. In the long term, however, alternative ways of organising the future energy system (e.g. in a more decentralised or distributed way), with different roles of the communities, could be considered.

Illustration of the different roles that communities can play and the potential energy and flexibility services they can offer.



1. Services to raise energy awareness
2. Joint acquisition and maintenance of (shared) assets
3. Supply of (shared) energy
4. Peer-to-peer delivery
5. Optimisation of the energy profiles of individual prosumers
6. Provide flexibility services on the explicit demand side
7. Optimise the community's energy profiles

This may be a community in its own right, which needs the help of an ESCo or aggregator to act in the energy market. They could unite again, as a group, and become stronger. They can have a P2P (peer-to-peer) platform that allows them to register for just one supplier. In the case of direct access to the market, it is probably difficult to talk about a community.

Crash course 5 | Energy market roles

INSIGHT | What do the roles on the energy market mean for energy communities?

In the future, individuals and communities will be able to adopt roles that they were previously unable to take on. This offers opportunities to participate in new activities that contribute to achieving their environmental, social and economic goals.

Examples of such activities are (see also the tool | Objectives & Activities):

- Installing of renewable energy generation capacity at the level of households and communities (e.g. solar panels) - (Prosumer role)
- Collectively developing an energy project to generate renewable energy on a single location or site (e.g. solar farm, collective solar roof project, wind project) and sell the generated energy to a third-party supplier - (Producer role)
- Buying energy from the community and selling it back to members of the community and/or selling it on the energy market (as licensed energy supplier) - (Supplier role)
- Enabling households to respond to dynamic prices to maximise the financial benefit for the household - (ESCo role)
- Actively collecting, aggregating and selling renewable energy flexibility, controllable devices and storage (bundling this with flex from other communities, as an aggregator) (at distribution or transmission level) - (Aggregator role)

Tool | Value-Goal-Activity

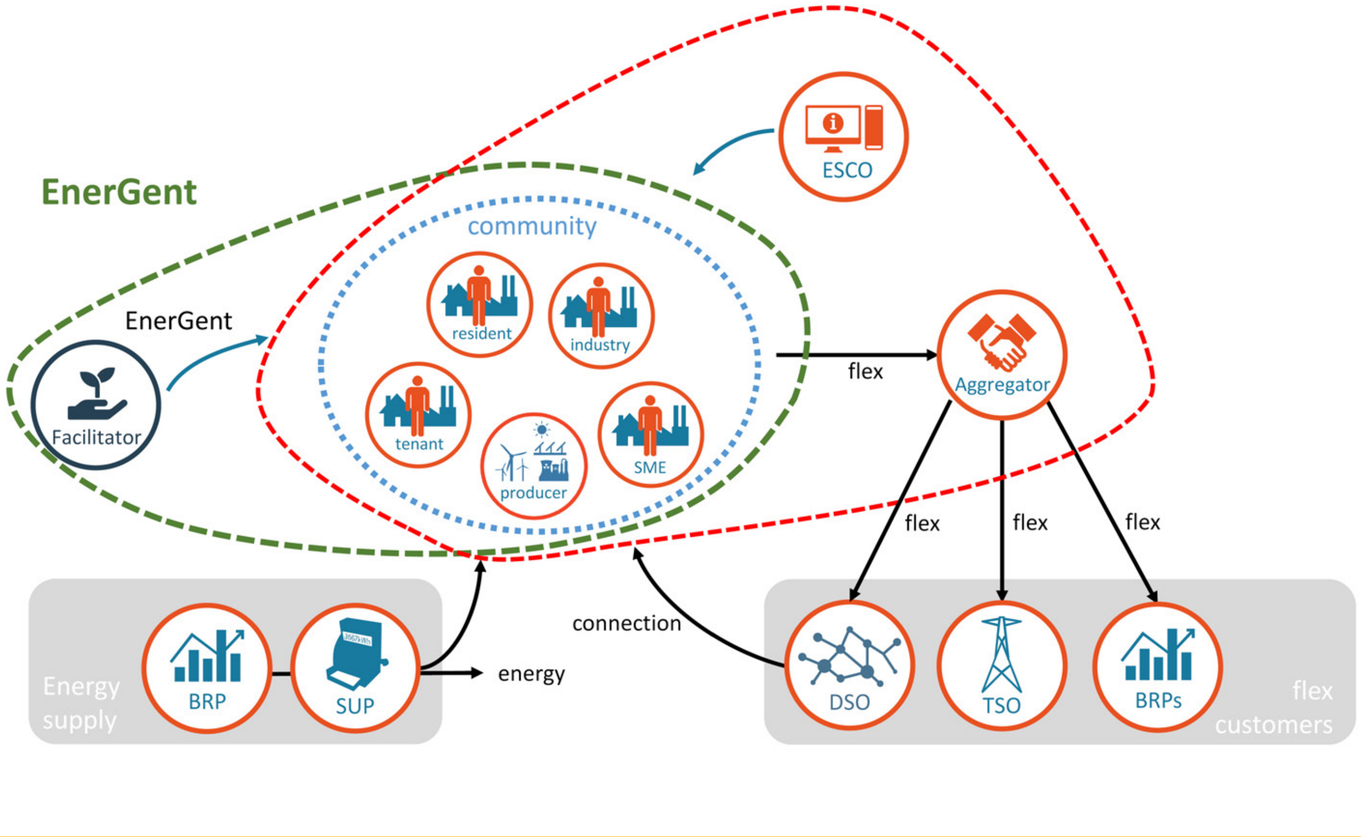
INSIGHT cVPP | Which roles can you take on as a community?

EnerGent | Community as Facilitator

EnerGent Role Model | The intended roles in the energy system could be adopted by EnerGent (green circle) and by the federation of cooperatives (red circle) **by the year 2025**.

This will ensure activities that contribute to the development, implementation and/or expansion of the cVPP. This role may include a wide range of activities relating to information, financing, consultancy, organisation of co-financing, group procurement, etc. A community may facilitate collective participation in a cVPP operated by a third party Aggregator or Energy Service Company (ESCo).

St-Amandsberg & EnerGent

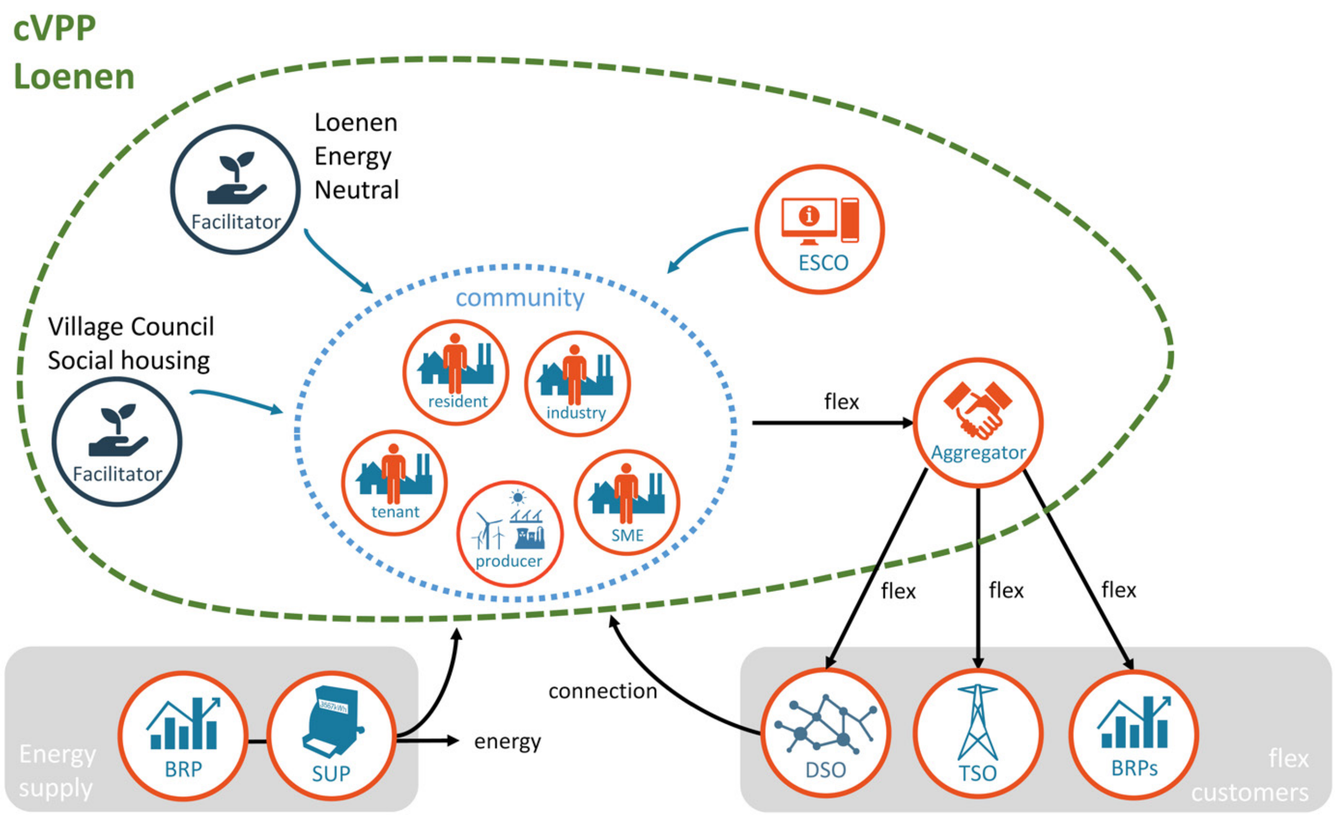


Loenen | Community as Energy Service Company (ESCo)

Role model Loenen | The green circle shows the roles cVPP Loenen envisages in the energy system **by the year 2025**.

This optimises individual and/or common energy profiles (e.g. supply and demand) with regard to, for example, dynamic prices (implicit demand-response) or the availability of locally generated and/or renewable energy. The objectives for optimisation are closely related to the values of communities, e.g. lowering energy bills, self-sufficiency and/or reducing carbon emissions.

PDF | Sustainable Loenen

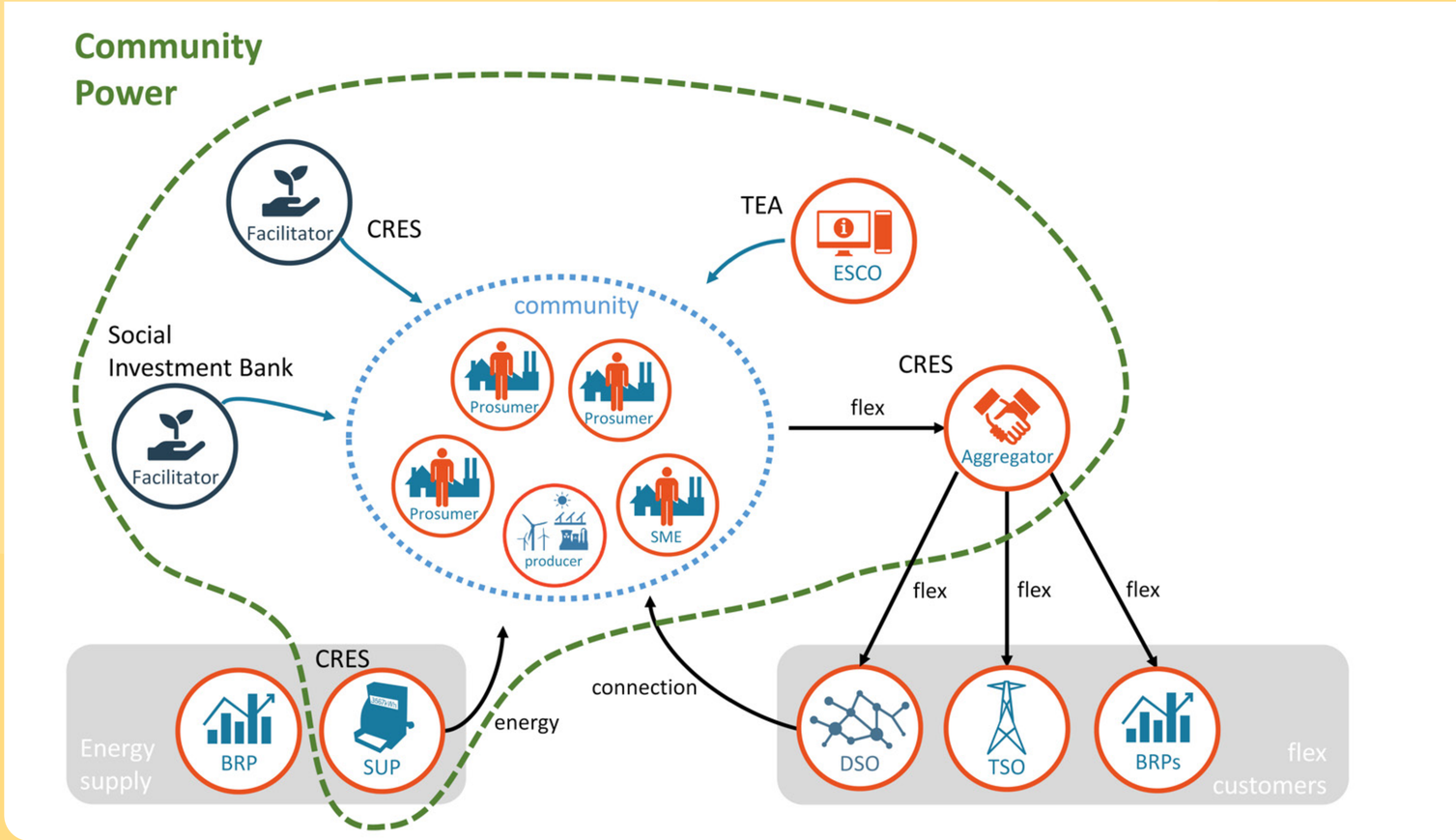


Community Power Ireland | Community also as supplier

Role model Community Power | The green circle shows the roles Community Power intends to play in the energy system **by the year 2025**.

The supplier takes part in energy trading. This may involve supplying self-generated energy to (members of) the community, trading self-generated energy on the wholesale energy market and/or facilitating intra-community trade in energy through a common energy market platform or through direct peer-to-peer energy trading. For example: energy cooperatives that sell electricity to their members.

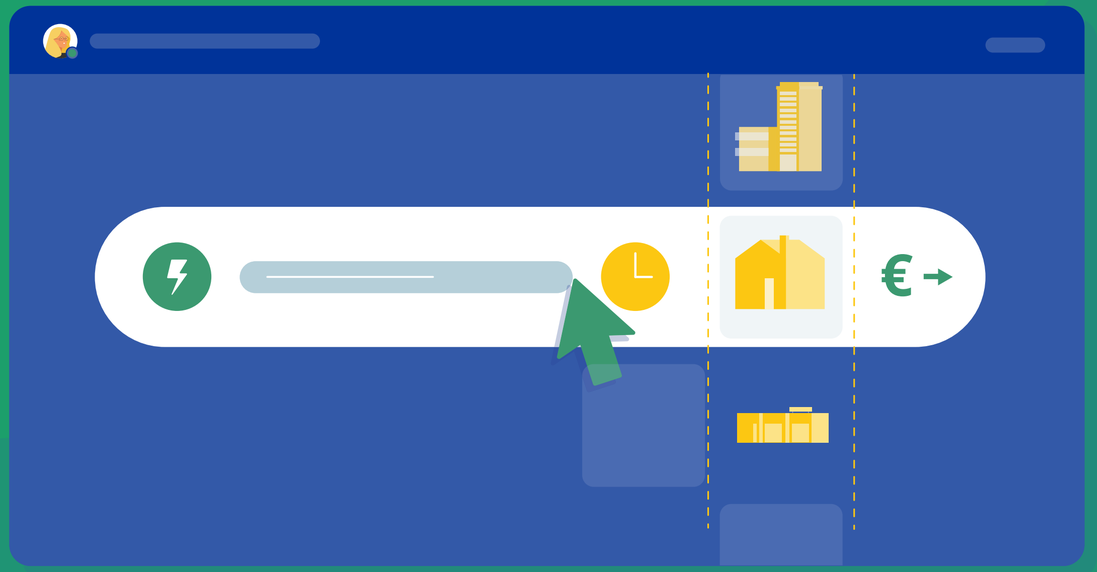
Friends of the Earth



Chapter 6

The MoRe Model

a process guidance tool for your energy community



Chapter 6 | The MoRe Model

Introduction

- For whom is this starter's guide?
- How do you involve your community? Where do you start?

Proces | Interactive backcasting

Roadmap to a cVPP (overview)

- Step 1 | Describing current configuration of (energy) community
- Step 2 | Identifying Values - Goals - Activity
- Step 3 | Drafting the future configuration of a cVPP
- Step 4 | Writing an inspiring story about the future cVPP
- Step 5 | Looking back to the present
- Step 6 | Creating a timeline and a short story about how the initiative became a cVPP
- Step 7 | Composing an overview of questions to be answered and of your network
- Step 8 | Reporting back: Final feedback to the Energy Community Initiative

Crash courses

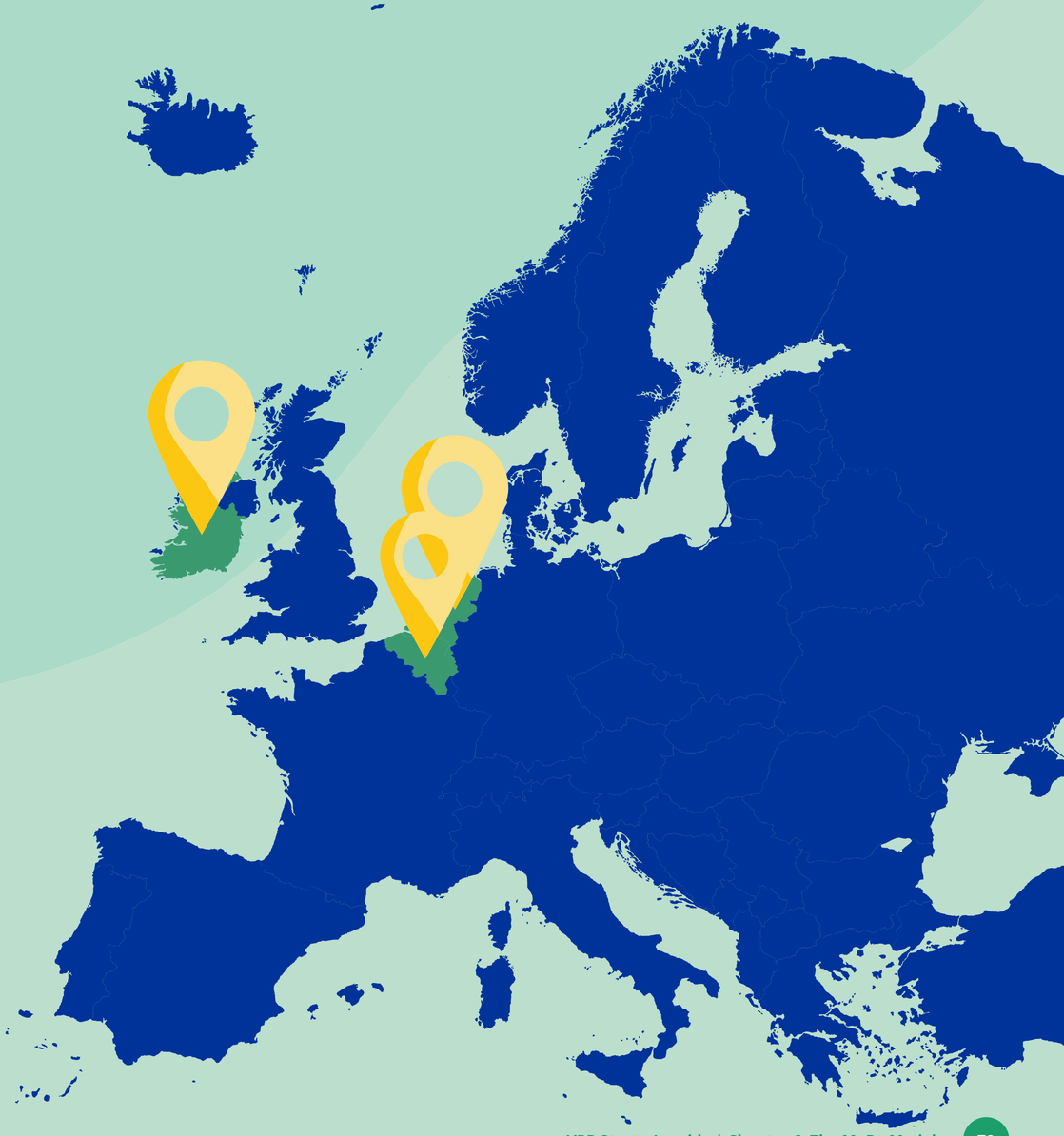
- see Crash course 6 | Community Engagement Practices

Introduction

The Mobilization-and-Replication (MoRe) model was designed by Eindhoven University of Technology and DuneWorks in collaboration with the cVPP project partners. Three implementation communities and 9 replication communities participated in this development: in Ireland, The Netherlands and Belgium.

The MoRe model was immediately tested in various social contexts and communities (rural, urban, rich, poor). The innovative ideas behind cVPP were exposed to the centralised and fossil fuel based regime.

Process guidance and tools were actively applied and tested. This training material is now ready and available to be used by your energy community.



For whom is this starter's guide?

This starter's guide is aimed at **process moderators** (intermediaries) who want to support **energy communities** taking their first steps in exploring the possibilities of a community-based Virtual Power Plant (cVPP).

These **process moderators** or intermediaries could be:

- initiators or frontrunners of a project within a community;
- active board members of a cooperative;
- pioneers in a neighbourhood;
- other enthusiasts who invest time and energy in building the energy community.

They can be volunteers or paid, they can be part of the community or linked to the community.

Process moderators can use the **MoRe model** process and tools to start a co-creative project with (other) active community members. Together you explore the possibilities of a cVPP project and the actions and interventions needed to take the first steps for the future.

A cVPP is a way for energy communities to go beyond energy saving, energy efficiency, renewable energy and energy generation. The MoRe model helps to create a shared and contextualised perspective on the potential of a cVPP project for a community. It helps to clarify the actions and interventions needed.

As a process moderator you support the participants to come up with ideas about a future cVPP and how to involve the community. This takes time and effort for both the process moderator and the participants.

As a result, over time all members of the energy community will be better prepared to deal with the complexities of the energy transition and to choose which role they want to play in this transition.

The aim is to engage and empower members of energy communities and to support community energy initiatives.

How do you involve your community?

Where do you start?

Due to the great diversity of energy communities and the context in which they operate, there is no *one-size-fits-all* approach. The high complexity of a cVPP makes it challenging to engage a wide range of community members. The goal of this engagement approach is not just to inform and make community members aware about the challenges of the energy transition. Rather the aim is to make a story about cVPP that relates to their own questions, needs, ambitions and envisaged role in the energy transition.

For example, cVPP partner Kamp C (Centre for Sustainability and Innovation for the Province of Antwerp) has organised a series of Inspiration Days (the Dream-Dare-Do days) in 2019 to show new energy communities, municipalities and citizens what cVPP is and how it can benefit communities. During these Inspiration Days, people were informed about the effective use of renewable energy. You could listen to experts, learn about good examples and visit realised projects. You gained insight into the common interests of organising yourself around the generation, use, storage and distribution of energy.

In the Netherlands, the municipality of Apeldoorn, which is a partner in the project, links up with other municipalities, companies and local energy cooperatives. In Ireland, the partners ran a school competition in which schools, parents, young people and even national politicians took part.

Engagement suggestions for people and communities

1 Support: make it fun but also professional

The challenge for any community initiative is to create an inclusive and appealing process, whereby it is clear for community members how they can participate: in the design, planning and implementation.

Organising such a process takes time and effort. Municipalities or other (public) organisations may provide support in cases - e.g. financial support, professional/coaching support with tools on how to engage community members.

Examples of such organisations are:

Europe	REScoop.eu
The Nederlands	EnergieSamen, HIER, Buurkracht
Belgium	REScoopVlaanderen, KampC
Ireland	SEAI, Friends of the Earth

2 Timing

Give the members of the community time to understand the complexity of cVPP and its added value.

3 Simplify

Use a good basic story line to explain the challenges of the energy transition and the changing role of citizens and communities.

If you have questions about the MoRe model or need support, please contact our partners:

Sylvia Breukers	sylvia.breukers@duneworks.nl
Luc van Summeren	l.f.m.v.summeren@tue.nl of lucvansummeren@hotmail.com
Maro Saridaki	maro.saridaki@kampc.be
Jet Groen	jet.groen@kampc.be

4 Checklist for environmental justice

Discuss with your community the **5 dimensions** of **environmental justice** for community engagement.

A Recognition: who counts?

- Are all community members recognized? How are they recognized in their diversity of perspectives, needs, ambitions, expectations?

B Participation: who gets heard?

- How are community members involved in defining needs, solutions, and priorities in various stages of the process?
- How do they have a say about the way in which co-creation process is organized? ?

C Distribution: who gets what?

- What sort of problems are addressed, are to be solved by the cVPP? Whose problems?
- What vulnerabilities are important to reckon with in this community? How might these be affected as a result of steps towards a cVPP?

D Capabilities: who does what?

- What are the capabilities of different community members to contribute to the process (e.g. participate in meetings, help organize, invest, help engage others, act as 'ambassadors')?
- What capabilities and competences are needed to be able to meaningfully participate in the cVPPprocess? How can community members be supported in acquiring these?

E Responsibility: what matters (to whom)?

- Who is interested in taking what responsibilities?
- How are the community members supported in adopting responsibility?
- How much room is there for taking responsibility non-actively?

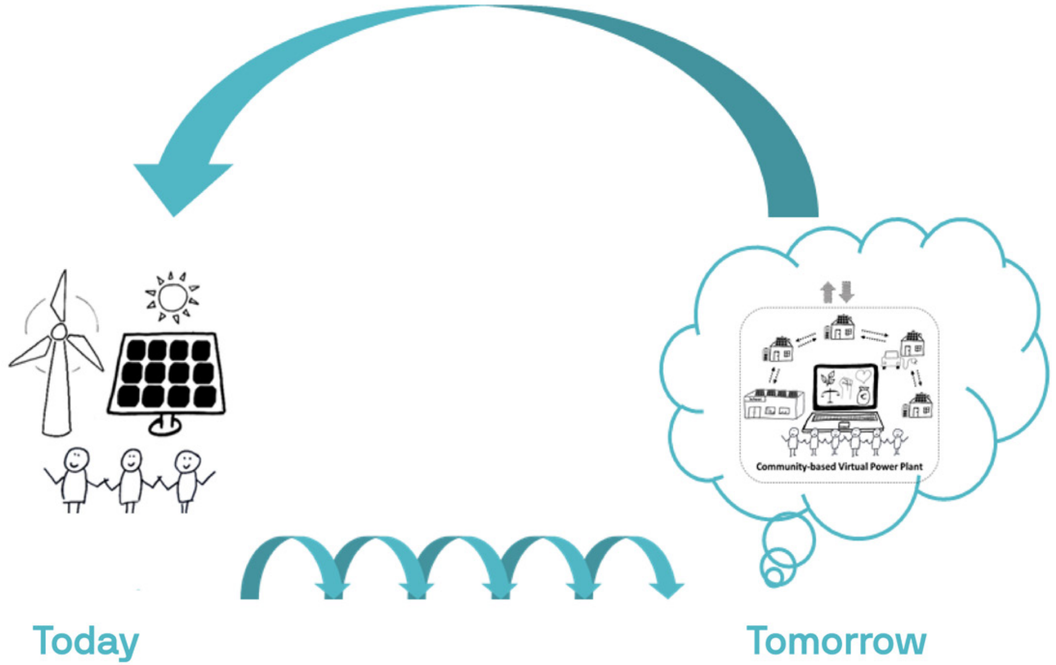
Crash course 6 | Community Engagement Practices ▶

Process | Interactive backcasting

What?
Interactive backcasting is a method to co-create a desired future story of a cVPP. Next, the participants look back to the present to assess what steps are needed to attain that future.

Why?
Backcasting is a proven method to explore future possibilities. Story-telling and out-of-the-box thinking are important in (social) innovation processes because they trigger imagination, mobilise enthusiasm and help to arrive at new ideas.

How?
Backcasting is a structured approach to tackle complex innovations - such as a cVPP - and to build a contextualised vision of the future. It helps to focus on the steps needed to achieve a certain result. And it shows how today's decisions can influence future opportunities. If we then zoom in on the short term, the main challenges and opportunities for the long term become clear. Storytelling and out-of-the-box thinking are important in (social) innovation processes in order to come up with new ideas. Stories about a desired future triggers the imagination and stimulates enthusiasm. It also shows how today's decisions can influence future possibilities.
The process moderators who guide the participants through the interactive backcasting process follow eight steps which are explained in the following pages.



INSIGHT | The objective of the interactive backcasting method

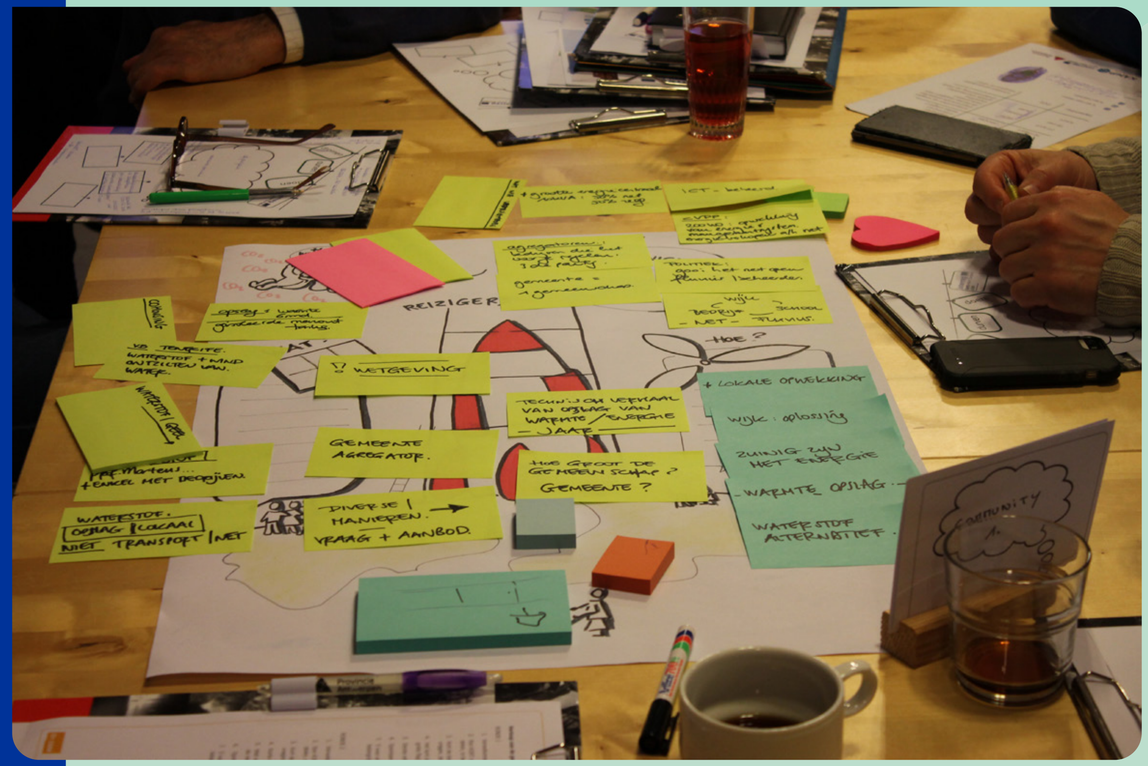
The interactive backcasting approach as presented has the aim to jointly explore how a cVPP could contribute to create value for a community.

A cVPP can take many forms and shapes.

The backcasting process has been successful if at the end the participants have clearer idea about the cVPP configuration in terms of:

- how it enables activities and goals that the community values;
- how it is to be organised (organisational, and time-wise);
- the technologies involved;
- how it fits with an already existing configuration;
- how to engage the broader community;
- how to learn from other, similar initiatives;
- which short term choices may have crucial impact on future possibilities of the cVPP;
- which actions to undertake on the short term to find answers to main questions.

These questions provide direction for participants to take the first concrete steps, together with the wider community and other relevant stakeholders.



Before you start, a few points of attention:

The exact number of interactive sessions, the type of meetings, how these are exactly prepared, **that is up to you as a process moderator.**

If you, however, want to use the full process approach with all the steps (and perhaps even some additional activities in order to engage more community members), then **you will need at least three meetings**. In between these meetings you will need time to collect or process feedback and inputs from the participants.

The process is quite time intensive, and it is advisable to work with two process moderators. Not only to divide the work and tasks, but also to be able to discuss the feedback collected and translate it into next steps. Sometimes the feedback collected will be quite limited, and then you will need to rely on your own knowledge and insight in the situation in order to, for example, write up an inspiring story.

It is important to show the participants clearly what **the purpose of each step and of the journey is**. Each interactive session should address this.

Depending on the participants, it can be good to **repeat** each time **what a cVPP is**.

Prezi

It is worth emphasising that **the participants are involved in an innovation process,** characterised by uncertainty and complexity and that **their efforts are also likely to benefit future initiatives.**

Live, face-to-face sessions are also important for participants to meet each other. **There should be sufficient time for networking and fun.**

Live, face-to-face meetings are very important for a good process.

It is important to realise that participants are often **volunteers. Their time is limited.**

The process is a joint exploration and the proposed process steps can be adapted to the needs of the participants.

It is important to **evaluate each step and each session together with the participants** so that the approach can be adjusted if necessary.

Some more points of attention:

This interactive backcasting can also be done with more than one initiative. The advantage is that **the participants can also respond to, and be inspired by, other initiatives.** Moreover, they can decide to work together in addressing questions and challenges.

While the process moderator needs to be able to understand and explain all content, the most important ideas and content are provided by the participants. **A good report/minutes is essential** in order to make the best use of the input of the participants.

For the process moderators, this process is as much an exploratory one as it is for the participants. It is very useful to be able to discuss with a co-moderator.

The lists of possible activities (goals and activities) also include activities that are not yet permitted or feasible (e.g. due to regulations, immature technology). **The relevance of this list of activities is likely to change as the energy market and system are constantly evolving.** In addition, there are differences between countries. However, this list of activities is still useful to launch a discussion among participants on what their collective energy project could do. It gives an idea of what a community can do. This could mean an energy project that not only focuses on energy generation, saving and efficiency, but also storage, increased self-use, peer-to-peer exchange and activities that support the stability of the electricity grid and enable more renewable energy generation on the grid.

Roadmap to a cVPP

Overview

Step 1	**Current configuration of (energy) community** Defining the current configuration of the energy initiative of the community
Step 2	**Values - Goals - Activities** Identifying the values and goals of the community related to the energy initiative
Step 3	**Future configuration of a cVPP** Preparing an initial rough sketch of the desired future cVPP configuration
Step 4	**Writing an inspiring story about the future cVPP**
Step 5	**Looking back to the present** Backcasting with the help of the storylines
Step 6	**Creating a timeline and a short story about how the initiative became a cVPP**
Step 7	**Composing an overview of questions to be answered and of your network**
Step 8	**Final feedback to the Energy Community initiative**

Step 1 Describe the current configuration of the project or initiative

What?
Ask the participants to describe the current configuration of their project or initiative, covering all relevant aspects.

Why?
Such a comprehensive overview is useful to gain a clear insight into the starting situation, for which a vision of the future will be developed.

How?
This step works best after a first acquaintance or meeting. At this first meeting you explain: what is a cVPP, the backcasting process and an explanation of the configuration categories. When participants are unfamiliar with the general concept and idea of the trajectory, filling in the template becomes a difficult and demanding exercise. The participants and/or the process moderator fill in the Tool | Configuration Tables. Participants are informed why they need to fill in the template. If they have already provided a detailed description of their current situation, the process moderator can use this information to fill in the template and, if necessary, ask for additional input.

Another possibility is to complete it together, as part of the first meeting. The current situation needs to be outlined, the aim is not to come to a detailed overview with technical information.

Tool | Configuration tables ▶

RESULT: An overview of the current configuration (including insight into what information is missing).

This overview contains information about:

Values:
- economic
- ecologic
- social values

Practices:
practices and governance of the energy community

Technical and physical elements:
generation, storage and controllable devices

Infrastructure:
ICT, internet and electricity grid

Policy:
policies, regulations and support schemes

Resources:
network, knowledge and financial resources

More detailed explanation of the configuration categories in the tool, configuration tables.

Assignment: In order to map out what is possible, we first need to map out what is already there. Together with the community, complete the questionnaire (as far as you can), in order to get a clear picture of the current configuration.

Step 2

Identifying goals and activities

What?
The participants in the community already have an idea of the values that are important to the community. These have been mapped out in step 1 in the current configuration. Based on these values, pre-defined goals are presented. Each goal is related to a list of predefined activities. These are activities that help achieve the goal. The participants are invited to select the goals they are most interested in. The corresponding activities are then shown.

In the Tool | Value – Objective - Activity, the predefined overviews of goals and activities are described.

Why?
The question is how can a cVPP help to realise the values of the community or to put it in another way, what does a cVPP have to offer for:

S | Households
M | Community
L | Energy transition

Step 2 results in an overview of the goals and activities in which the participants are most interested. When selecting the goals, they discuss their preferences and priorities. They also discuss which goals and activities are not (yet) of interest, reducing the possible cVP configurations.

How?
This step introduces a lot of information. The process moderator should reserve time to present all the predefined goals and make sure the participants understand them. Although this step can be overwhelming due to the (complex) content, it is important to keep in mind that this step actually helps to reduce complexity and reduce the number of options to a 'manageable level'.

The tool | Value – Goal – Activity shows how the community-values, translated into a set of goals that a cVPP can help achieve, result in a limited number of activities for the cVPP to perform.

Tool | Value – Goal – Activity

RESULT : Overview of possible activities that the cVPP can help perform in order to achieve the goals that have been chosen.

The purpose of this step is to help participants to better understand and discuss in what ways a cVPP can contribute to the values that they consider important. This may trigger a discussion about the way in which the concrete activities are indeed in line with what the participants have in mind, and which activities are envisaged for the shorter or the longer term. Here you can consider additional activities which do not result from this exercise but nevertheless are considered important.

In any case, it clarifies the ways in which a cVPP can contribute to value creation for households, the community and the energy transition.

As such, it provides a good basis for the next steps that address the future configuration.

The resulting overview is shared with all participants.

Assignment: During a live meeting you name the values of the community. Afterwards the participants can discuss and select the main goals for their cVPP project, after which the tool shows which activities their cVPP project needs to include in order to achieve these goals. The participants then discuss what they think of these outcomes.

Step 3

Drafting the future configuration of a cVPP

What?
You ask the participants to draft the future configuration of their project or initiative, addressing all relevant configuration categories from step one:

- **Values:** economic, environmental and social values.
- **Practices:** ways of doing things and governance of the energy community.
- **Technologies and physical elements:** generation, storage and controllable devices.
- **Infrastructure:** ICT and electricity grid.
- **Policies,** regulations and support schemes.
- **Resources:** relational, knowledge and financial resources.

Why?
After step 2, or in case step 2 is not performed but another form of discussion has taken place about what the cVPP could bring, the generated ideas can be fed into a first rough overview of the future cVPP.

How?
This step can be done as part of the first meeting, after step 2 has been finalised. In that case, with the outcomes of step 2 in mind, the participants can freely come up with ideas for the future configuration.

After the meeting, this input can be added to the Configuration Table document that has been filled in in step 1 (in a different colour to distinguish between the current and future configuration). A possibility is also that the process moderator fills in the template, based on the discussions and inputs gathered (asking additional inputs from the participants to complement it).

Tool | Configuration Tables

RESULT: Overview of the basic elements of the future configuration.

The purpose of this step is to start drafting the future of this particular community energy initiative, with attention for the potential of a VPP. It provides insight and the direction the community chooses and what is needed, and also provides a basis for the development of the future story (step 4). This overview is shared with all participants..

Step 4

Writing an inspiring story about the future cVPP

What?
Based on all the collected input and discussions from the previous steps, you write a story that reflects this input and brings it together in an appealing future image.

Why?
This step creates a more elaborate picture of the future cVPP configuration that covers all configuration categories. The purpose is to support and inspire community members by envisioning a future cVPP that is appealing yet feasible. The story focuses on possibility and opportunity.

Next to the function that the story has in the backcasting process, it also helps to trigger enthusiasm and inspiration among the participants. Participants may want to use the story to engage other community members or in their interactions with other stakeholders.

How?
The story can be written using the Tool | Story n°1 template.

This can be done by the participants during a face to face meeting. Another option is that the process moderator writes the story based on all the input of the participants. Take care that the participants feel ownership of the future vision –that they feel that this indeed is their story.

When the process moderator has completed the (final) story, it is important to find a moment to tell the story to all participants. The written story should be shared with all participants.

Tool | Story n°1 template ▶

RESULT: A story about the future cVPP

The outcome of step 4 is a story that shows more clearly the possibilities of a cVPP for this particular community. The story (or parts of it) can also be used at a later moment to communicate with the broader community how a cVPP for the community could look like.

It provides the basis for the next step in the backcasting process: looking back from the future to the present.

Step 5

Looking back to the present

What?
In this step, we look back from the future to the present to consider what would be needed to arrive at that future.

Why?
By looking to the present, participants can see how today's choices and actions influence the possibilities of a future cVPP. What are the necessary steps to achieve the future cVPP? And what are the short and medium term challenges and opportunities?

How?
Organise an interactive session and you read the story to the participants. The participants are invited to discuss the most important uncertainties, challenges and opportunities on the path towards this future cVPP. On the basis of these interactions (during or after the session), they may fill in the challenges and opportunities table during or after the session. The level of detail may vary and if the participants have difficulties with filling in yet another template, you can fill it in based on the discussion and inputs.

Tool | Challenges and Opportunities ▶

RESULT: Looking back to the present

The result of step five is a clearer assessment of the main uncertainties, challenges and opportunities and how they can be addressed (or not) by the participants, as well as an assessment of who or what would be needed to support them.

During this step, questions may well arise about community involvement. This is an important challenge to address in this and following steps. It is likely that during this step participants want to discuss the challenge of how to engage the broader community. As a support to this discussion, have a look at the Community Engagement Practices crash course.

The result may also be that the participants feel that the story needs to change.

Crash course 6| Community Engagement Practices ▶

Step 6

Creating a timeline

What?
A timeline specifies community-related aspects (engagement over time), technological and physical developments, as well as the activities that the cVPP enables. It clarifies what the cVPP and the process of developing this cVPP could look like for this specific community.
In addition, a short story is written and presented together with this timeline. This story is not an account of the future situation (Story I, step 4), but describes the path towards that desired future cVPP.

Why?
The tools **Timeline** and **Story n°2** contribute to a clearer picture of the process towards the cVPP. The story will clarify concrete choices, considerations and priorities.

Tool | Timeline

Tool | Story n°2

How?
Discuss beforehand with the participants what they prefer: either you prepare the timeline and Story n°2 based on their inputs, or they do this together. Again, important is that the participants have the feeling that it is their story.

The timeline and Story n°2 are created using the relevant tools. During a live session, you read out the story and simultaneously present the timeline.

You ask for feedback and zoom in on the first years in the timeline, asking the following questions:

- **What question needs to be answered/ addressed in this period?**
- **Why is this question important?**
- **What and who do you need to answer this question?**

Note down all the questions and issues brought up by participants, as input for the next step.

In addition, a stakeholder overview that is prepared by the moderator based on earlier inputs, is presented to the participants, asking for additional inputs here. This provides insight in how participants can ask for support from others when addressing concrete challenges.

Tool | Timeline

RESULT: Main questions and challenges

The purpose of this step is to further clarify the main questions and challenges that need to be tackled, with emphasis on the short-term. Together with the participants you create a timeline and a second story. This second story is not focused on the future situation (story n°1) but on the path towards that desired future cVPP. Attention is given to community-related aspects (engagement over time), technological and physical developments, as well as the activities that the cVPP enables.

Step 7

Composing an overview of useful questions

What?
Based on the outcomes of previous discussions, this step aims to generate an overview of questions to be addressed by the participants themselves in the short term and an overview of stakeholders that could support the energy community in developing their cVPP.

Make clear that the overview that is compiled is a 'living document', that can be adapted and complemented as time progresses.

Why?
This overview translates the results of previous discussions into a clear list of questions and actions, as well as insight into the needs for external expertise.

The stakeholder overview makes it clear which stakeholders are already part of the community network and are easy to approach, and which stakeholders are important, but at a greater distance (and the discussion about this can help generate ideas to connect with this stakeholder). In this way, it helps participants to define the next concrete steps and actions to be taken to further explore and/or work towards a cVPP.

How?
Using the aptly named tool, a table of useful questions is created, focusing on who should take the actions and what or who is required to do so. This table with all useful questions and a stakeholder overview is compiled based on the outcomes of the previous steps and the notes taken during the discussions. It can be used as part of the feedback to be reported to the participants in step eight.

RESULT: List of useful questions and stakeholder overview

The purpose of this step is to provide an overview of questions to be answered by the participants in the short term and an overview of stakeholders who can support the energy community in the development of their cVPP.

Tool | Table of useful questions

Step 8

Reporting back

What?
During the preceding process, there has been a continuous gathering of input from as well as reporting back to the participants. Depending on the needs and time available, a final report can be compiled that summarises the main ideas developed:

- The rewritten story and timeline
- Overview of useful questions & stakeholder overview
- SWOT: overview of strengths, weaknesses, opportunities and threats

Why?
This report provides the building blocks for a plan of action (which is outside of the scope of the MoRe model), because at this point the ideas about the possibilities of a cVPP are clear and concrete. It may also be that the participants conclude that a cVPP is not (yet) a viable option, but that they have developed other valuable ideas to take their initiative a step forward.

How?
Bringing together the relevant parts in one document and adding a SWOT and sharing this with all participants. If possible, organise a final brief meeting to evaluate the process and discuss how participants envisage next steps. Share the document in such a format that the participants can easily add, complement and change parts of the document.

Tool | Story n°2

Tool | Timeline

Tool | Table of useful questions

Tool | SWOT-analysis

RESULT: A detailed overview

The result of step eight is a detailed overview of the results of the exploratory trip undertaken, including a final feedback to the Energy Community Initiative.

Tools

The purpose of this section is to provide material that can be completed as part of the co-creation process, allowing you to put the cVPP options for your community into context.

Abbreviations

cVPP	community-based Virtual Power Plant	**ICT**	Information Communication Technology
DSO	Distribution System Operator	**RE**	Renewable Energy
EMS	Energy Management System	**RES**	Renewable Energy Sources
EV	Electric Vehicle	**TSO**	Transmission System Operator
		VPP	Virtual Power Plant

Glossary

Aggregator An entity that aggregates and sells flexibility.

Capacity tariff A fee that energy consumers pay to a DSO in order to be allowed to use the electricity network. The tariff depends on the maximum capacity needed to supply a consumer in a certain timespan.

Community-based Virtual Power Plant (cVPP) A cVPP is a portfolio of renewable energy sources, controllable appliances and energy storage systems aggregated and coordinated by an ICT-based control architecture, adopted by a (place-and/or interest-based) network of people who collectively perform a certain role in the energy system. What makes it community based is not only the involvement of a community, but also the community-logic under which it operates.

Controllable appliances: Appliances which can be turned on/off using ICT to lower or shift energy demand in time (e.g. heat pump, smart dishwasher).

Demand Response A specific form of flexibility that focuses on the demand-side. It refers to changing the energy demand of controllable appliances and energy storage systems.

Dynamic prices Energy prices that fluctuate throughout the time of the day, depending on the difference between demand and supply.

Energy community A group of citizens that actively invest in and become owners of renewable energy sources.

Energy Management System (EMS): An ICT system that monitors and controls renewable energy sources, controllable appliances and energy storage systems. An EMS can operate on the household, building or community level.

Energy monitoring The monitoring of the demand and supply of energy facilitated by an energy monitoring system.

Flexibility (flex) Flexibility means being able to adapt. Energy flexibility entails changing or the shifting in time of supply and/or demand.

Interactive backcasting A method that starts with formulating a desirable future. Next, the participants look backwards to the present to assess what steps are needed to attain that future.

Licensed energy supplier An entity that has a license through which it is legally allowed to sell energy to customers.

Peer-2-peer energy trading: The trading of energy from one entity (e.g. a household) to another entity.

Prosumer: An entity (e.g. a household) that is both a consumer and producer of energy.

Self-consumption: The consumption of self-generated energy.

Virtual Power Plant (VPP): A software-based solution that aggregates renewable energy sources, controllable appliances and energy storage systems into one coordinated and controlled portfolio that operates as one single entity similar to a conventional power plant, and which allows for performing roles in the electricity system related to managing and trading of electricity.

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