Ports Energy and Carbon Savings

Pilots and joint ventures to make the harbours of Hellevoetsluis sustainable

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1. Introduction

From 1 February 2014 to 31 July 2015 the municipality of Hellevoetsluis participated in the Sustainable Ports cluster project (SuPorts) which was subsidised by the European Union. Following the SuPorts cluster project a strategic sustainability vision was drawn up for the port area of Hellevoetsluis.

The Ports Energy and Carbon Savings (PECS) / Sustainability Impulse project for the port area of Hellevoetsluis is a follow-up to the SuPorts cluster project and aligns with the objectives of the strategic sustainability vision for the port area to expand the sustainability of the harbours. This report sets out the conclusions of the study which was conducted into the possibilities of cooperation between the port stakeholders and describes the pilots which will be implemented to test, demonstrate and validate small-scale sustainable energy technologies.

1.1. PECS / Sustainability Impulse for the port area

1.1.1. Objectives

The overarching objective of the project is the development, testing, validation and demonstrating of various methods, instruments and concepts of proven and innovative applications for energy-efficient, cost-related renewable energy sources and energy storage. This is to reduce CO_2 emissions in small and medium-sized ports.

The long-term objective (2040) is the realising of an energy-neutral port in Hellevoetsluis. The short-term objective (2020) is for 10% of the energy consumption in the port to be sustainably generated.

Within the SuPorts cluster projects, ten port-related organisations (water sports associations, commercial harbours, businesses) were visited for a sustainability scan. The PECS / Sustainability Impulse for Ports follow-up project furthermore studied what options there are for making the harbours more sustainable and pilots were started.

1.1.2. Activities

The most important activities within the PECS project are:

- Development and validation of four instruments in the area of energy saving and sustainable energy, inter alia an energy audit. Study of the options for an energy corporation.
- Conducting of feasibility studies for specific sustainable energy options, inter alia small wind turbines, solar panels in the outside space and energy storage.
- Realisation of investments in the area of sustainable energy. Inter alia solar panels in the outside space of Heliushaven, small wind turbines in Koopvaardijhaven and Heliushaven and trialling an energy pontoon.
- Giving demonstrations relating to the implemented technologies and other communication and monitoring of the pilots.

A stakeholder analysis was carried out in a prior report in which the various stakeholders of the port area were charted and an analysis was made of the energy consumption and production in the port area. The underlying report describes the pilots which are being carried out and the joint ventures which have been realised or are in preparation (activities 3 and 4 from the above list). Lastly, this report presents the conclusions of the study which was conducted into the options for an energy corporation.

2. The port area of Hellevoetsluis

The port area of Hellevoetsluis consists of four harbours: Veerhaven, Kanaalhaven, Vestinghaven and Heliushaven. Two commercial ports and four water sports associations are active in the port area. In addition, there are water sports-related activities. Lastly, part of the port area is owned by the municipality of Hellevoetsluis. The port area can be seen in Figure 1.

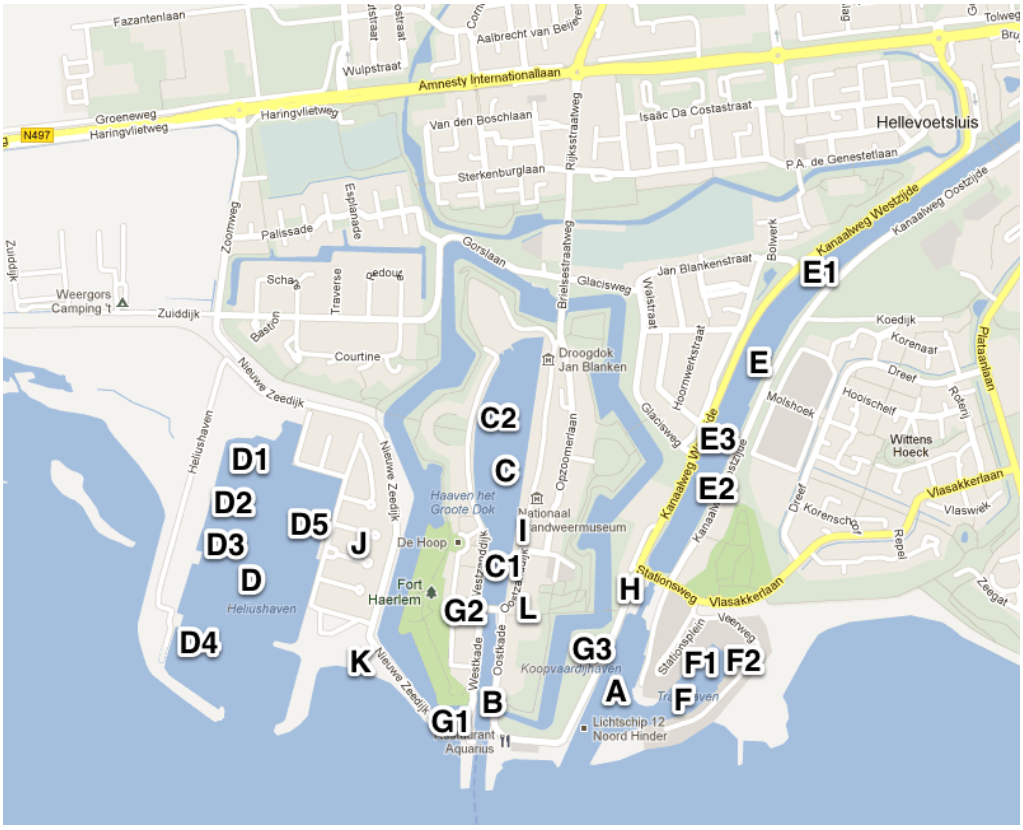


Figure 1: The port area of Hellevoetsluis

2.1. Veerhaven

Veerhaven is a port on the east side of the city with a water sports service centre (F1 and F2) under construction with two existing companies: Yagra Yachtservice and repair and Ceilidh Composite Technologies BV (mast builder). See also photo 1 of Annex 1. Housing construction and expansion of the water sports service is also planned for the location. At this time the body of water is still owned by the municipality. A transfer of part of this body of water to the businesses in the Veerhaven is currently being prepared.

2.2. Kanaalhaven

2.2.1. Koopvaardijhaven (A)

Koopvaardijhaven is a communal harbour with 20 berths for passing vessels and charter ships. This is also where the harbour master's office of the municipality of Hellevoetsluis with a bridge and a sluice (H) is located and a building with toilets and shower areas (G3).

2.2.1. Kanaal door Voorne (E)

The yacht harbour capacity is set up in the former Kanaal door Voorne, with 400 berths and 3 water sports associations (WSV Waterman, WSV Hellevoetsluis, WSV Haringvliet), as well as 5 houseboats.

2.3. Vestinghaven

The Vestinghaven is in the old centre of Hellevoetsluis, "De Vesting" (the Fortress). People live in De Vesting and businesses are run there such as restaurants and small-scale retail trade. De Vesting is a protected urban landscape which entails restrictions for sustainable energy generation like solar panels and small windmills.

2.3.1. Haaven (B)

Communal harbour outside of the bridge with 100 berths for passing vessels, also entrance to Groote Dok via a sluice (not in use) and a historical swing bridge. There is a harbour master's office for operating the sluice and bridge (G2) and a shower and toilet block (G1).

2.3.1. Groote Dok (C)

Harbour of the municipality of Hellevoetsluis with 75 fixed berths and mooring for passing vessels (C1). In addition there is a commercial harbour, Marina Hellevoetsluis (shareholders) with 325 fixed berths and mooring for passing vessels (C2). Entrance to the historical drydock "Jan Blanken" and visitor's centre and work place (leased by the municipality to the drydock foundation). Recently the Museumkade (museum quay) was set up with historical ships like "de Buffel" (run by a foundation), the lightship Noordhinder (run by a foundation) and the Bernisse (run by a foundation).

2.4. Stakeholders

Primary stakeholders	Secondary stakeholders
• Municipality of Hellevoetsluis • Watersportvereniging Haringvliet • Watersportvereniging Helius • Watersportvereniging Hellevoetsluis • Watersportvereniging Waterman – Hellevoet • Stichting Watersportcentrum Hellevoetsluis • Marina Cape Helius • Marina Hellevoetsluis • Yagra • Ceilidth • Marcel Marine Service	• Rijkswaterstaat • Natuurmonumenten. • Waterschap Hollandse Delta • Staatsbosbeheer. • Recreatieschap Voorne-Putten • Zeilschool de Zuidwester • Stichting droogdok Jan Blanken • Restaurant and retail trade in De Vesting • Residents of Hellevoetsluis • Hiswa • Nature and environmental organisations • Regional municipalities • Restaurants and retail trade in De Vesting • Residents of De Vesting • Energiecorporatie Voorne-Putten • European partners in PEC

3. Analysis of energy consumption and production

This chapter describes the most important characteristics of the participants and gives an interim update on the implementation of sustainable measures since the sustainability scan. For previously implemented measures reference is made to the reports of the sustainability scans. For the measures implemented in the past year and the ongoing pilots, reference is made to Chapter 5.

3.1. Water sports associations

Association	Characteristics	Actions taken
Watersportvereniging Helius*	Based in Heliushaven. Room for approx. 300 boats (of which 260 in the water). Has a public restaurant.	All lighting replaced by led. Kitchen renovated, including new low-consumption equipment (part of which is still on gas). Pipes insulated.
Watersportvereniging Hellevoetsluis*	Based in Heliushaven, second location in Het Kanaal. Room for approx. 300 boats (of which 240 in the water). Sailing association leases the canteen.	All outside lighting (2000 Watts) changed to led (300 Watts). Switches for canteen spotlights modified. Southern wall insulated. Radiators cleared. Pipes insulated.
Watersportvereniging Haringvliet*	Based in Heliushaven, second location in Het Kanaal. Room for approx. 300 boats (of which 250 in the water). In possession of Blue Flag (environmental award). No canteen.	Outside lighting changed to led. Boiler temperature reduced. Pipes insulated.
Watersportvereniging Waterman	Based in Het Kanaal. 90 berths. No catering facilities. The building (partly) belongs to the municipality.	The association itself has a limited influence. Measures are only possible in cooperation with the municipality.

* These 3 associations are all in the Heliushaven. Energy is purchased collectively via the joint foundation Stichting Watersport Centrum Hellevoetsluis.

The 3 water sports associations in the Heliushaven together consume approx. 212,000 kWh and 18,000 m^3 gas per year. The consumption was virtually the same in 2016 and 2017.

WSW Waterman consumes approx. 6,000 kWh and 2,000 m^3 gas per year. The consumption for 2017 is not known.

The energy consumption of the water sports associations causes an emission of 180 tons of CO_2 per year.

3.2. Commercial yacht harbours

Yacht harbour	Characteristics	Actions taken
Marina Cape Helius	Based on the opposite side of Heliushaven, next to Roompot holiday park Cape Helius. The land belongs to Roompot. Approx. 300 berths. Residence above the premises. In possession of Blue Flag (environmental award). No catering facilities.	Had already done a lot before the sustainability scan, after scan executed a number of quick-wins and requested offer for floating solar panels.
Marina Hellevoetsluis	Based in De Vesting. Approx. 225 berths. Harbour master's office and shower building are at some distance from berths, wish to place a new harbour master's office on/by the water. No catering facilities.	Had already done a lot before the sustainability scan, particular opportunities in connection with realising new harbour master's office.

Marina Cape Helius consumed 124,000 kWh and 2,435 m^3 gas in 2016. The electricity consumption increased in 2017 to 127,000 kWh. The gas consumption in 2017 is not known. CO_2 emissions are approx. 86 tons.

The consumption of Marina Hellevoetsluis for 2016 is not known, in 2017 the consumption was 112,000 kWh. There is only data for the gas consumption for 2015, this was approx. 6,000 m^3 gas. CO_2 emissions are approx. 84 tons.

3.3. Municipal harbours

Location	Characteristics	Actions taken
Operating building at sluice	A shower block is also near by. 65 fixed berths. Poorly insulated building.	Trial with small Archimedes wind turbine. Did not provide a lot of electricity and fell and broke because it was not properly affixed.
Operating building at Vesting bridge	Situated in De Vestiging and consequently subject to restrictions, including a prohibition on solar panels.	None.

The energy consumption of the municipal harbours, including bridges, jetties and buildings was 119,000 kWh in 2016. In 2017 consumption fell to 100,000 kWh. It is unclear whether the figure over 2017 is complete, on virtually all connections consumption is lower without a clear explanation for this drop. That is why the consumption in 2016 has been used. The related CO_2 emissions are 77 tons of CO_2. The municipal harbours do not use gas.

3.4. Businesses in Veerhaven

Business	Characteristics	Actions taken
Ceilidh	Production of Carbon masts. New construction. Residence with the business and part of building is leased.	No gas connection, heating via 3 heat pumps, very well insulated, glass on south-facing. High roof is filled with solar panels, supplies the greater part of the energy requirements. Wants to become fully self-sufficient via electricity storage, busy with adjustments in the production process (working hours) to make this possible.
Yagra	Repair shipyard. An old shed and a new shed.	Not known which actions have been taken.
Marcel Marine Service	Provider of technical total solutions relating to motors, generators and the like for shipping and industry. Busy with new construction of a shed.	Shed (new construction) very well insulated and provided with floor heating. Not yet opted for heat pump (too expensive), but are prepared so that it can be easily installed later.

Ceilidh consumes 80,000 kWh per year. Ceilidh generates 36,400 kWh itself using solar panels. The remaining consumption is on balance 43,600 kWh per year. The related CO_2 emissions are 28 tons of CO_2.

Yagra's consumption is not known. Marcel Marine Service has not consumed any energy yet (at the new location), as the building is under construction.

3.5. Residents in De Vesting

All of the harbours are situated around and partly in De Vesting. Because of the protected urban landscape, it is difficult for residents of De Vesting to place solar panels, solar panels may in any event not be visible from the public road. This means that it will be difficult to generate sufficient sustainable electricity for consumption in De Vesting. The municipality is investigating the options of generating the electricity necessary for De Vesting just outside De Vesting, it is looking at the harbours in this respect.

According to Energie in Beeld, in 2017 approx. 1,369,000 kWh and 422,000 m^3 gas was consumed. This comes down to 1,477 tons of CO_2.

3.6. Workshop

On 20 November 2018 there was a workshop with the stakeholders in Droogdok Jan Blanken. During the meeting the possible pilots were discussed with the stakeholders. There was a discussion of collective purchase of solar panels for boats and trialling an energy ponton, the stakeholders had the opportunity to present views on the choice for small wind turbines and Coöperatieve Vereniging Voorne-Putten Energie (VPE) gave a presentation on the *Postcoderoosregeling* (a scheme set up by the Dutch government to encourage people within a specific post code area to join together to form a cooperative to generate their own energy, with tax incentives). The meeting led to the implementation of a number of pilots (see Chapter 4). The meeting report is attached as an annex.

4. Pilots being implemented

This chapter describes the pilots which are being implemented in the ports and the pilots which have been put on hold.

4.1. Solar panels on roofs

Watersportvereniging Hellevoetsluis has 40 solar panels (12 kWp) placed on a storage shed near the club building. The roof of the club building is unsuitable for large quantities of solar panels. With this they generate approx. 10,500 kWh per year, 20% of the total electricity consumption. Watersportvereniging Hellevoetsluis financed these solar panels itself.

Watersportvereniging Haringvliet has placed 54 solar panels (18 kWp) on the youth club in Heliushaven, here too the roof of the club building itself was unsuitable. In addition, 27 solar panels (9 kWp) have been placed on the building at the second location of Watersportvereniging Haringvliet, by Het Kanaal. This generates 15,600 kWh per year in the Heliushaven location (13% of the total electricity consumption) and 7,800 kWh in the Het Kanaal location (which generates the greater part of the consumption for that location). Watersportvereniging Haringvliet financed these solar panels itself.

Watersportvereniging Helius does not have a suitable roof for solar panels.

Through the PECS, Stimular supported the associations in applying for subsidies (EDS – Energy Savings and Sustainable Energy for Sports Accommodations) for the solar panels. Stimular also supported the associations in applying for and assessing offers. This guarantees the choice for high quality solar panels.

4.2. Pilot for floating solar panels at Marina Cape Helius

Marina Cape Helius has a small roof, which will only hold a limited number of solar panels. This roof can best be used for a number of PVT collectors or solar collectors. In order to generate its own electricity, it has been studied whether it is possible to place floating solar panels in the water. Solar panels on the water have a higher efficiency, due to reflection and cooling by water. In the meantime a tender has been put out, which was awarded to Sunfloat. Applications have been made for an environmental permit and a permit pursuant to the regulations for floating solar panels. As soon as the permits have been granted, the 80 solar panels (27.6 kWp) will be placed in the water. These will supply approx. 27,000 kWh per year (22% of the consumption of Marina Cape Helius). The yield will be carefully monitored, to get a picture of the actual yield of the floating solar panel installation.

4.3. Pilot small wind turbines

The municipality of Hellevoetsluis wants to trial small wind turbines. Harbours are often suitable locations for such trials, due to the good supply of wind. An earlier trial, by the municipal harbour at the sluice, with an Archimedes screw turbine, did not provide the desired result. That is why a new type of turbine is being trialled. Stimular has charted the various options, including the technical details and the advantages and disadvantages. These were discussed during a meeting in Droogdok Jan Blanken with the stakeholders in the ports. The stakeholders indicated a number of preferred models. A tender was put out, with the wish to be able to use several types. The tender showed, however, that only one type had a good price-quality ratio. The other types turned out to have unreasonably high costs compared to the expected yield. The choice was therefore for the Flower Turbine. The six Flower Turbines will be situated at the following locations:

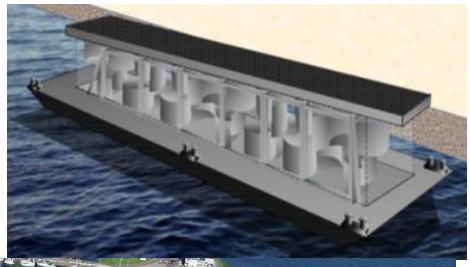
- 1 at Helius (at 5.9 metres on hill; 3kW at 13 m/s)
- 2 at Haringvliet (at 5.9 metres on container; 3 kW at 13 m/s)
- 3 at the Sluice (at 2 metres on 2-metre poles; 500W at 13 m/s)

The yield will be carefully monitored, in order to get a picture of the actual yield of the turbines. In addition, specific attention will be paid to the monitoring of nuisance aspects, like noise and visual aspects.

4.4. Energy storage

Ceilidh, a business located in the Veerhaven, already has solar panels on its roof. The company is studying the options for energy storage. The study has now been completed. The study showed that energy storage is not yet feasible at this time. This is not only due to the high costs but also because Ceilidh's electricity surplus is too low to make investments. Ceildh has itself indicated it will place more solar panels and will conduct further research into energy storage.

In addition, an energy pontoon will come to Hellevoetsluis with various combined technologies, including wind turbines, solar panels and energy storage. This pontoon will be placed temporarily as a trial by the supplier Blue Power Energy. This energy pontoon will be placed in the harbour of Marina Cape Helius (see figure below, blue circled area). The pontoon has an average production of 25 to 30 kW and a storage capacity of 37 kWh.



4.5. Collective purchase of Solar Panels on boats

A large part of the electricity is consumed on the jetties (jetty light, electricity for charging boat batteries). In most locations it is not known what the ratio is between building and jetties. Stimular estimates that for all yacht harbours together at least 60% of the electricity consumption takes place by the jetties. If we only look at the boats (battery charging) this comes down to at least 40% of the total consumption. This means that charging boat batteries is an important focal point in the push to make harbours sustainable.

Consumption by boats can be reduced if the boats are fitted with solar panels. That is why a collective purchase action has started in cooperation with all water sports associations and yacht harbours. The supplier was selected on the basis of price and quality of the solar panels offered, but also on the basis of its plan to support the communication relating to the purchase action. The best offer was made by Sailspecials, who works together with Sail & Solar. Together they supply solar panels for producer SUNBEAMsystem. They provided communication materials, which were shared with the boat owners via the water sports associations and yacht harbours. A well-attended information evening was organised, whereby the offer was explained. This resulted in approx. 65 people showing an interest in participating in the collective purchase. This was enough for a purchase discount of 15%. The interested persons do still actually have to make the definite purchase (there is thus still a chance that people will bail out).

4.6. Options which have been put on hold

There are two options which are deemed desirable by the municipality and at least one other organisation, but which cannot be implemented for the time being. This is particularly connected with the available financial means. These options may be implemented at a later stage.

- Putting a roof over the parking lot of WSV Helius with solar panels on the roof. WSV Helius does not have a suitable roof for solar panels and this would allow it to generate its own solar energy. However, the investment in putting up a roof would be high, a sturdy construction is necessary, and the regular costs of the solar panels would have to come on top of that. It has been considered to set this up in the form of an energy corporation, this did not result in a good business case (earn-back time around 15 years, so that on balance investors would earn nothing from their investment).
- PVT collectors heat water and generate electricity at the same time. In theory this system fits in well with water sports associations and yacht harbours, because a lot of showers are taken in the summer months. The hot water is thus generated at precisely the right time. These collectors are a big step toward making the accommodations natural gas-free, while directly generating electricity. WSV Haringvliet and WSV Hellevoetsluis are interested, but cannot afford the investment themselves at this time, and the municipality does not have room in the budget for this either. WSV Hellevoetsluis will have to replace its boiler in the near future, so it may choose this option. It will be given support by Stimular, which can help it assess the offers and apply for subsidies.

5. Study of options for an energy corporation

5.1. Background

The harbours are all situated around and partly in De Vesting. Because there is a protected urban landscape, it is difficult for residents of De Vesting to place solar panels: solar panels may in any event not be visible from the public road. This means that it will be difficult to generate sufficient sustainable electricity for consumption by the residents of De Vesting. The municipality is therefore considering generating the electricity required for De Vesting just outside of De Vesting, it is looking at the harbours in this respect. There are a number of large sheds situated in the harbours. The sheds do not consume a lot of energy. If the roofs are suitable and the owners are interested, these roofs could be used to generate sustainable electricity for the residents of De Vesting. They can then co-invest in the solar panels. This could take place in the form of an energy corporation.

5.2. Available roofs

No suitable roofs are available in the yacht harbours and at the water sports associations: the users need the roofs themselves to generate energy (and in part already do so, see Chapter 4). The most promising are the sheds in Veerhaven. Ceilidh has high energy consumption itself and already has solar panels on its own roof. Yagra and Marcel Marine Service have large roof surfaces and themselves consume little electricity (in view of the nature of the work, which particularly includes a lot of storage). These roofs offer a lot of scope for energy generation for the nearby De Vesting, where solar panels are not really an option. There has been discussion with the owners of the two companies.

Marcel Marine Service, which has just built a new shed, is not open to roof leasing via an energy corporation. This is because of the limited revenue which an energy corporation can offer (approx. € 1 per solar panel per year).

Yagra is open to roof leasing to a corporation. The owner wanted to make the large shed available. The roof construction was then reviewed: it turned out to be unsuitable for large numbers of solar panels. Yagra has plans for the construction of a new shed, in the middle of 2020. Yagra will include the wish to fill the roof with solar panels in the construction plans. This means that in 2020 there will probably be a possibility to set up an energy corporation. The corporation will place solar panels on Yagra's roof and the financing will be organised together with residents of De Vesting.

5.3. Coöperatieve Vereniging Voorne-Putten Energie (VPE)

An energy corporation is active on Voorne-Putten: Coöperatieve Vereniging Voorne-Putten Energie (VPE). The goal of VPE is to get a development going on the part of the residents and businesses on Voorne-Putten, which will make a contribution to a society on Voorne Putten in 2040 which is fully based on sustainable sources. At present the corporation has approx. 40 members. In 2020 the corporation will cover the roof of Sporthal Maaswijk (Spijkenisse) with solar panels, provided sufficient investors can be found. VPE would like to realise a comparable project in Hellevoetsluis. There are two options for financing, which are worked out below. No detailed calculation has been made: too little is known about the new shed and in a year there may be a lot of changes in the costs and yields of solar panels.

5.4. Energy corporation via post code cooperative scheme

5.4.1. Financial picture for investors

The Post Code Cooperative Scheme (official name of the arrangement: "*Regeling Verlaagd Tarief*" [Arrangement for Reduced Tariffs"]) entails that residents may co-invest in solar panels on a roof within their own post code area or an adjacent post code area. They invest by purchasing 'solar panel parts'. Residents who want to co-invest will become a member of VPE (membership costs € 20 per year). The costs of co-investing are € 300 per purchased solar panel part. An average household will pay for its own electricity consumption with approx. 10 solar panel

parts. If a resident (of an average household) purchases solar panel parts to pay for his/her household's own complete electricity consumption, this will cost approx. € 3,000.

In exchange for the solar panel parts the members are exempted from the energy tax which they pay for the electricity that they consume at home. This comes down to a discount of approx. € 0.11 per generated kWh on the energy bill (this is based on the number of solar panel parts purchased). (Based on the average household) approx. 2,700 kWh per year is generated with 10 solar panel parts. This gives the investor an advantage of € 297 per year. This means that the investment can be earned back in 11 years (taking account of costs of VPE membership). A post code cooperative scheme runs for 15 years. The return for the investor is the yield in the last 3 years.

5.4.1. Financial picture for roof owner

The margins are very limited within the post code cooperative scheme. There is therefore scope for approx. € 1 per solar panel which can be paid out for roof leasing. A roof with 500 solar panels will receive approx. € 500 per year in lease payment. The roof owner does not have to make investments him-/herself. Costs of insurance and the like are at the expense of the energy corporation. The roof lease is thus 100% profit for the roof owner. Participation will involve some time.

5.4.1. Financial picture for energy corporation

VPE is a corporation based on volunteers. There are no costs for manpower. Costs are made in the preparations, inter alia for studying roof construction, hire of conference rooms, production of communication materials. A contribution is requested from the municipality where a post code cooperative scheme is set up.

The investments are then collected from the residents joining in the investment scheme. The generated electricity is supplied to the grid. The energy corporation receives the (limited) proceeds. It pays the annual costs from those proceeds, such as insurance, maintenance, etc. An energy corporation is not a profit-making organisation and on balance does not earn anything from a project.

5.5. Energy corporation via SDE+

An alternative form of financing is applying for the SDE+ subsidy (Sustainable Energy Subsidy). This subsidy pays out a contribution per generated kWh for 15 years. Investors pay the same amount for solar panel parts. However, they do not get a discount on their energy bill, but receive a part of the electricity which is supplied back and part of the SDE+ subsidy from the corporation. For the rest the financial picture is similar to that of financing through the post code cooperative scheme.

5.6. Lessons learned

It has still not been possible to set up a pilot with an energy corporation. An important lesson is that many roofs are not suitable for solar panels. It is thus important at a very early stage to investigate the roof construction of a potential roof. This prevents unnecessary consultation and calculations afterwards.

The margins at an energy corporation are tight. The business case is just feasible, but if something goes wrong, the project will no longer be profitable. Consequently the contributions for roof leasing are on the low side. This is a barrier for roof owners to make their roof available. They foresee problems and participation takes time. That is why they believe the limited contribution for roof leasing does not make this worthwhile.