LIFE TANDEMS

Whitepaper: Business Models for Energy Sharing

TANDEMS

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1 FOREWORD

In the realm of energy communities, there is a lot of ambition when it comes to energy sharing and the impact that it might have on its participants. Yet, there is not a lot of clarity on how energy sharing might actually work in practice.

With this whitepaper, our goal is to shed light on what a business model for energy sharing can actually look like, taking into account the different aspects of the entire energy supply chain, from production to consumption. Over the past years, we at Agem Energie Experts have worked with municipalities and citizen groups to move beyond the traditional models of energy supply. In doing so, we asked a simple but powerful question: how can we supply our own energy, to ourselves, at a cost price? That journey led us to the development of a cost-price model — a model that prioritises fairness, transparency, and local reinvestment over profit.

What you will find in these pages is not a utopian idea or an academic abstraction. It is a framework informed by real-life projects in the Netherlands — projects where municipalities became active players, not just facilitators, in their own energy supply. This document integrates what we've learned in the field: the practicalities, the trade-offs, the governance implications, and yes — the potential for real change.

We believe that by making the concept of energy sharing concrete, replicable, and grounded in cost reality, we give local communities the tools to become meaningful players in the energy transition. And if this model can help to shift the narrative from niche and experimental to structural and scalable, then we are moving in the right direction.

I hope this paper helps others in Europe and beyond to take that next step — to rethink not only how energy is generated and used, but how it is organised, shared, and valued.

Justin Pagden
Agem Energie Experts

CONTENT

2 INTRODUCTION

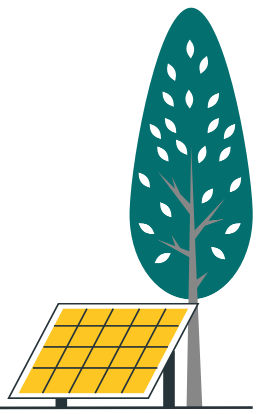
Energy communities, which empower local actors to participate actively in the generation, consumption, and sharing of renewable energy, play a crucial role in driving the transition to a sustainable energy system from the bottom up. This Whitepaper explores the potential of energy communities to transform the traditional energy market by focusing on collective self-consumption models and their associated business structures.

This Whitepaper builds on the work of the EU-funded LIFE TANDEMS project (2022-2025). In the framework of the project, Agem Energie Experts have mapped the value exchanges between the different actors involved in the TANDEMS pilots in Bulgaria, Flanders and the Netherlands. The project deliverable 2.2 examines in operational detail the economic and organizational dimensions of energy sharing, comparing traditional energy market models with emerging approaches that prioritize community-driven energy management. By employing a Business Model framework and analysing case studies, the deliverable report provides a comprehensive perspective on how these models can be designed, implemented, and scaled. Key considerations include the cost structures, equity requirements, and the integration of innovative pricing mechanisms to ensure fair and sustainable operations.

Through this analysis, the report aims to provide actionable insights for EU policymakers, energy community leaders, and stakeholders seeking to implement effective energy-sharing models.

We unravel and quantify the key elements that make up the business model of community energy. Every energy community is different, but the key elements that make up the business model are more or less the same. So by understanding these key elements and quantifying them, it becomes easier to design a new model or to analyse and adapt an existing one.

Energy communities want to contribute to the energy transition and often start by developing production assets, which is a great start. In many cases however, the energy community wants to be more active in the energy market by also sharing this energy with its members as end-users. Here, Energy Communities are often confronted with a lack of knowledge about the energy sector and/or a dependency from market actors. This report aims to cover part of this knowledge gap by showing what happens within the entire energy supply chain and how this effects the business model of energy sharing.

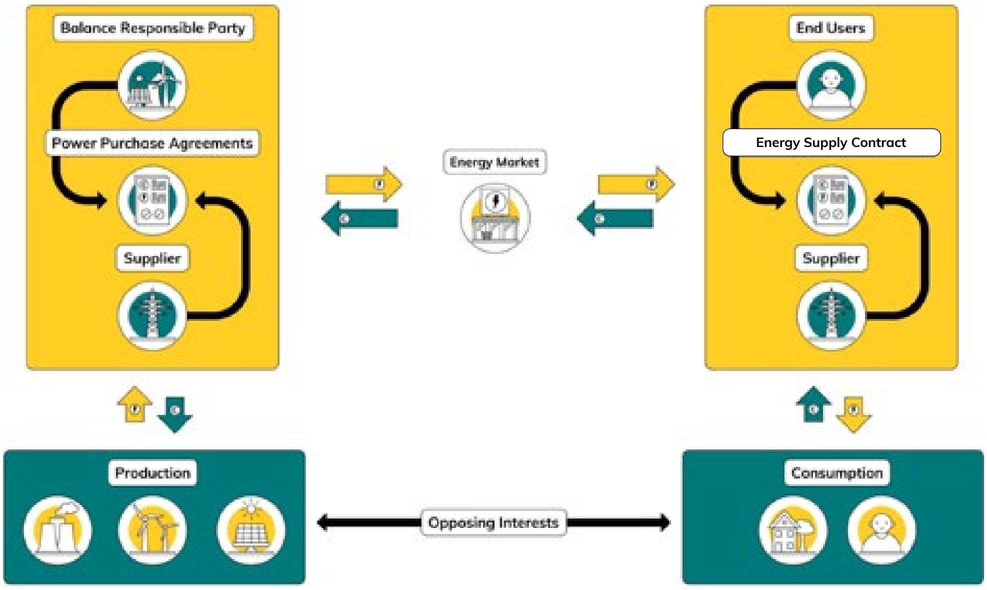


3 THREE MODELS

Energy Sharing Explained

To understand energy sharing as a concept, and in particular how it can fit into the existing energy sector as a whole, it is useful to understand the current traditional market model (Figure 1).

FIG 1: THE TRADITIONAL ENERGY MARKET MODEL



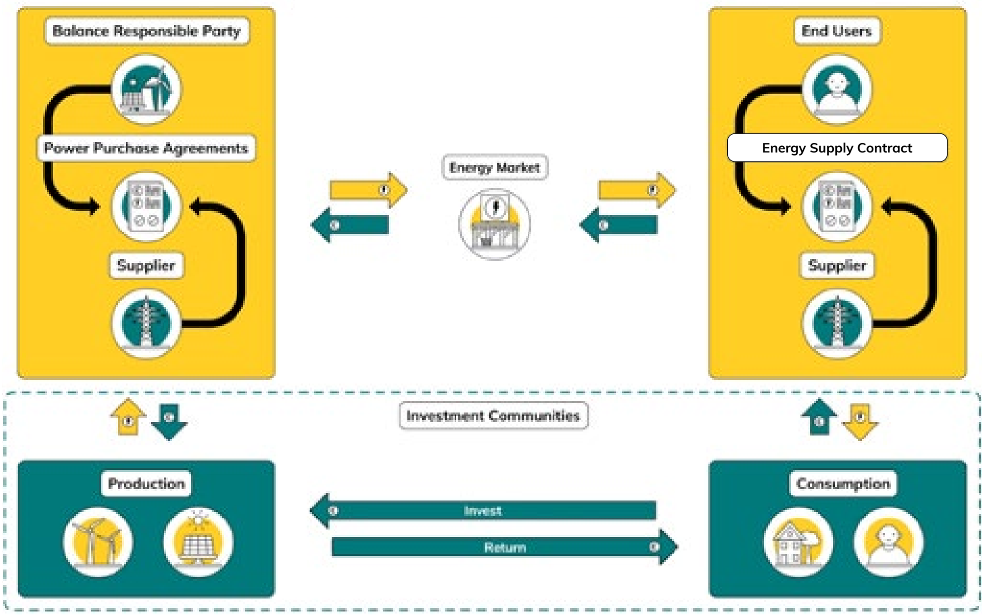
All producers have a contract with a supplier. These contracts are often referred to as PPA's (Power Purchase Agreements). Generally, the price of these contracts refer to the market price. Sustainable production assets like solar and wind farms sell their production on the day ahead market because the subsidy they receive from the government, referred to as a Contract for Difference (CfD), is based on the development of this market.

On the other side, end-users also have a contract with a supplier. The price per kWh in this contract is also based on the energy market, regardless if it is a dynamic price or a one-, two-, or three-year fixed price.

This means: production and consumption are not directly related, as prices are determined by the market. Producers generally want the highest price for their production, and consumers want to pay the lowest price. Producers and consumers therefore have opposing interests. The price in the energy market is determined by the marginal cost for the most expensive dispatchable plant which is producing electricity. The electricity market price is therefore strongly influenced by an event like the availability and price of oil, coal or gas.

Traditional energy communities, usually work based on this traditional market model (Figure 2). Consumers invest in production assets and receive a financial return. That's why we sometimes call them `investment communities´.

FIG 2: THE ENERGY COMMUNITY MODEL



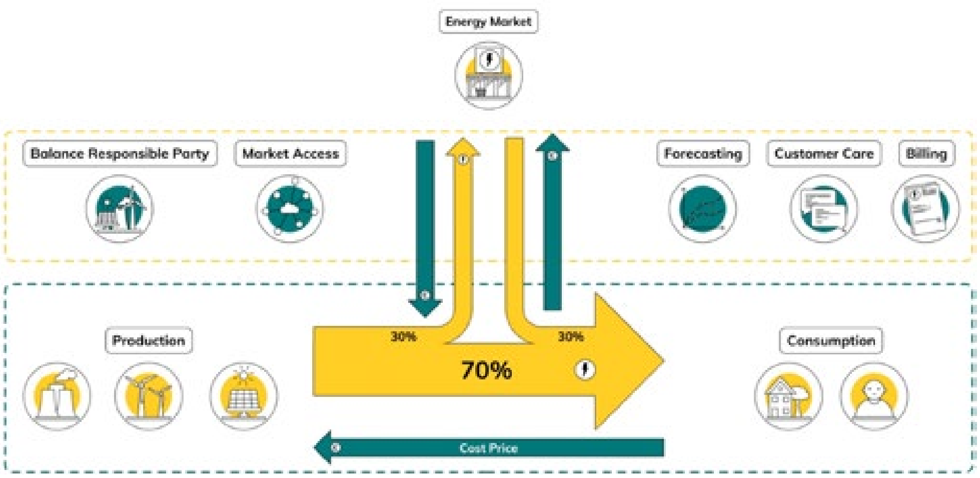
The opposing interest is removed although there is no relationship between the energy bill of the consumer and the production of the producer. During the energy price crisis of 2022 this meant a very high income on the production side of the community (with potential high returns for the investors) and (still) very high bills on the consumption side.

Many energy communities in Europe are organised this way, and although it is a great way to organise ownership of assets within communities of end-users, this model could not be characterized as energy sharing.

When production and consumption of electricity within an energy community occur simultaneously at the same time, the production can be shared with the consumers directly, without interacting with the energy market (Figure 3).

This is not possible in 100% of the time. Therefore, market interaction will always be necessary. The energy community will have to sell electricity when production is higher than demand and buy electricity when production is lower than demand. Typically, the market of choice would be the day ahead market, but in theory, this could also be another community.

FIG 3: THE ENERGY SHARING MODEL



A Fair Cost Price

In the energy sharing model, the price paid for the produced electricity is the cost price: the price that has to be paid to cover all costs. Paying less will mean the Energy Community will go bankrupt and paying more will mean a surplus or profit for the Energy Community, which is being paid for by their own members. Both don't make much sense, so the cost price is the most reasonable middle ground. Of course it is wise to include certain financial buffers within the cost price.

The business model of energy sharing is therefore also very simple. The energy bill of the consumers has to cover all the costs within the energy community. This includes the cost price of production, the costs that come with buying and selling on the market and other handling cost.

The Role of the Energy Service Provider

In the energy sharing model, there is still an organisation that plays the role of the energy supplier and BRP. We prefer to call this party the Energy Service Provider (ESP) because it facilitates the energy sharing activities for the energy community.

These services include:

- Forecasting
- Energy Sharing (internal matching within the community)
- Balancing (BRP)
- Market access and trading
- Customer care & Billing

Traditional energy suppliers fulfil these functions to provide the commodity to their customers but generally don't provide these as a separate service.

Agem Energie Experts, om | nieuwe energie and Energie VanOns are examples of Dutch cooperative energy suppliers that are now experimenting with these models in real life Pilots and are developing services like this for energy communities.

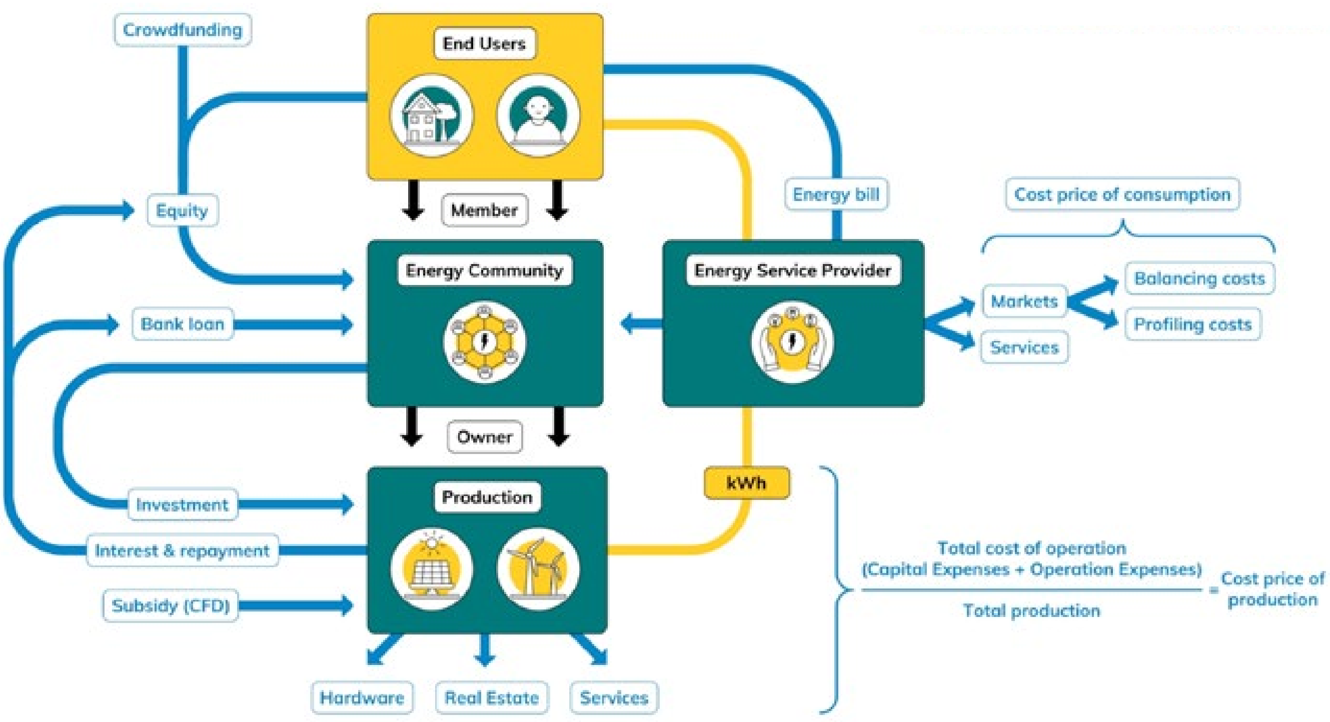
A Business Model for Energy Sharing

In very simple terms, the Business Architecture of the energy sharing model will look approximately like Figure 4. Here we see an end user who is a member (co-owner) of an energy community that is owner of an assets. The production of the asset is supplied to the end user through an Energy Service Provider (ESP). We now add values flows to the business architecture.

The end user invest equity into the Energy Community or funds the equity through crowdfunding. In case the equity is not sufficient for the overall investment it can be supplemented by a bank loan or other debt capital. The Energy Community will then invest in the production assets. The costs for the production assets are hardware, real estate, services and of course the interest on the loans.

The Energy Service Provider also makes costs to provide the service needed to supply the energy to the end users. Through the energy bill, the end users pay per kWh and maybe a fixed service fee. The whole model is based on the idea that the energy bill covers all the costs within the value chain.

FIG 4: THE ENERGY SHARING BUSINESS MODEL



Calculating a Fair Cost Price

To determine the cost price of production (€/kWh or €/MWh) we have to look at the total cost of ownership (TCO) and divide this by the total production. See Table 1: Cost price of production

The TCO is made up of the CapEx (Capital Expenditure) and the OpEx (Operating Expenditure). The exploitation period that is chosen in this calculation has a great impacts on the cost price. In most cases the financial exploitation period is around 15 years, whereas the technical lifespan of the asset is around 25 years.

The cost price of production is determined in the project development phase and can differ greatly per project and has many defining elements. However, it can also be broken down into a few key figures shown in Table 1: Cost price of production. These figures have been published by PBL, the Dutch environmental assessment agency in 2024, whom also advises the ministry on the guaranteed price in the SDE++ subsidy. This is a one side contract for difference (CFD) form of subsidy.

The numbers show quite a discrepancy between the subsidized price (SDE++ (CFD) price) and the calculated cost price over a period of 20 years.

To be on the safe side we advise to use the subsidized price of around 6-7 ct/kWh in the calculations. This is often times the price that is used by the bank to determine financial feasibility.

In further calculation examples we will use an average cost price of 6,3 ct/kWh or €63/MWh and an exploitation period of 15 years.

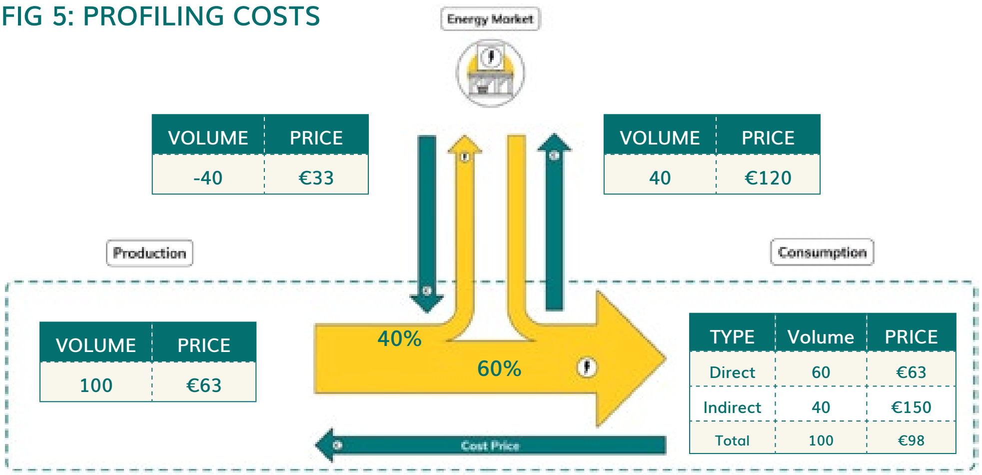
If the actual cost price is lower, and/or the exploitation period longer, that can be seen as a bonus.

		WIND	PV ON LAND
Capacity	MW	10	10
Investment (capex)	€/kWp	1450	472
Fixed OpEx (year)	€/kWp	13,37	12,1
Variable OpEx (year)	€/kWp	0,0089	0,0019
Full load hours		2980	855
SDE++ (CFD) price	€/kWp	€ 0,062	€ 0,066
Exploitation period		15	15
Total CapEx	€	€ 14.500.000	€ 4.720.000
Total OpEx	€	€ 5.983.800	€ 2.058.675
TCO	€	€ 20.483.800	€ 6.778.675
Production (year)	kWh	29.800.000	8.550.000
Total production	kWh	447.000.000	128.250.000
Cost Price	€/kWh	€ 0,046	€ 0,053

Profiling Costs

If all the electricity produced can be directly and simultaneously used by the consumers, the cost price of production can be the same as the cost price of consumption. Unfortunately, the production profile of sustainable energy is never the same as the consumption profile and so the energy community will have to sell the surplus production and buy the shortage at another moment. We call this process profiling.

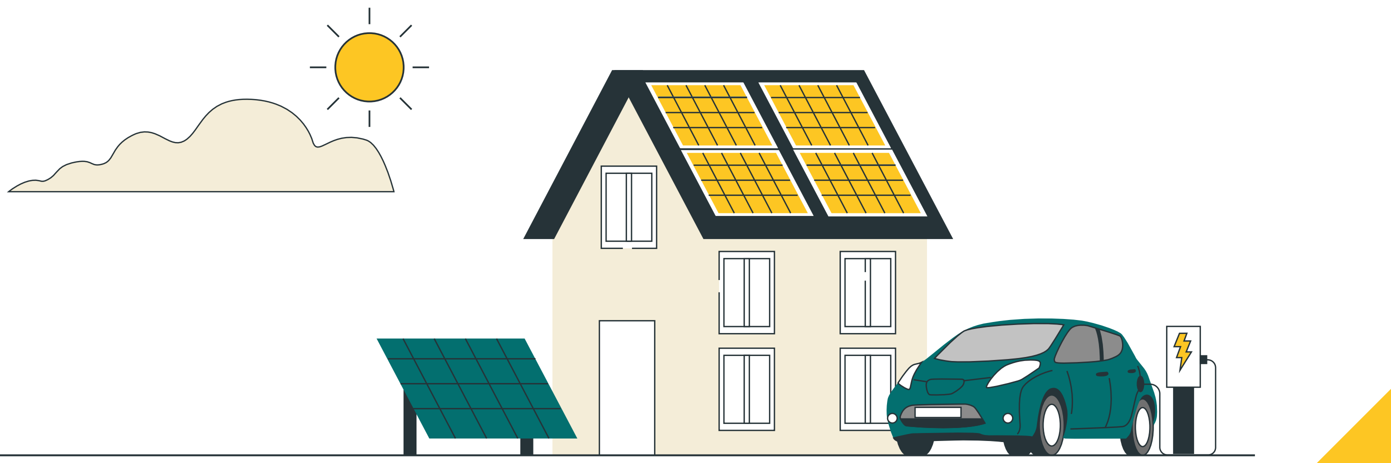
FIG 5: PROFILING COSTS



Because the price received for selling the produced electricity will most likely be lower than the price at which it is bought back to consume it, this whole market interaction will increase the costs for the energy community and therefore the final price of consumption. We call these costs the profiling costs.

The profiling costs are determined by the difference between the production profile and the consumption profile, and the price difference between buying and selling. In other words the market exposure and the market volatility.

To mitigate the risks of these profiling costs it is important to have a production profile that fits the consumption profile. A combination of wind and solar is therefore important. Energy storage or demand side flexibility can also mitigate this risk, but it is unrealistic to expect no profiling costs at all.



Calculation Example

The example from Figure 5: Profiling is put into a more elaborate calculation example in Table 3: Profiling costs calculation.

ENERGY COMMUNITY	VOLUME	PRICE	TOTAL
Total production	100	€ 63	€ 6.300
Sell	-40	€33	-€ 1.320
Buy	40	€ 120	-€ 1.320
Consumption	100	€ 98	€ 9.780
MARKET EXPOSURE	**VOLUME**	**PRICE**	**TOTAL**
Extra cost for indirect consumption	40	€ 87	€ 3.480
END USER	**VOLUME**	**TARIFF**	**TOTAL**
Direct consumption	60	€ 63	€ 3.780
Indirect consumption	40	€ 150	€ 6.000
Total consumption	100	€ 98	€ 9.780
PROFILING FACTORS			**FACTOR**
Profiling factor for indirect consumption	/	/	2,38
Profiling factor for single tariff	/	/	1,55

In Table 3: Profiling costs calculation we see:

- Total production of 100 MWh at a cost price of €63
- 40% market exposure (or 60% simultaneous usage)
- Sell 40 MWh at a price of €33
- Buy 40 MWh at a price of €120
- The extra costs for indirect consumption are therefore:
  €120 [buying] - €33 [selling] = €87
- The price of indirect consumption is therefore:
  €63 [cost price] + €87 [extra costs for indirect consumption] = €150
- The average price of consumption is:
  (€63*60%) + (€150*40%) = €98

Profiling Factors

The profiling factors are an indicator on how much the cost price is influenced by the profiling process. The factor for a single tariff is calculated by the relationship between the cost price and the price of consumption.

€98 [Consumption Price] **/ €63** [Cost Price] = **1,55** [Profile factor for indirect consumption]

In other words: the average price of consumption is about 1,5 times the cost price of production.

We can do the same if we use a double tariff structure:

€150 [Indirect Consumption Price] **/ €63** [Cost Price] = **2,38** [Profile factor for indirect consumption]

In other words: the price for indirect consumption is more than double the cost price of consumption.

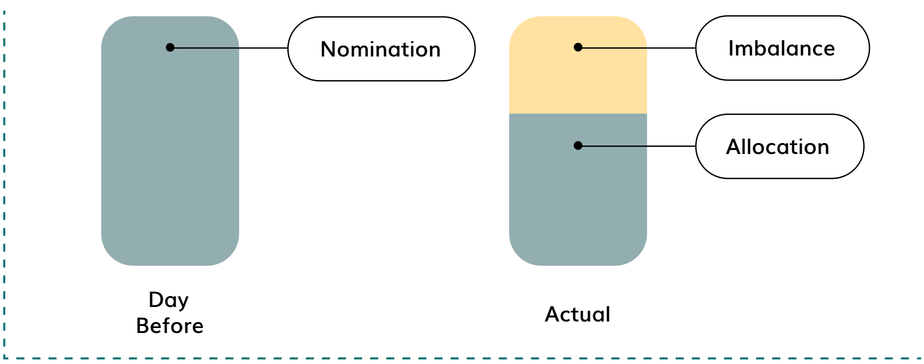
In a perfect world, where every kWh produced would also be simultaneously consumed, nothing more, nothing less, the cost price of production would be the same as the cost price of consumption and the profiling factor would be 1.

Balancing

All users with a grid connection have balance responsibility and need a Balance Responsible Party (BRP). In most cases, this market roll is organised by the supplier without the end-users even knowing of its existence. Yet, this roll is instrumental for the balancing and functioning of the electricity grid, especially in a unpredictable and volatile market. Also, there are risks and costs involved in the process of balancing that will impact the cost price of consumption.

A BRP has to nominate (forecast) the expected production/consumption per Imbalance Settlement Period (ISP) in their E-Programme to the Transmission System Operator (TSO) the day before its occurrence. This process is called nomination. The actual production is measured and allocated by the Distribution System Operators (DSO). This process is called allocation. The difference between the nomination and the allocation is the imbalance as shown in Figure 6.

FIG 6: BALANCING



The imbalance can be positive or negative and has to be bought or sold for the imbalance settlement price. The settlement price can also be positive or negative. A negative price means you will have to pay if you consume less than expected and have to sell on the imbalance market (and vice versa). It can also mean you will have to pay if you produce more than expected and sell on the imbalance market (and vice versa).

Sustainable production is difficult to predict (specially solar) and therefore the imbalance risk is high. Also, the imbalance settlement price has become very volatile increasing the risk even more.

The volatile imbalance market has also become a trigger for users and producers to use their flexibility to financially gain from the negative prices by creating imbalance on purpose. This has lead to rapid oscillations in the power grid forcing the TSO to delay its imbalance price signals.

The imbalance costs are therefore currently hard to determine. We estimate these costs at about 10% of the profiled price.

Large scale portfolio's, curtailment and load flexibility are measures that can be taken to mitigate the risks and lower the costs.

Service costs

The service of the energy service provider includes:

- Forecasting
- Energy Sharing (internal matching within the community)
- Balancing (BRP)
- Market access and trading
- Customer care & Billing

In this document we will not go further into detail about what these services entail.

The service costs of the energy service provider are estimated at around 1 ct/kWh and a fixed fee of €5 a month.

Pricing

Now we have all elements to determine the cost price of consumption:

- Cost price of production
- Profiling factor
- Imbalance factor
- Service fees

With these factors we can calculate a realistic average cost price of consumption. This can be used to compare the price with other offers in the marketplace.

SINGLE PRICE FORMAT		
Cost price of production	0,063	€/kWh
General profiling factor	1,55	/
Imbalance factor	1,1	/
ESP service fee	0,01	€/kWh
Cost price of consumption	0,12	€/kWh

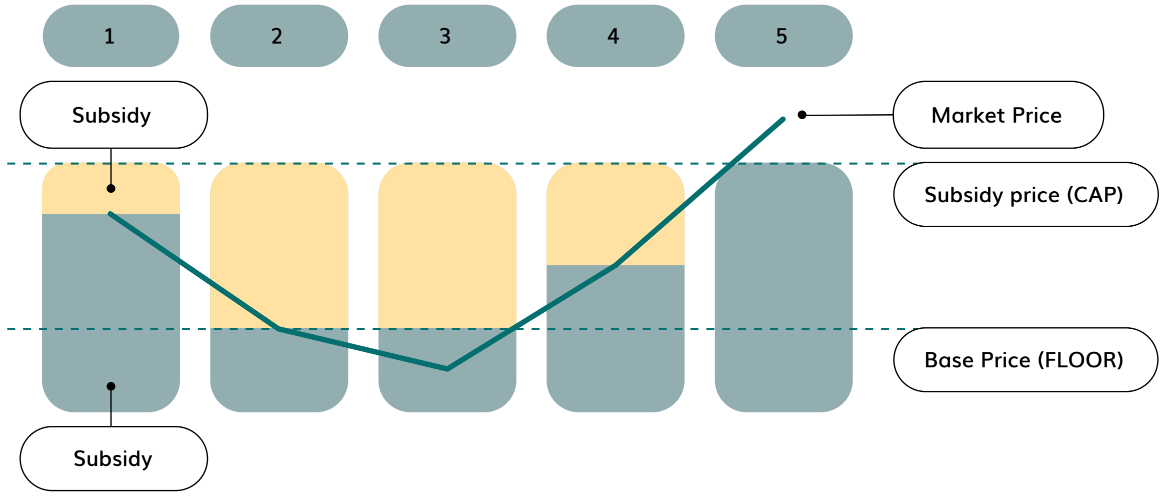
A single tariff for consumption does not incentivise direct use, and this is, of course, something that we should encourage. Therefore we can choose to use a double tariff. One for direct use and one for indirect use. Smart meter data can be used to determine per end-user when direct and indirect use occurs. All prices are excluded of Energy tax, VAT and network charges.

DUAL PRICE FORMAT	DIRECT USE	INDIRECT USE	
Cost price of production	0,063	0,063	€/kWh
Profiling factor for indirect consumption	/	2,38	/
Imbalance factor	1,1	1,1	/
ESP service fee	0,01	0,01	€/kWh
Cost price of consumption	0,079	0,175	€/kWh

SDE++ (Contract for Difference)

The previous calculations have been done with the assumption that there is no subsidy based on the actual market price, a so called contract for difference (CFD). In some countries the subsidy is a one way contract for difference that guarantees the difference between the subsidy price and the market price, in the case the market price is lower than the subsidy price.

FIG 7: ONE-SIDED COTRACT FOR DIFFERENCE



This subsidy mechanism creates a cost price of production that varies according to the market price as shown in Figure 7.

The subsidy has a cap and a floor: the cost price of production will stay between these two lines. So if the market price is lower than the floor (situation 3), the cost price of production remains at the price of the floor. If the market price is higher than the cap (situation 5), the cost price of production will not rise above it. This is the actual cost price of production.

Privately owned solar - prosumers

Until now we have not taken into account that end-users can have solar panels on their own roof (prosumers). In the Netherlands for example, more than 30% of households have solar panels (and this percentage will be higher with members of energy communities). Reason for this high adoption of solar panels has been the financially very attractive netting regulations for feed in of solar power. These regulations are problematic for the energy sharing concept because the price the energy community has to give the end-user for the power injected into the grid is much higher then its actual value or cost price. This netting scheme will end in 2027.

Without the netting scheme, it is possible to integrate privately owned solar into the energy sharing model. The most consistent method would be to determine a cost price for household solar power using a similar method as done for larger scale solar fields. The end-user then receives this cost price of production for every kWh that is injected into the grid. This guarantees the prosumer a reasonable return on its investment in the solar panels. Also, for all the electricity that is directly consumed within the building, the end-user does not have to pay taxes, adding to the individual business case.

From an energy community perspective the sum of all individual installations can be viewed as a collective installation. This also means less collective solar assets are needed in the portfolio to ensure a high direct use and low market exposure.

Proposition

This brings us to the proposition for the end users:

- Invest and receive locally produced sustainable energy at a cost price for 15 years (or more).
- The price of consumption is, at current market conditions, about 12 ct/kWh, which is a very reasonable price, compared to current market offers.
- Because 60% of production is directly consumed from the source at the cost price, the influence of external markets like the oil, gas or coal price is strongly reduced.
- The model and creates opportunities for democratizing the whole energy supply chain, from production to consumption. As a member you can be part of this process.
- Because the model covers the entire energy supply chain, adaptability to new market circumstances to reduce dependency, risk and lower costs is possible.
- The model is based on transparency and is non-commercial cost price driven.
- A fair price for a fair product.

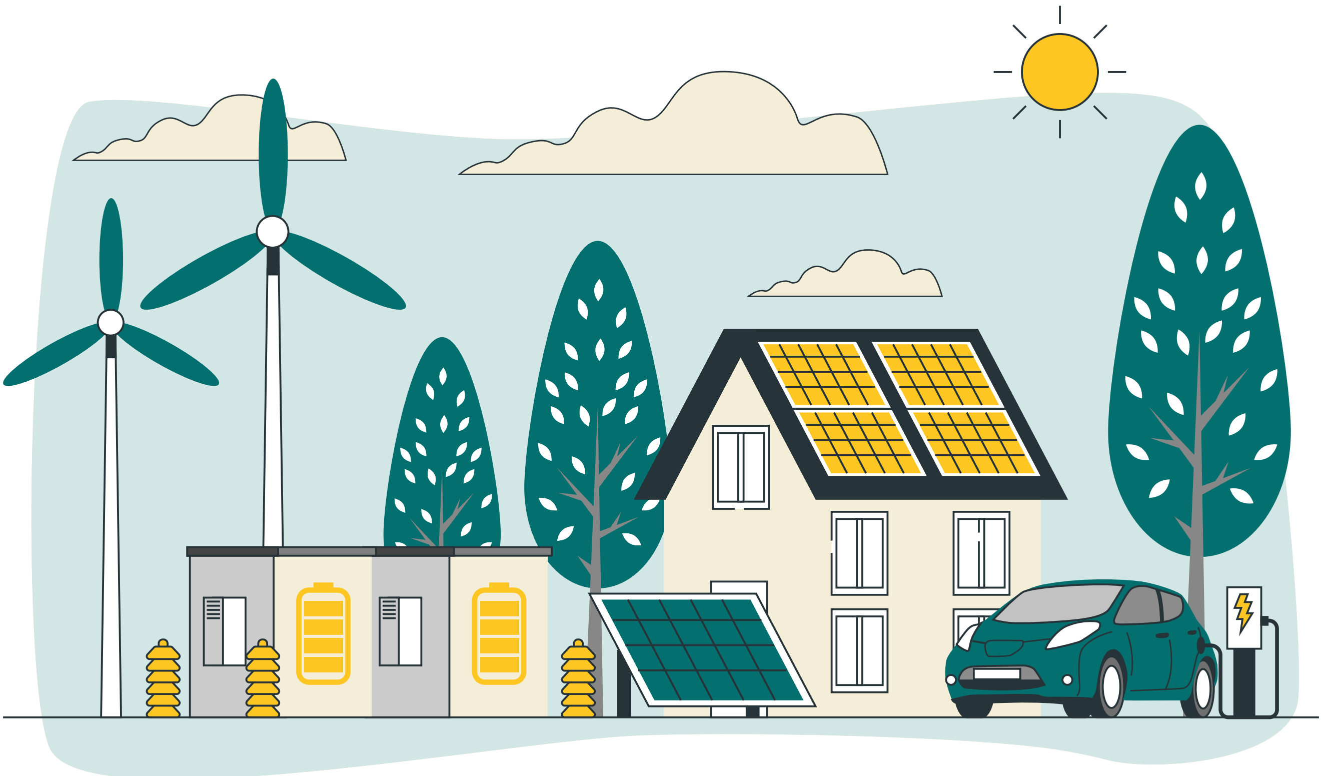
But is Energy Sharing cheaper?

It is difficult to compare the energy sharing model to the traditional market model in terms of price and risk. Will the cost price of consumption be lower than other commercial offers in the market place? Simulations of the past show that the energy sharing model would have led to a lower price than the market. This, however, is strongly influenced by the energy price crisis of 2022. To be able to answer this question for future scenario's we would have be know how the market will develop over time, which we can't. There are however some clues that indicate the energy sharing model will be lower priced and produce lower risk in the long run.

Because of its not-for-profit characteristics (as opposed to traditional market actors), it is to be expected that the cost price could therefore be lower in an energy sharing model than in a traditional market model. An energy community can choose to lengthen the exploitation period of its assets and as a result lower the cost price. A commercial player would probably use the extra exploitation period to increase its profits.

The energy price crisis of 2022 shows that the income for sustainable asset owners was much higher then it's cost price. In the energy sharing model, this would have resulted in a cap on the cost price, a commercial player would just increase its profits. We do not know when another energy price crisis will occur, but it is not unthinkable that it will.

The energy suppliers are being confronted with more risk, on both the production as the consumption side. This has to do with increased unpredictability of production and consumption profiles and higher volatility of markets. A commercial player has to increase the price to cover these risks but can also use it as a revenue model (like insurance companies do). In the energy sharing model, the energy community is directly exposed to the risks involved and has the chance and direct incentive to mitigate these collectively to keep the cost price of consumption low.



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4 The TANDEMS Project:

Encouraging the collaboration between municipalities and energy cooperatives for a just and accelerated energy transition

The TANDEMS project (2022-2025) aims to encourage the development of energy communities as vehicles for energy transition through including citizens in every step, engage local governments and policy makers to support and invest in these communities.

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