BISEPS

empower carbon reduction in business

Output O2.1
Set of Pilot Business Cases

Project No. 2S01-067

Dissemination level:		
PU	Public	
PP	Restricted to other programme participants	
CO	Restricted to members of the consortium	

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1. Introduction

The aim of the BISEPS-project is to create synergies between SMEs in order to unlock investments in sustainable energy.

The main target group of these business cases are business park managers and other parties that want to facilitate the creation of synergies, e.g. to create "local energy communities" with businesses in a business cluster. Thus, it is not about a business case for one energy technology for one business. Therefore, this business cases template can be filled in with examples with a perspective from an energy technology (e.g. heat exchange) to cooperation as a driver (e.g. BID).

In this document, the BISEPS-partners created summaries about the essentials and focus points to create business cases for synergies between businesses. It contains the dos and don'ts and the lessons learned from the living labs, written for the target group of this document.

Each summary describes the following dimensions of the pilot business cases:

- Introduction to the business cluster: the nature of the business cluster, the reason why this business cluster is interesting, its geographical location, a description of type of industrial / economic activities in the business cluster, the opportunities and threats to create sustainable energy synergies in the business cluster
- The technical case: what is technically feasible? Which technical solutions and concepts for sustainable energy are the options for this business cluster? Perhaps different scenarios were researched. Are there spatial consequences? What are the conclusions on energy and carbon reduction: the production, consumption, volumes, load profiles, exchange?
- The financial case: is it financially feasible - yes or no? What are the investment costs, the IRR or payback time, the subsidies and other incentives? Who will invest (funding arrangements, third party, etc.), and who gets the advantages?
- Policies, Legal context, organizational options. What are the relevant Energy strategies of city, region, country (per country) that affect this case? What are the legal solutions or frameworks that are used? What is the method to facilitate cooperation between businesses (SMEs)? What is the role(s) of SMEs, public authorities, grid owners, business park managers, BIDs, etc.? And what management of the solution will work.
- Contact information

Annexes are attached to this document. These are detailed technical studies, financial studies, legal studies, agreements, etc. Due to privacy reasons, some of these annexes are not available for the general public.

Information is partly based on feasibility studies and research, containing estimates and expectations based on the information that was available on the date of creation of this document.

The pilot business cases described tackle various issues, illustrated in the table below.

	Solar	Wind	Heat	Geothermal	Biomass & biofuel	Combined Heat & Power (CHP)	Electricity sharing & smart grids	Heat exchange	Energy storage	Energy cooperation models for business clusters
Auto-self consumption (F)	X						X			X
Collective self consumption (F)	X						X			X
Direct electricity line between 2 SMEs (B)	X						X			
Smart grid on Business Park (B)							X			X
Heat from biomass power plant for business cluster (B)			X		X			X		X
Heat exchange on business park level (B)						X		X		
Heat exchange between SMEs (B)						X		X		
Manor Royal Cluster 1, 2, and 3 (UK)	X					X				
Solar PV for business park (B)	X									
Solar carpark	X								X	
Doornbos Breda (NL)	X									X
3-BO Breda	X	X							X	X
Manor Royal Cluster 5 (UK)	X			X						

The business cases in the 5 living labs originally target the involvement of 50 companies, to identify €15.000.000 of investments and a carbon reduction of 4.000 tCO2 per year. In reality, the figures proved to be much better. In total, the business cases identified (see table below):

- 742 companies
- €59,143,395 investments
- 63,561 tons of CO2 reduction

	Number of companies involved	Investements identified (€)	Tons of carbon reduction (tCO2)
Auto-self consumption (F)	5	125,000	7
Collective self consumption (F)	24	/	553
Direct electricity line between 2 SMEs (B)	2	1,100,000	218
Smart grid on Business Park (B)	6	/	7,765
Heat from biomass power plant for business cluster (B)	13	11,150,000	39,139
Heat exchange on business park level (B)	6	1,147,000	380
Heat exchange between SMEs (B)	9	1,056,000	219
Manor Royal Cluster 1, 2, and 3 (UK)	23	11,259,000	5,969
Solar PV for business park (B)	53	20,730,000	9,036
Solar carpark	2	840,000	116
Doornbos Breda (NL)	39	85,000	39
3-BO Breda	500	12,700,000	23,220
Manor Royal Cluster 5 (UK)	60	345,000	120
TOTAL	742	59,143,395	63,561

2. Electricity sharing & smart grids

Electricity sharing is a key concept for creating energetic synergies between different SMEs in a business park. The legal options for electricity sharing in the 4 countries of the 2-Seas region are limited and varied. BISEPS-partners experimented with the options of electricity sharing.

2.1 Auto-self collective consumption (F)

Introduction

PV collective self-consumption has been allowed in France since September 2017. This law is still to be updated and that's why the French government needs feedback. The "Base 11 19" business cluster in Loos-en-Gohelle, north France, will be one of the first in this area where photovoltaic electricity sharing is tested. Below you can find the business case for this energy synergy and this business cluster.

Business cluster

The Base 11 19 business cluster is a former mining area. The public authority, Communauté d'Agglomération de Lens-Liévin (CALL), decided to convert the place around sustainable development. The CALL owns the building the businesses are paying rent. This is a small business cluster with 5 companies involved. At this scale we can test the new sustainable energy synergy laws for electricity sharing.

Geographical location

The Base 11 19 is located in Loos-en-Gohelle, 30 minutes from Lille.

Economic activities

5 companies are involved in the business cluster. The CERDD, around 10 people, the CD2E, 30 people, and the startup nursery are working weekly from 8am to 6pm. CPIE and Culture Commune, 10 people each, have the same kind of work regime plus the week-end. A restaurant will be involved is the project as well.

Opportunities and threats to create sustainable energy synergies in the business cluster

In France, PV electricity sharing is allowed since September 2017. This is a test law and the stakeholders of the business parks (including the CD2E) had the opportunity to be one of the first to test PV collective self-consumption.

Synergies will be created between the businesses involved by cumulating the consumption/load profile of the 5 companies of the loop and then spread the solar electricity between the companies.

The main technical challenge is the state of the grid. Enedis, the grid owner had to undertake a study to determine if the grid can support the maximum power injected.

The threat is the economic model which is still to be adjusted while in experimental operation.

Technical case

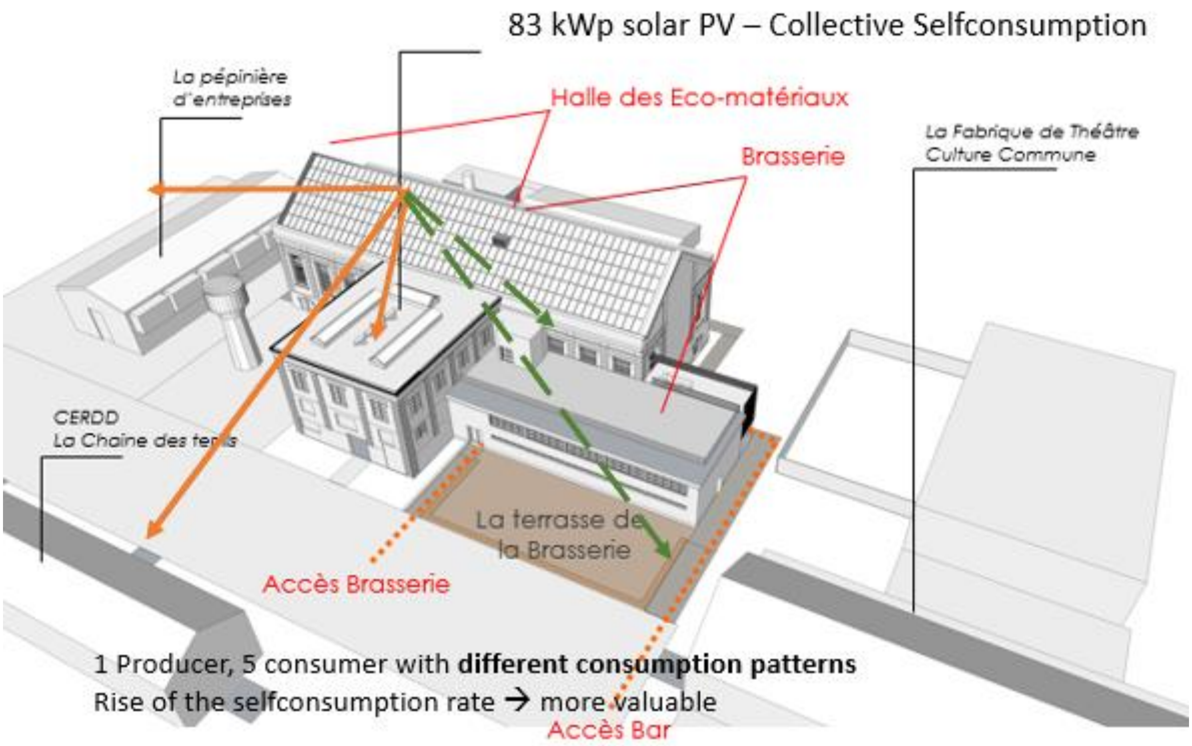
Technical solutions

Due to architectural constraints, all the roofs orientated south have to be filled with solar photovoltaic panels. The total power is 82 kWp.

This is monocrystalline solar panel with an efficiency of 18 %.

Each solar panel has a power of 295 Wp and a weight of 18 kg.

For self-consumption a study of the yearly, monthly, weekly, daily and hourly load profile of the businesses involved needed to be completed. ENEDIS put smart meters for each company of the loop to establish the load profiles.



Energy

CD2E studied the energy production and consumption based on both theoretical and real data. ENEDIS put smart meters in September 2018. The project studied the consumption data and load profile for each company involved during a usual week of November. This data was used to estimate consumption for one year.

Below you can find the load profile of 3 companies involved in the project during a week of November 2018 (Figure 1,2,3) and the aggregate load profile (Figure 4). These are based on the ENEDIS smart meters' data.

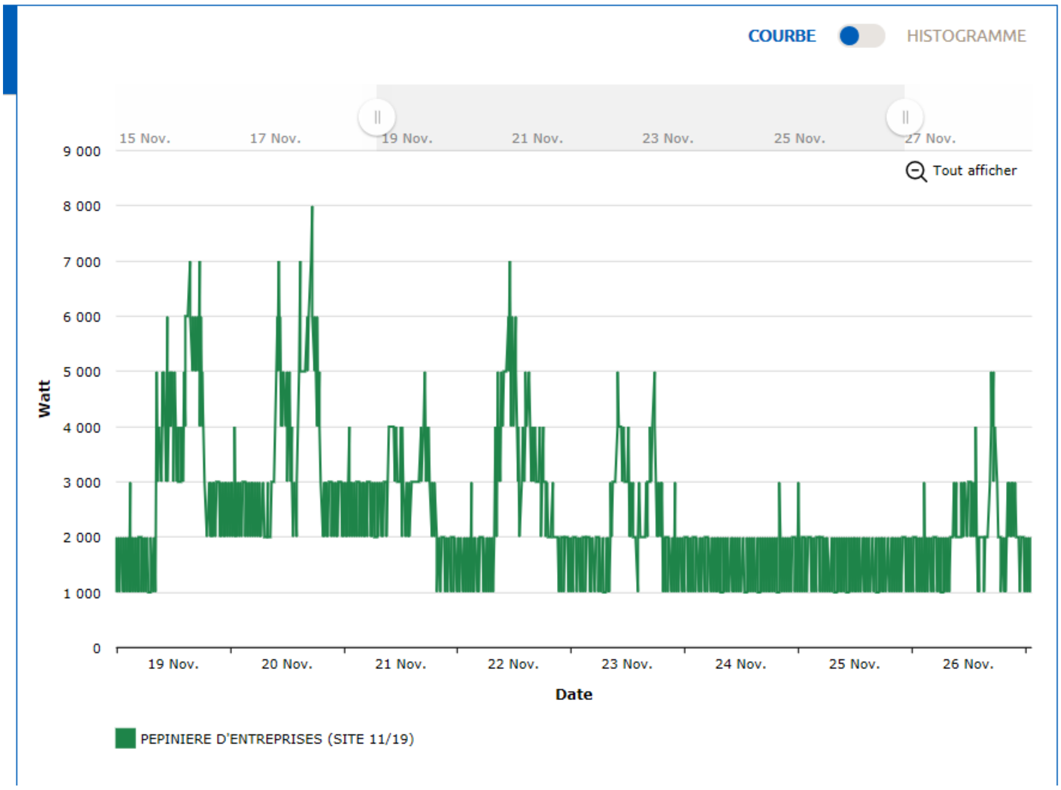


Figure 1

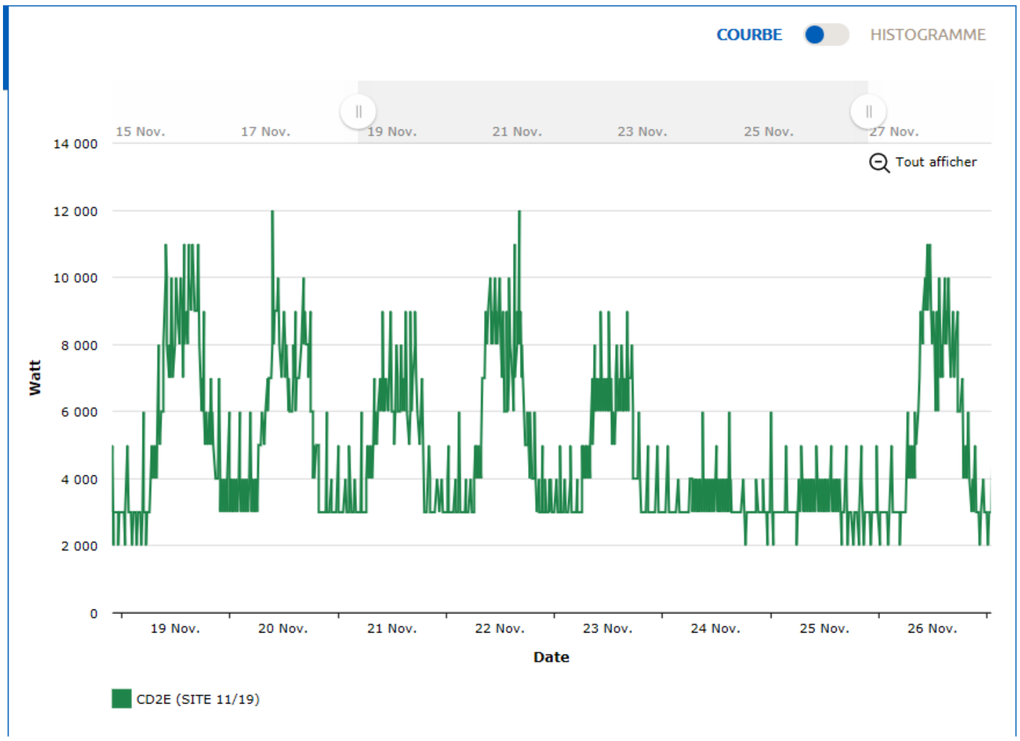


Figure 2

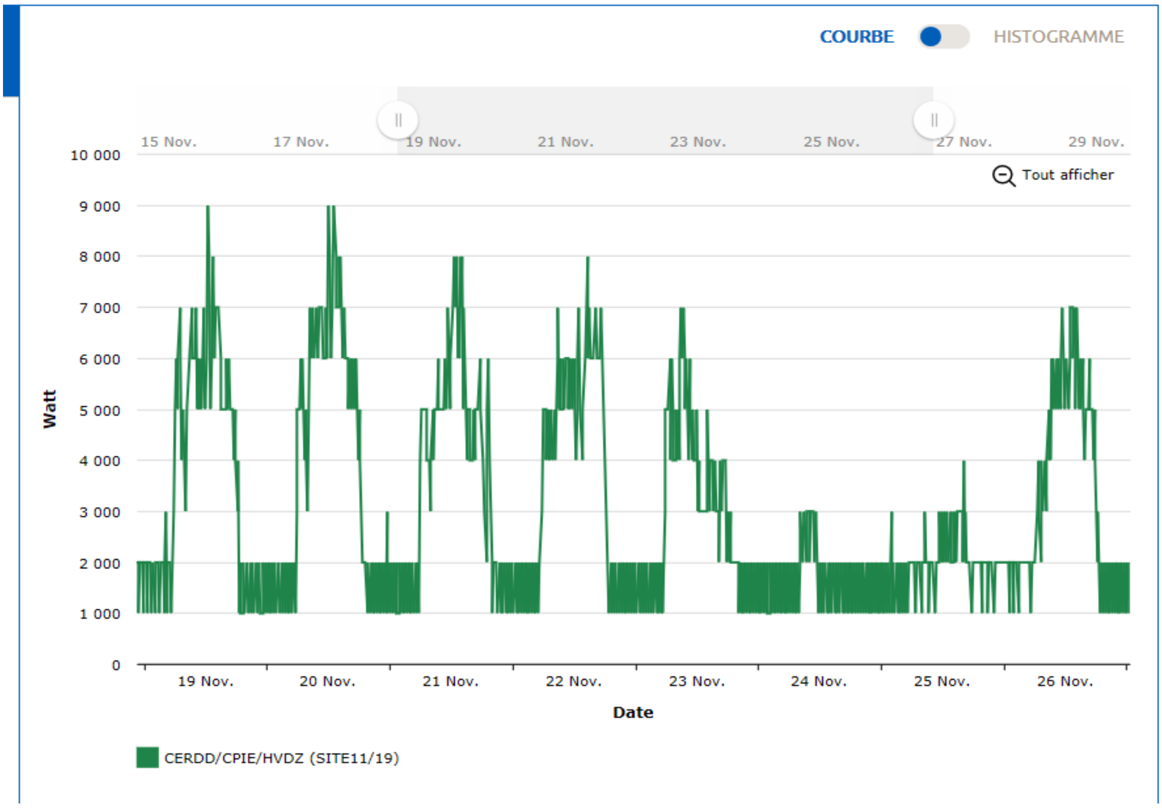


Figure 3

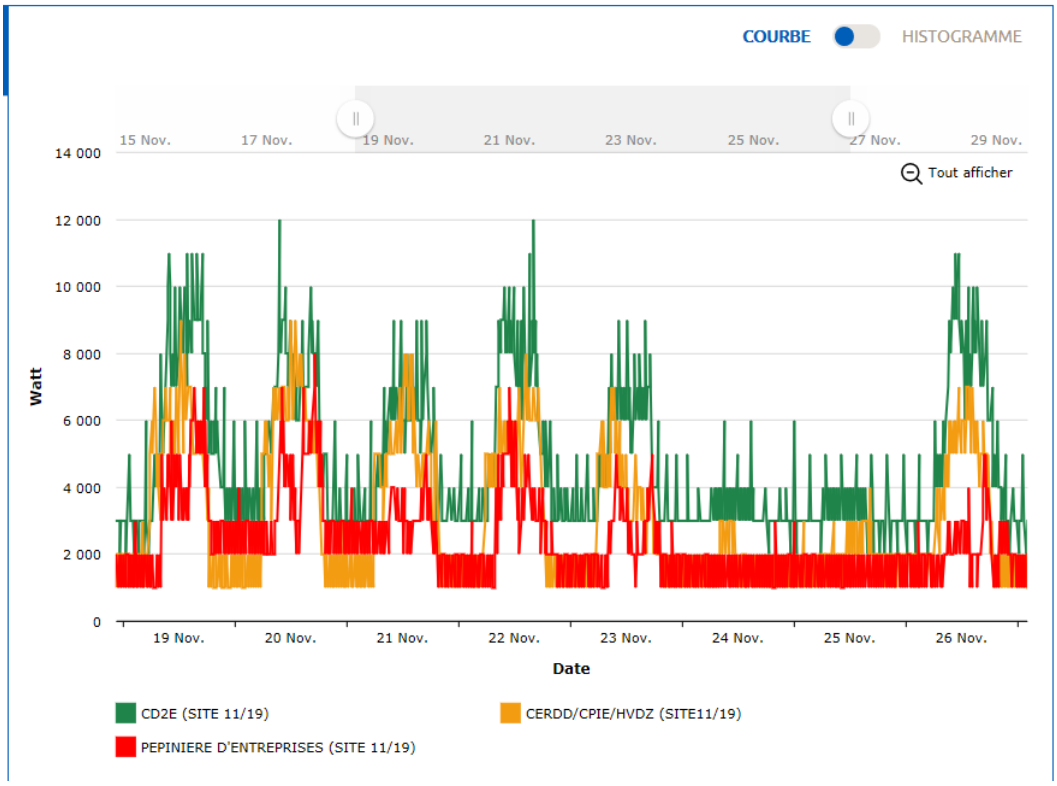


Figure 4

The aggregated load profile was compared and the solar production for a usual week of November (Figure 5) so that the estimate of global self-consumption rate for this week could be determined.

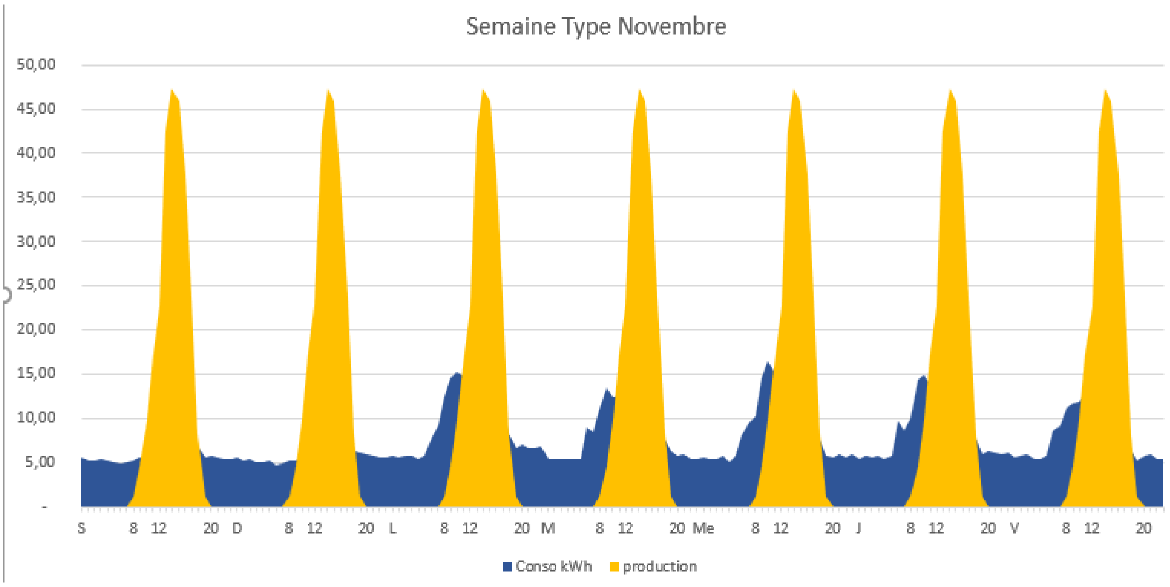


Figure 5

For a common week of November, the global self-consumption rate is up to **60 %**

Then, based on this assumption and extension of the real data, the self-consumption rate for a one-year period was estimated.

Aperçu du système

282 x Hanwha Q.Cells GmbH Q.PEAK BLK-G4.1 295 (12/2017) (Générateur photovoltaïque 1)
Azimut: 0 °, Inclinaison: 40 °, Type de montage: Intégré, Puissance de crête: 83,19 kWp

2 x STP 25000TL-30 **1 x STP 25000TL-30**

Données de configuration photovoltaïques

Nombre total de panneaux photovoltaïques:	282	Indice de performance*:	85,1 %
Puissance de crête:	83,19 kWp	Rendement énergétique spécifique*:	993 kWh/kWp
Nombre d'onduleurs photovoltaïques:	3	Pertes dans les lignes (en % de l'énergie photovoltaïque):	---
Puissance nominale AC de l'onduleur photovoltaïque:	75,00 kW	Charge déséquilibrée:	0,00 VA
Puissance active AC:	75,00 kW	Consommation d'énergie annuelle:	72 000 kWh
Rapport de puissance active:	90,2 %	Autoconsommation:	33 655,88 kWh
Rendement énergétique annuel*:	82 598,97 kWh	Taux d'autoconsommation:	40,7 %
Facteur d'util. de l'énergie:	100 %	Taux d'autosuffisance:	46,7 %

Figure 6

For a one-year period, the self-consumption rate is **41%.** You can see that the surplus (the energy we produce but we don't consume) is up to 49 000 kWh so one of the issues for the profitability of the project is to sell this electricity to a supplier. This still needs to be negotiated.

Carbon reduction

85 000kWh will be produced per year for a CO_2 reduction of 6.9 t per year.

Conclusions

Yes, this is technically feasible. The roof is well orientated, full south and the installation of solar panels is quite easy. The only barrier could be the state of the grid: if we have to improve it because of the power injected, it could put the project in danger.

Financial case

Financial, economic and commercial

The cost of the installation is 125 000 €.

The collective self-consumption is something new so this is really experimental in France. The economic model still needs to be defined. There is only one owner the local authority, CALL. The companies in the business clusters rent the building so it reduces the complexity of the project. The load profile of all the companies involved needs to be studied for a longer period and then improve the global self-consumption rate to be more valuable.

Below you can find the cost comparison between the project with and without PV installation (Figure 7) on a 20-year period

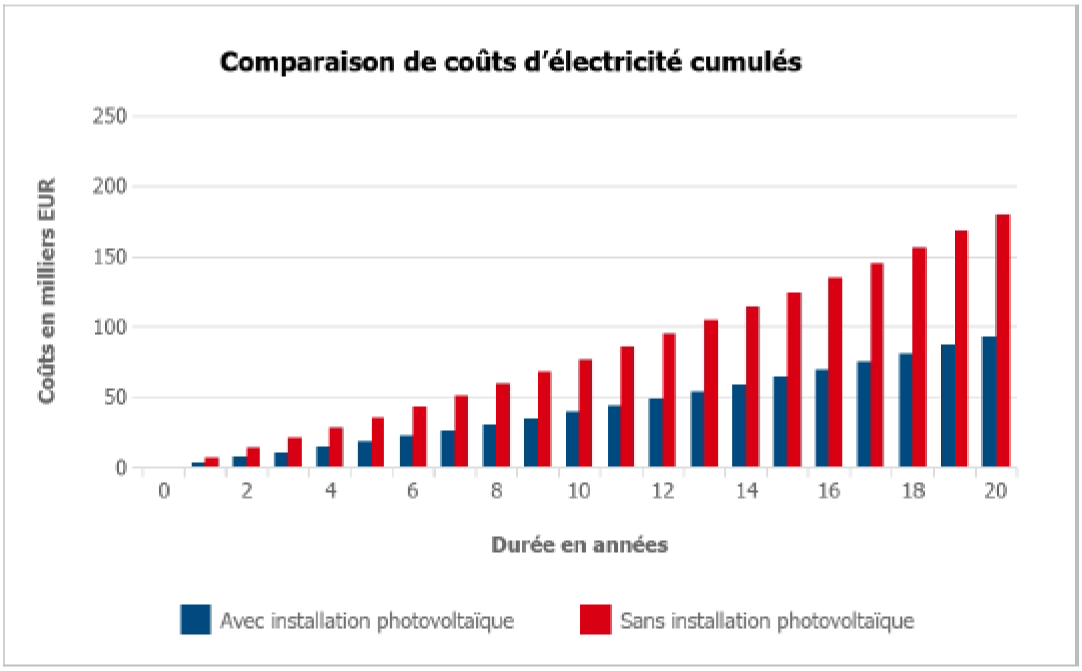


Figure 7

One of the major barriers is whether the surplus electricity can be sold or not. It is up to 49 000 kWh per year. This is in talks with a supplier.

Roles

The CALL is the only investor as the owner of the building. They are paying the electricity charge as well so they get the advantage. The 5 businesses involved rent the building.

Conclusions

This is financially feasible because the local authority is the only investor and they are not expecting a short return on investment. This is a test law and we are the “early bird” trial. The economic model of PV collective consumption will be adjusted afterwards. We are in talks with a supplier to sell to excess electricity and with local authorities to get a subsidy up to 30 % of the investment.

Policies, Legal context, organizational options

Collective self-consumption law

Law No. 2017/227 dated 24 February 2017 on self-consumption and Decree No. 2017-676 dated 28 April 2017 on self-consumption sets up a legal framework authorizing collective self-consumption. Recent developments in French regulations governing self-consumption will facilitate implementation and application of renewable energy production and consumption modes. Electricity self-consumption has been implemented in the France Energy Code (FEC). This sector should grow rapidly over the years, as the FEC allows for self-consumption on a personal scale, but also on a small collective scale. From now on, any electricity producer using renewables and/or co-generation methods (simultaneous production of two different types of energy) for less than 100kW, will be allowed to form local partnerships with other producers to share the energy produced and sell the surplus. Three conditions remain obligatory:

1. The stakeholders (energy producers and end users) are legally bonded together by a legal entity
2. Consumers and producers are fed by the same MV/LV substation
3. Each consumer and producer has a smart-meter

The energy market is evolving from a centralized production model to one that produces and consumes energy locally.

Conclusions applied on specific case

Looking at the three conditions for this case study:

- The CALL owns the building and pay the electricity fee so there is one legal person for the supply side and the consumer side – condition 1 is satisfied
- The 5 businesses involved are fed by the same MV/LV substation – condition 2 is satisfied
- ENEDIS, the grid owner put smart meters on each building involved – condition 3 is satisfied.

The case is feasible and allowed by the law. There is no legal risk, only economic risk.

Conclusion & Recommendations

The investment has been made and the works are ongoing. The installation of the solar photovoltaic panels is planned for the beginning of 2019. The CALL and the CD2E are studying the load profile of each company involved in the electricity sharing loop. By studying the load profile, there will be a defined global self-consumption rate and the economic model will be adjusted accordingly.

Contact

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Annexes

To be added

2.2 **Collective Electricity Self-consumption** (F)

Introduction

The Ravennes-les-Francs business park has 24 companies committed in a collective electricity self-consumption project. The considered renewable energy production focusses on photovoltaic and medium size wind energy. Two studies are currently in progress on possible renewable energy installation and the compliance with energy regulations.

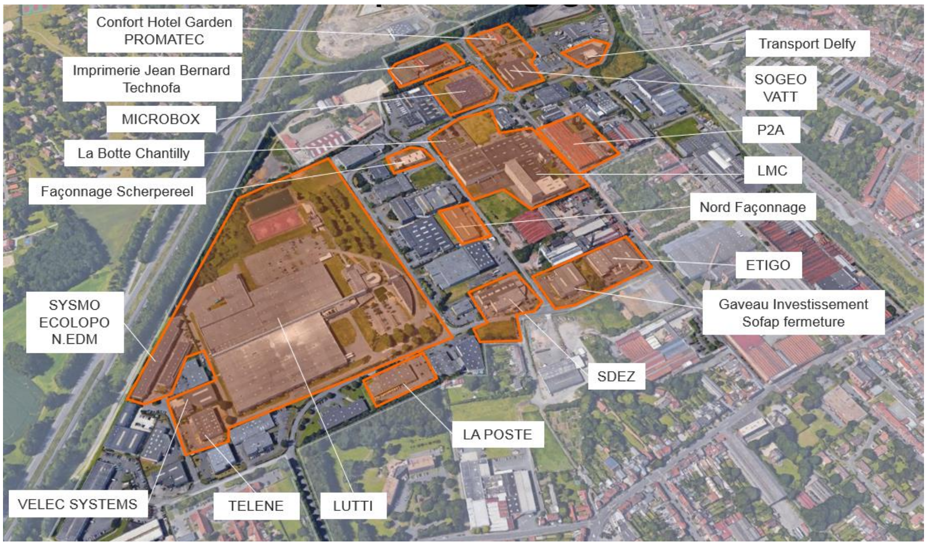
Although technical constraints still have to be raised, the BISEPS project major issue for this business case lies in legal and organizational aspects.

Business cluster

The Ravennes les Francs business park consists of around 120 companies spread over 80 sites. There are various activities, from industry to the tertiary sector, including a hotel, offices, post services and warehouses. An organization called ASL coordinates some of the park's companies. An operational wind-turbine is located in the middle of the park.

Geographical location

The business park is located between Tourcoing and Bondues, in the north of the Lille Metropole Area, France. 24 out of 120 companies have committed to the project.



Companies in BISEPS project – Ravennes-les-Francs Business Park

Economic activities

The company profiles in the park are highly diverse regarding both their size (from 1 to 400 employees) and their industry (offices, hotel, logistics, production activities, laundry, agrifood, chemistry, printing house). Working hours are mainly office hours, although some production companies have more extended time slots (2 or 3 shifts).

Opportunities and threats to create sustainable energy synergies in the business cluster

This project has several issues:

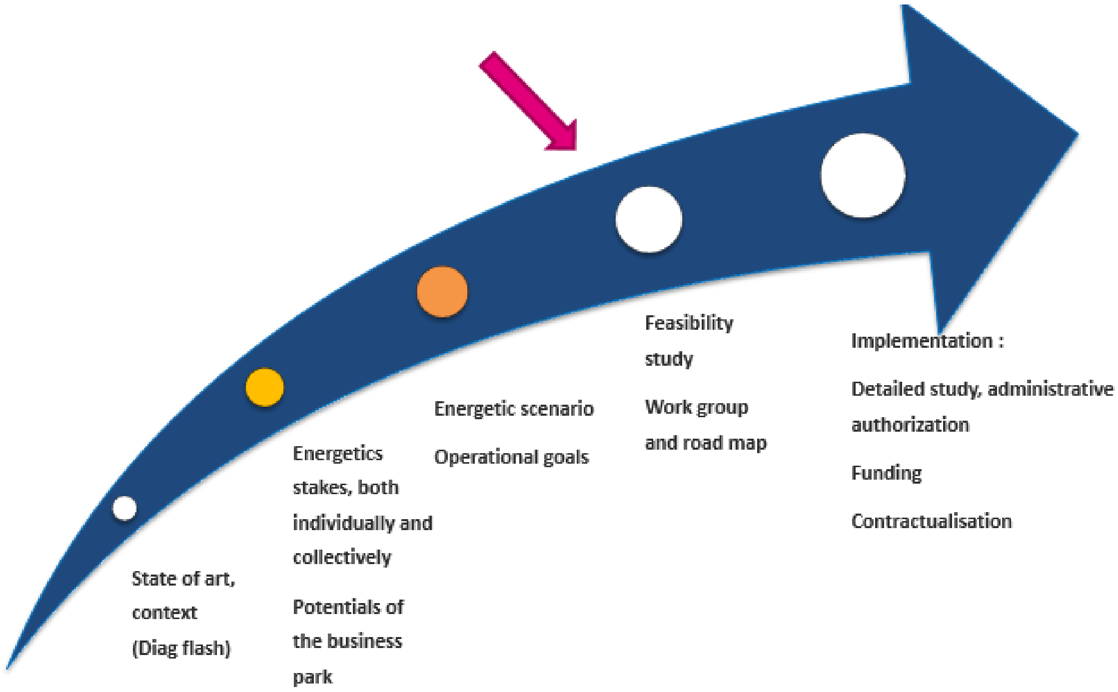
- Legal: this electricity sharing scheme between industrial consumers and producers still does not exist (no experienced feedback). The aim is the creation of an organisation or structure to manage relationships between each party (consumers, producers, financiers, and network manager), financial flows related to electricity sale, companies joining and leaving the electricity sharing scheme.
- Financial: what will be the most relevant financial package? According to companies, it will not be possible for all of them to invest in the project. The goal will be then to find a balance between a low price on electricity supply and a return on companies' capital investments.
- Regulatory: the collective self-consumption as defined in the law, does not allow all companies of the park within only one electricity exchange grid (presence of multiple separate loops). Considering future evolutions, the project objective could be the optimization of the production systems in order to be in compliance with regulation.

Technical case

Technical solutions

Current regulation allows the use of public electrical network for the implementation of collective self-consumption operation (limited to the consent of the transforming substation). As a consequence, only three types of technologies are considered:

- Solar photovoltaic on industrial buildings
- Solar photovoltaic in car-park shadow-houses and/or ground mounted solar power plant (on available lands)
- Medium wind turbine (large wind turbine cannot be implemented because of regulatory restrictions. Small wind turbine has a too low power to be appropriate)



Overview of the methodology implemented and current progress

Scenarios

Two scenarios were produced:

1. A reference scenario analysing consequences in financial terms for companies if they don't take care of their energy consumption/production
2. A scenario presenting maximum potential of renewable energy production and its impact in financial terms.

Current assumptions about energy price trends show a doubling of energy bills by 2030 if no action is undertaken. The implementation of renewable energy systems could enable the reduction of this increase by 40%. This would mean an increase of the bill by "only" 30% for companies by 2030.

At this stage it is not possible to determine accurate numbers of installed equipment and their power.

Spatial

The environmental consequences will be established within the framework of the study on wind energy.

Energy

Knowledge of energy consumption profiles of companies is too low. Only bigger companies have access to their load curve. Thus, to make up for this lack of data, a measurement campaign was carried out last summer in all companies of the project. This will enable the project to model each company's energy consumption.

At the same time, a study on potential photovoltaic and wind productions is in progress. So far, only ratios have been used in order to determine the production potential. However, a visit to each company is considered to refine the photovoltaic and wind potential (restrictions related to the structures of the building, state of the roof, available lands). The exchange of energy between companies is currently technically limited. Data presented below show the maximum potential photovoltaic production (constraints connected to the site are not taken into account) according to every collective self-consumption loop. Photovoltaic typologies are roof modules, (3,800 MWh/year) and ground level power plants (2,860 MWh/year).

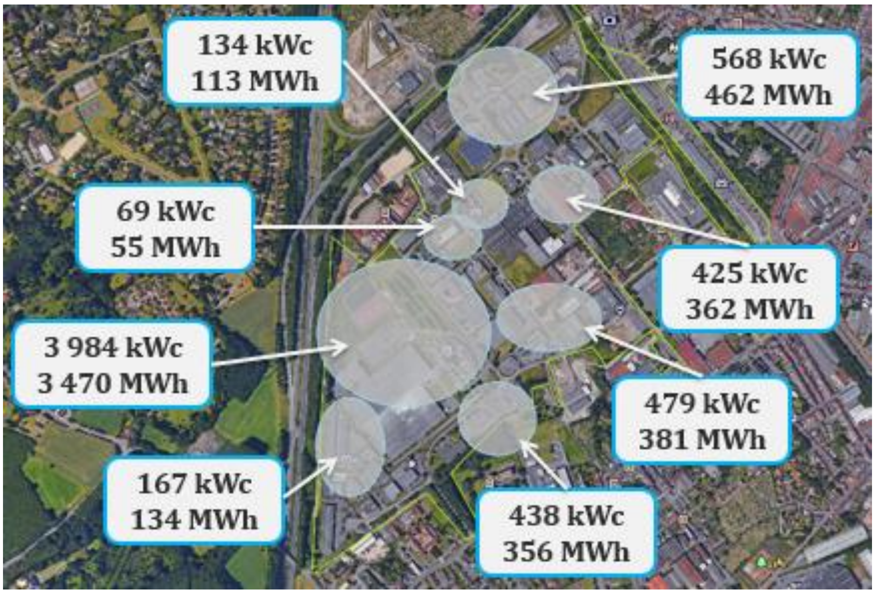
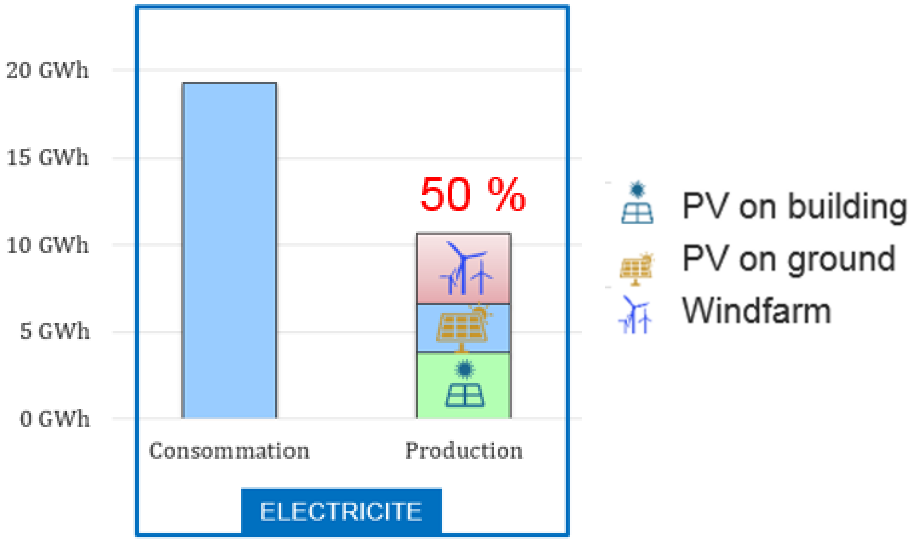


Figure : potential production of solar PV



Comparison between energy consumtion (blue) and potential energy production per source

Carbon reduction

The maximum potential production is 6,660 MWh/year in PV, which is a carbon reduction by 554 tCO_2/year (contenu carbone français : 0,084 $kgCO_2$/kWh, source : arrêté du 8 février 2012 relatif au diagnostic de performance énergétique[1])

Conclusions

The implementation of renewable production systems does not raise any technical obstacles, even if specific constraints related to production systems still remain to be analysed (building structure capacity, shadow).

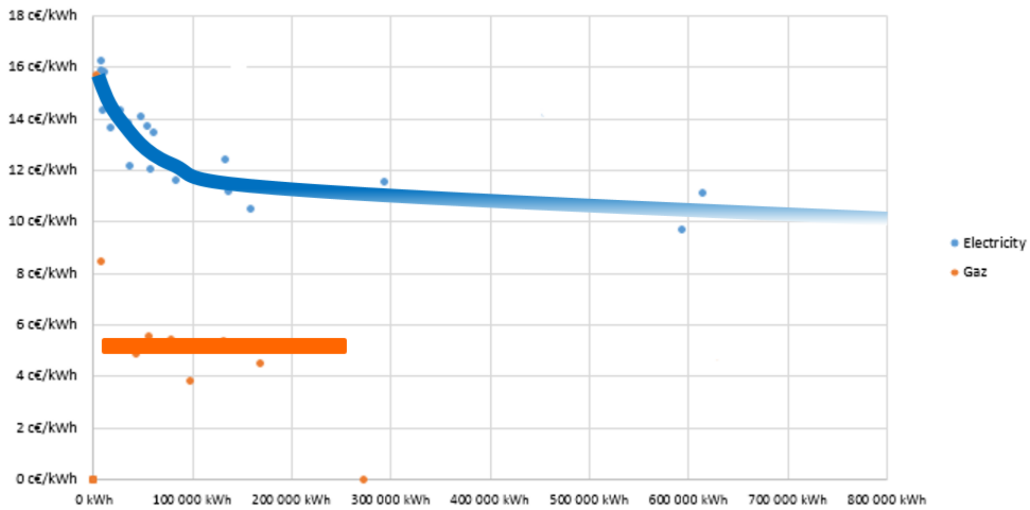
Financial case

Financial, economic and commercial

No detailed analysis has been made on an economic model. It will depend on the results of the technical studies in progress.

At the same time, project profitability depends on the individual profitability of each company. They have different energy prices, depending on their annual consumption, the subscribed power and their consumption profile. As a result, every company must have a financial interest in the project while keeping an overall economic balance.

[1] https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000025509925&categorieLien=id



Price for energy supply (ex. VAT) in relation with annual energy consumption

Roles

No decision on the economic model has been made yet. All solutions are still to be considered:

- Investment by consuming companies
- Call on third-party financiers
- Call on citizen investments

The economic objective has not been defined. The project can explore several models:

- Return on invested capitals by companies
- Production of the most competitive electricity possible

Conclusions

Economic feasibility of the model has not been proven yet, particularly with regards to diversity of present stakeholders (consumer of different size, producers, and investors).

Policies, Legal context, organizational options

Collective self-consumption law

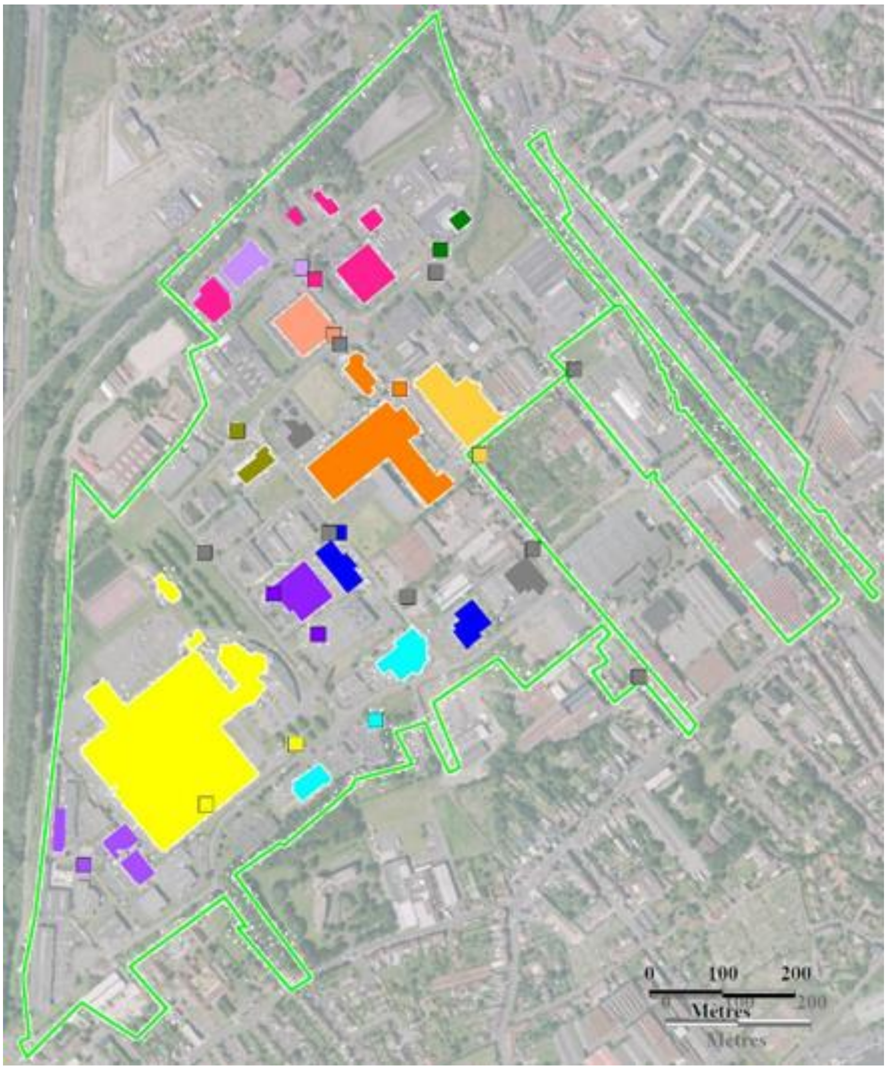
Law No. 2017/227 dated 24 February 2017 on self-consumption and Decree No. 2017-676 dated 28 April 2017 on self-consumption sets up a legal framework authorizing collective self-consumption. Recent developments in French regulations governing self-consumption will facilitate implementation and application of renewable energy production and consumption modes. Electricity self-consumption has been implemented in the France Energy Code (FEC). This sector should grow rapidly over the years, as the FEC allows for self-consumption on a personal scale, but also on a small collective scale. From now on, any electricity producer using renewables and/or co-generation methods (simultaneous production of two different types of energy) for less than 100kW, will be allowed to form local partnerships with other producers to share the energy produced and sell the surplus. Three conditions remain obligatory:

1. The stakeholders (energy producers and end users) are bound together by a legal entity
2. Consumers and producers are fed by the same MV/LV substation
3. Each consumer and producer has a smart-meter

The energy market is evolving from a centralized production model to one that produces and consumes energy locally.

Conclusions applied on specific case

The implementation of collective renewable energy production is possible on the Ravennes les Francs business park. However, regulatory restrictions on transforming substations impose the constitution of multiple consumers' loops. As a result, the BISEPS project in the Ravennes les Francs business park is not a single project but a great number of collective self-consumption loops, gathered within the same structure.



Consumers 'loops (one colour for each loop)

A legal entity must also be created in order to bring consumers and producers together in one place. There is no available experienced feedback at the moment on that kind of company, in particular regarding the involvement of businesses.

Conclusion & Recommendations

The implementation of collective self-consumption loops is subject to the will of companies and their consuming profile. Some businesses are already a driving-force and very interested by the project, although no economic model has been produced yet. However, the implementation of collective self-consumption loops, in a technical perspective, is not an obstacle for the project.

Potential production analyses and the consumption measurement campaign are in progress. A legal study will also be launched in early 2019 to define possible contracting options with companies and possible legal schemes.

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Annexes

To be added

2.3 Direct electricity line between 2 SMEs (B)

Introduction

The presented business case gives insight to the process of setting up a direct line (direct wire) between two companies and the barriers that need to be tackled.

The direct line will transport electricity produced by solar panels on the roof of one company to another company where the electricity will be used.

The main barrier is the legal context. The financial feasibility is essential for the companies to realize the business case or not.

As the study is still ongoing, the conclusions will be detailed later.

Business cluster

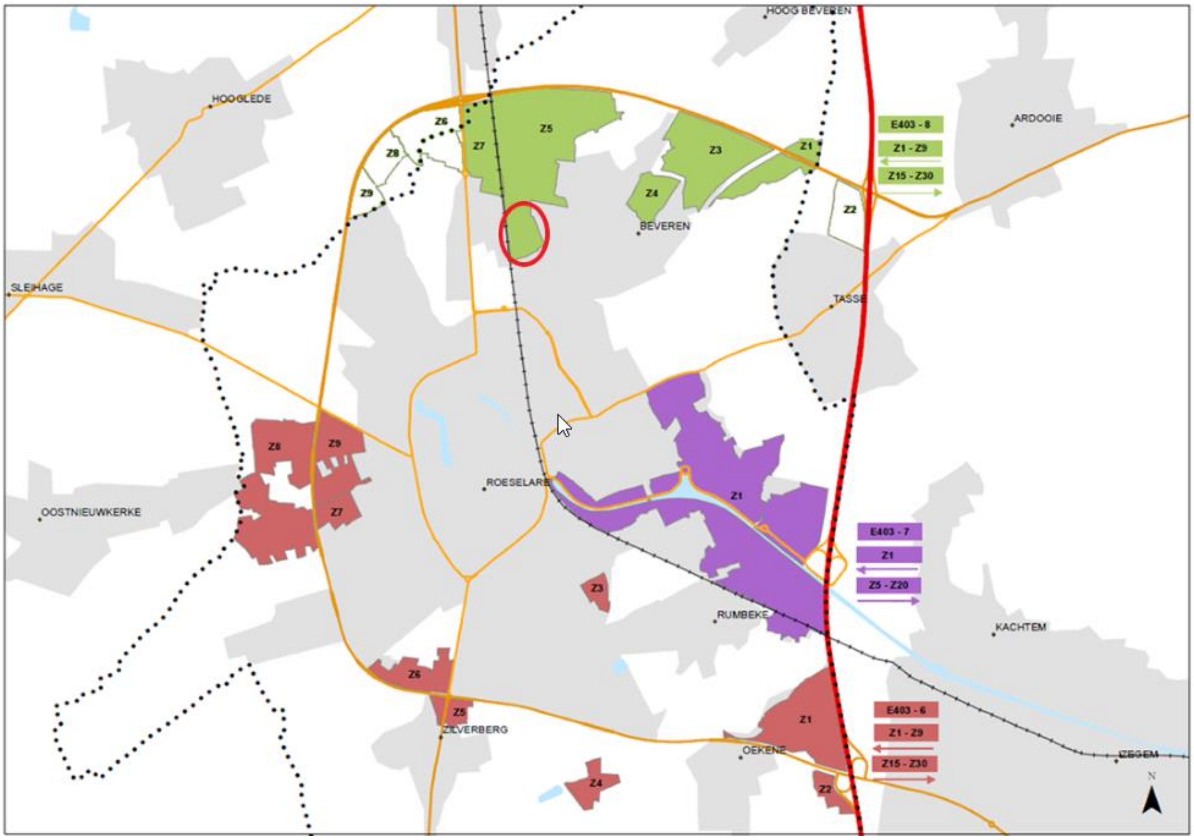
The business cluster consists of two companies. Company A has large roof space available and only limited electricity consumption. Company B has a large electricity use and is working 7 days a week 24h a day.

The roof space of company A can be used to install solar panels. A small part of the produced electricity will be used by the company itself. The remaining and largest part of the produced electricity will be used by company B. Company B will also let a third party install solar panels on their own roof.

Geographical location

Location living lab in West-Flanders, Belgium:

Location of business cluster in wider region:



Map of the business cluster:

Opportunities and threats to create sustainable energy synergies in the business cluster

The main challenge to tackle is the legal context. Until now the legislation in Belgium does not allow a direct line between two companies. This case is even more complicated as there is a street (public domain) situated in between the two companies.
In 2019, the legislation will change and direct lines will become legally possible. Some legal authorizations will still be required.

For a good cooperation between the companies, a legal contract will be made. In this contract all necessary items, including electricity price, assurance in case of roof damage, assurance in case of bankruptcy, contract duration, will be clarified.

Technical case

Technical solutions

The concept regarded in this business case is a 'direct line'. This is a line, not part of the electricity grid, which enables the transportation of electricity between two companies.

Company A will install solar panels (PV) on their roof and use one third of the electricity produced. The remaining electricity will be transported by the direct line to Company B. Company B has a large electricity use. Company B will also install solar panels on their own roof.

The case arose as Company A asked WVI to investigate this case.

The research happened by meeting the companies. The first meeting was attended by the two companies and WVI. The second meeting was attended by the two companies, the consultancy company (doing the PV study), architects of both companies and WVI.

Energy

A solar installation of 1156 kWp with self-consumption of 91% will be installed on the roofs. The roof of Company A will have a solar installation of 474 kWp. The roof of Company B will have an installation of 682 kWp.

The annually produced electricity by the solar panels can be estimated to be 1 098 200 kWh. The self-consumption can be estimated to be 999 362 kwh/year.

Carbon reduction

The carbon reduction of the total amount of electricity produced can be estimated to be 210 tons. The self-consumption of produced electricity is 191 tons of CO_2 reduction.

Conclusions

The case is technically feasible. The biggest barrier is the public road situated between the two companies. A bore underneath the road has to be constructed. This bore will raise the price and has an influence on the financial feasibility.

Financial case

Financial, economic and commercial

Company A wants to invest in the solar panels on their own roof. The investment for 474 kWp can be estimated to be € 486 600. The project IRR is 6,9%. A reduction of 25% with regard to the current electricity price will be obtained.

As Company A wants to sell electricity to Company B, a direct line between the two companies needs to be installed. This implicates more expensive connection costs and an injection cost per MWh. Therefore, project duration of 20 years will give the project higher chances of success.

Company B prefers a third party to install the 682 kWp on their own roof. The company will have no investment costs themselves. The investment for the solar panels to be made by the third party can be estimated to be € 613 800. The contract duration with the third party can be 10, 15 or 20 years.

Roles

Company A wants to invest in the solar panels. The company wants to sell the electricity to Company B. Company B would like to have a price advantage when buying electricity produced by the solar panels from Company A.

Both companies should profit from the business case. The cooperation needs to be clarified in a juridical contract.

Conclusions

The financial case gives profits for both companies. Some of the profit margins are small. The decision to develop this business case will depend on the expected profits per year of the companies.

Policies, Legal context, organizational options

In the energy decree a direct line is be defined as follows (article 1.1.3, 26°): "An electricity line with a nominal voltage that is even or less than 70 kV, which connects a production installation with a consumer."

The requirements below must be met, to authorize a direct line:

- Free choice of supplier (article 4.4.1 energy decree)
- The principle prohibition to connect installations with their own access point to the electricity net (article III.5.1.3 TRDE)
- In case of a housing project: Each house is required to have their own access point to the distribution net (article IV.2.1.4 TRDE)
- Private distribution networks are prohibited (article 4.7.1 §1 energy decree)

- Permission of the VREG (Flemish regulator of the energy market) to establish a direct line (article 4.5.1, second section energy decree).

To install a direct line, the permission of the VREG is required if the line crosses the borders of the own site (article 4.5.1 energy decree). When assessing the application, the VREG regards the following points:

- Risks concerning efficiency
- Risks concerning safety
- Impact on the net rates
- The guarantee of the rights of consumers
- The potential refusal of the DNO or a lack of connection offer or access to the net on reasonable economic or technical conditions.

The legislation concerning direct lines can be found on: http://www.vreg.be/nl/directe-lijnen-en-leidingen

On 30/03/2018 the Flemish government approved a draft amendment to the energy decree. This draft amendment needed to simplify the installation of a direct line.

It also contains a charge for the exploitation of direct lines. This charge will be collected by the Flemish tax service and will be attributed to the energy fund. The rate of the charge depends on the voltage level:

- Direct line crossing the borders of the site with a consumer on low voltage: €53,83/injected MWh
- Direct line crossing the borders of the site with a consumer on medium voltage: €5,95/injected MWh
- Direct line crossing the borders of the site with a consumer on high voltage: €0,36/injected MWh

Conclusions applied on specific case

The main barrier is the legal context. Until recently the legislation didn't allow a direct line between two companies. This case is even more complicated as there is a street (public domain) situated in between the two companies.

In 2019, the legislation will change and direct lines will become possible. Authorization of the VREG (Flemish regulator) will still be needed. The city of Roeselare will also need to give permission to cross the public domain.

More information about the juridical context can be found in annex 2.

The role of WVI is to unburden the two companies.

Conclusion & recommendations

The feasibility study is finished. A meeting with the companies will be held beginning of January 2019 to present and discuss the business case.

The financial feasibility will decide if the case will be realized or not.

Contact

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Disclaimer

Information is partly based on feasibility studies and research, containing estimates and expectations based on the information that was available on the date of creation of this document.

List of annexes

- Feasibility study: Feasibility en technische economische haalbaarheidsstudie BPI – Indupac
- Presentation study juridical context: Energiedelen juridisch bekeken

2.4 Smart Grid on a business park (B)

Introduction

Several companies in Desselgem asked to research the most interesting way to use the electricity produced by two existing wind turbines as this electricity is currently injected to the grid. Furthermore, there is additional potential for producing solar energy and wind energy on the business terrain. Based on a first feasibility study the best option is to connect the 6 companies in one smart grid and use all produced local energy (existing and new installations) by the consortium instead of injecting the electricity into the grid. It is deemed that this option would generate economic benefit for all companies and would reduce the overall fossil fuel consumption of the business park.

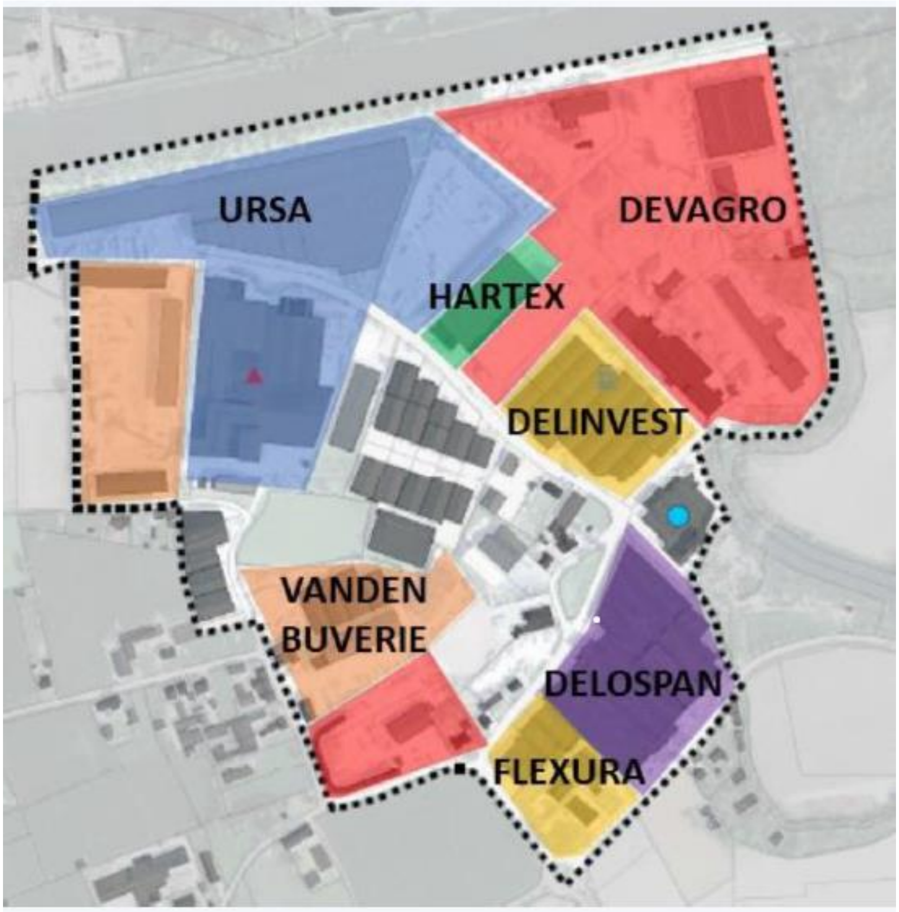
Business cluster

This business cluster offers a lot of potential for electricity exchange of locally produced renewable energy. At this moment, the produced renewable energy from 2 x 2MW wind turbines is 100% injected on the central grid. Additionally, the local energy consumption of the produced solar energy can be optimized and there is additional capacity for producing wind and solar energy. On the other hand, the energy consumed by the companies is nearly 100% coming from the central grid. In this way, the central grid is used twice. This business cluster has the potential to use 100% of all produced renewable energy and share it between a group of companies connected in a local energy community (LEC), without injecting renewable energy to the central grid.

Geographical location

The business case for smart grids is located in South-West-Flanders in the north of Waregem. The business park concerns a terrain in Desselgem (see red in figure below).

A detail of this business park indicating the companies involved is provided below.



Economic activities

In this business cluster, there are several activities. The largest company is URSA, which is an isolation producing company. URSA has a work regime of 24/24 and 7/7 and has 169 employees. Other companies actively involved in the business case are SME's and have in the range of 15 to 30 employees. The total electricity demand of the business park equals almost 95 GWh/y.

Opportunities and threats to create sustainable energy synergies in the business cluster

The main objectives of a smart grid are increasing the use and therefore maximizing the total installed capacity of renewable energy produced on the business park and to minimize injection of renewable energy to the grid.

Main opportunities:

- Large quantity of renewable energy consumption which is injected into the grid
- Large potential for additional production of renewable energy
- Stable and high base load of electricity consumption
- Some companies produce their electricity through diesel generators. This creates an interesting financial incentive to use locally produced renewable energy
- The availability of (backup) diesel generators offers backup potential for the members of the local energy community

Main challenges are:

Technical:

Additional PV and a wind turbine can be installed. Who will be the project developer (one for the LEC or as per the choice of each business)? Who will bear the investment costs?

A new system needs to be implemented, including metering devices and software to distribute all renewable energy flows between the different consumers as per the largest economic benefit which can be generated.

Additional investments are needed, such as new high-voltage cabins and additional cabling. As all companies are adjacent, the additional cabling can be easily implemented.

Legal:

The main barrier for this business site is the legal barrier. It is forbidden to make an electric link between 2 companies. Two different enterprises can only be delivered with electricity through the central grid. A smart grid construction is not allowed in Flanders' law. Under pressure of changing European Directives (Energy winter Package 2016), all regulations in Flanders (and Belgium to a lesser extent) are under evaluation.

Financial:

Who will make the additional investments, and who will benefit? This information is still unknown, but under evaluation.

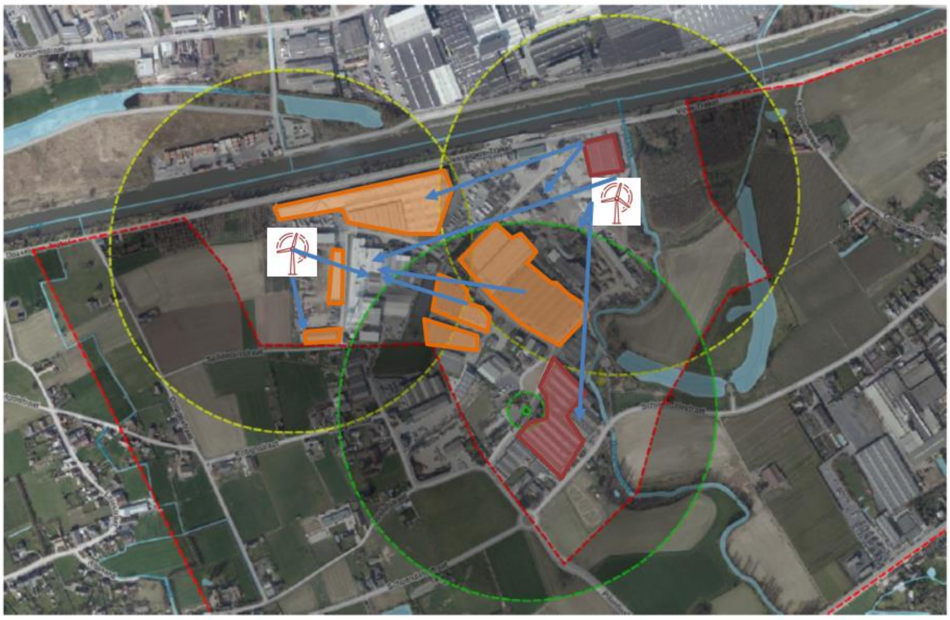
Organizational:

- How will a local energy community be realized? This information is still unknown, but under evaluation.

Technical case

Technical solutions

The POM was contacted by one of the companies of the business park. The company's interest is to use the renewable electricity produced by one of the wind turbines and to share the electricity with the neighbouring companies. For all the involved companies an inventory was made of the existing energy production and a feasibility study was performed on the additional potential to produce all renewable energy which is visualized on the image below. The potential for heat exchange was subject to another study.



- Existing wind turbine
- Existing PV-installation
- Additional potential PV
- Additional potential wind
- Electricity Exchange

Based on the obtained information a master study was done on the potential of electricity exchange, storage and electric vehicles for the site in Desselgem. This study is in an Annex.

Scenarios

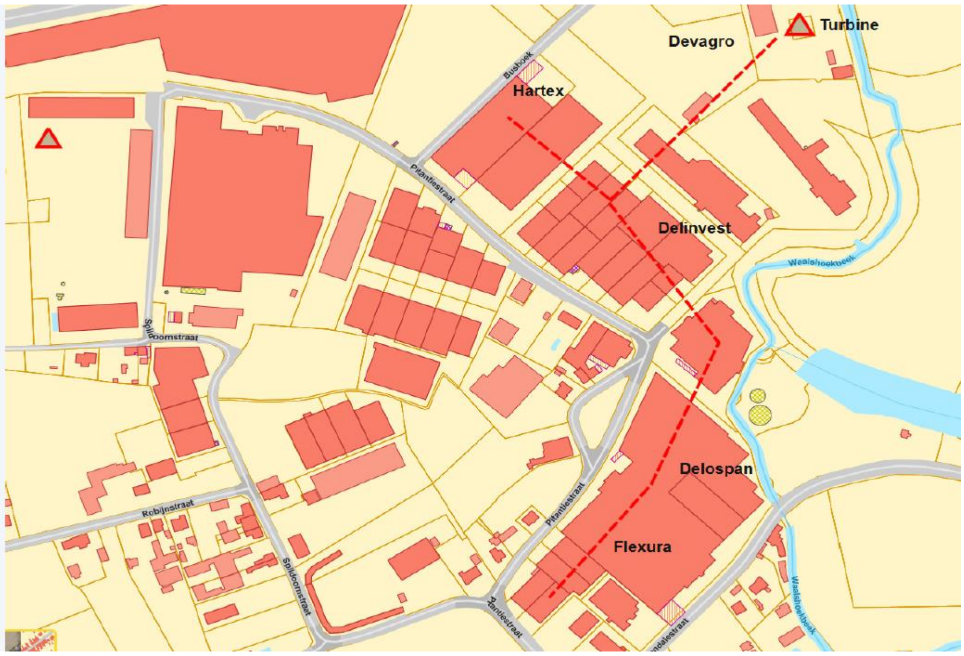
To optimize the use of the existing renewable energy sources the following scenarios were evaluated:

- Optimization self-consumption PV Delospan and Flexura
- Optimization self-consumption PV Devagro
- Direct supply wind turbines to the companies
- Direct supply PV installations to URSA
- Local energy storage (battery) at Delospan and Devagro
- Central energy storage business park

Based on the above research, the load profiles, energy prices and spatial limitations of the following optimizations are possible.

1. *The four companies (Hartex, Delinvest, Delospan, Flexura) are neighboring companies and can be connected without need to cross a street (pubic domain). As such there is no or limited interference with the grid.*
2. *Windmill 1 can be connected to URSA through a direct line and can be monitored on the same platform*

3. *The four companies south of URSA have a lower usage of electricity, which results in a higher price level for the electricity (all prices are confidential). The business case for the usage of wind or solar energy is higher for the four smaller enterprises. However, the remaining available electricity could be used by URSA*
4. *There is room for a third windmill between windmill 1 and 2 (near the URSA premises) and additional potential for producing solar energy. All the additional produced energy can be used by URSA.*



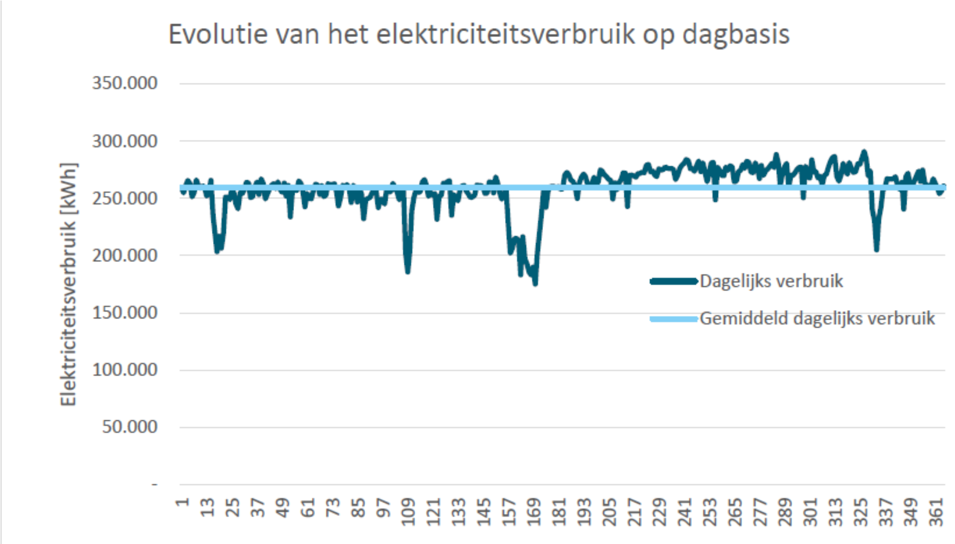
Spatial

The only limitation on a spatial level is the visual impact of an additional wind turbine. A smart grid has limited spatial impact as it mainly concerns additional infrastructure such as cabling which will be placed underground or on the premises of the involved businesses which are all adjacent.

Windmills have an environmental impact. There is an increase in the noise level, there is shadow nuisance and a possible nature (bird) interference can also be measured. However, since the turbine would be located on a business park with heavy industrial activities and with 2 existing turbines, the additional impact is estimated to be minimal.

Energy

The yearly average of the daily load profile of this business cluster is depicted below. The largest company in the business cluster is responsible for 97% of the electricity demand.



The electricity demand is very high and quite stable. This is a very good business case for a 100% usage of the production of renewable energy: solar on all available the roof premises, in addition to the existing 2 wind turbines, as well as a potential extra wind turbine. Currently 11 774 MWh of renewable energy is produced on the site in Desselgem. 97% of this energy is injected into the grid. Moreover, by using all additional roof space on the business park and by installing a third wind turbine an additional 4 639 MWh of renewable energy can be produced and consumed locally by the business in the business park.

Carbon reduction

By maximizing the production of renewable (PV on all roofs and extra wind turbine) and by optimizing the local consumption of the currently produced renewable energy, the amount of locally consumed renewable energy can rise to 19.413 MWh, or 20,5% of the total electricity demand. This corresponds with a reduction of CO2 emissions of 7765 tons (from 37.856 tons towards 30.091 tons).

Conclusions

This case makes sense; the base load of electricity consumption is high, thus making it possible to consume a large percentage of the locally produced renewable energy on site. The renewable energy can be used by the different companies through a smart grid and a possible Local Energy Community.

However, the case is not yet ready for technical implementation. Additional investments are still required:

- new high-voltage cabins (2 companies produce most of their electricity by means of diesel generators) and additional cabling.
- new system needs to be implemented, including metering devices and software to distribute all renewable energy flows between the different consumers as per the largest economic benefit which can be generated
- Additional renewable energy production: PV and wind

Financial case

Financial, economic and commercial

The financial business case is not yet completed and is currently under investigation.

A good software model will be required to manage the distribution of the different energy sources towards all companies. This model will need to maximize the financial benefit for each company in the business cluster. It is believed that this financial benefit will outweigh the additional investments required. However, a lot will depend on fees which will be implemented by the DNO and/or other parties for managing/allowing the Local Energy Community.

Roles

This is not yet clear at this point. The total amount of additional investments is limited (not considering investments in additional PV and wind turbines).

To create a smart grid including the existing renewable energy installations, mostly existing infrastructures (like cables and supplying cabins) can be used to create a grid parallel to the public net. Although there will be a need to invest in some new high voltage cabins and cabling.

The most important investment will be in the management software and metering devices including an algorithm which will decide how much renewable electricity will be assigned to which company.

Conclusions

The financial business case is not yet completed and is currently under investigation.

Due to fluctuating energy prices and scarcity during the Belgian winter, companies are prepared to invest in “cheap renewable energy”. Energy prices in Belgium are very unpredictable due to failing nuclear energy. Large companies, with a high energy demand like URSA, are now prepared to invest in solar and wind energy.

When renewable energy becomes the cheaper and reliable energy source, a growing interest from companies is observed. This smart grid can lead to a local usage of 100% of the produced renewable energy.

Policies, Legal context, organizational options

A smart grid construction is not allowed in Flanders’ law. Under pressure of changing European Directives (Energy winter Package 2016), all regulations in Flanders (and Belgium to a lesser extent) are currently under evaluation.

It is possible that some research cases will be set up under what is known as “regelluwe zones”, which means that these are cases which will operate outside of the boundaries of the prevailing law. However, the exact conditions under which a zone like this can be applied are not clear at this moment.

It is clear that for setting up a local energy community there is a need for an organizational structure bringing the involved businesses together. However, there are no legal stipulations at this moment for defining a local energy community.

Conclusions applied on specific case

The case is technically feasible. It is probable that it is also economically feasible, but legislation makes this case impossible. Due to the article 16 of the Energy Winter Package, possible feasible solutions are researched. Legislation will change, probably in 2020. The central government has searched for opportunities and is now studying this issue.

Many of the companies which would be part of the smart grid have the same shareholder and are family owned businesses. This might help facilitate the organizational implementation of the project.

Conclusion & Recommendations

Smart grids are way to increase local consumption of the produced renewable energy without burdening the public net. As such, investing in renewable energy will become more interesting. At this point the technical potential was identified. Next steps are to investigate financial feasibility and organizational opportunities for implementation.

Contact

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Disclaimer

Information is partly based on feasibility studies and research, containing estimates and expectations based on the information that was available on the date of creation of this document.

List of annexes

Annex 1 - BISEPS - Studie optimalisatie aandeel hernieuwbare energie bedrijvenzone Schoendale (CONFIDENTIAL)

3. Heat exchange & district heating

Exchanging heat is a clear way to create energetic synergies between SMEs. One company might have waste heat, for the neighbouring company this might be useful process heat. The following business cases give insight into possibilities for heat exchange for clusters of SMEs across the 2-Seas region.

3.1 Heat from biomass power plant for business cluster (B)

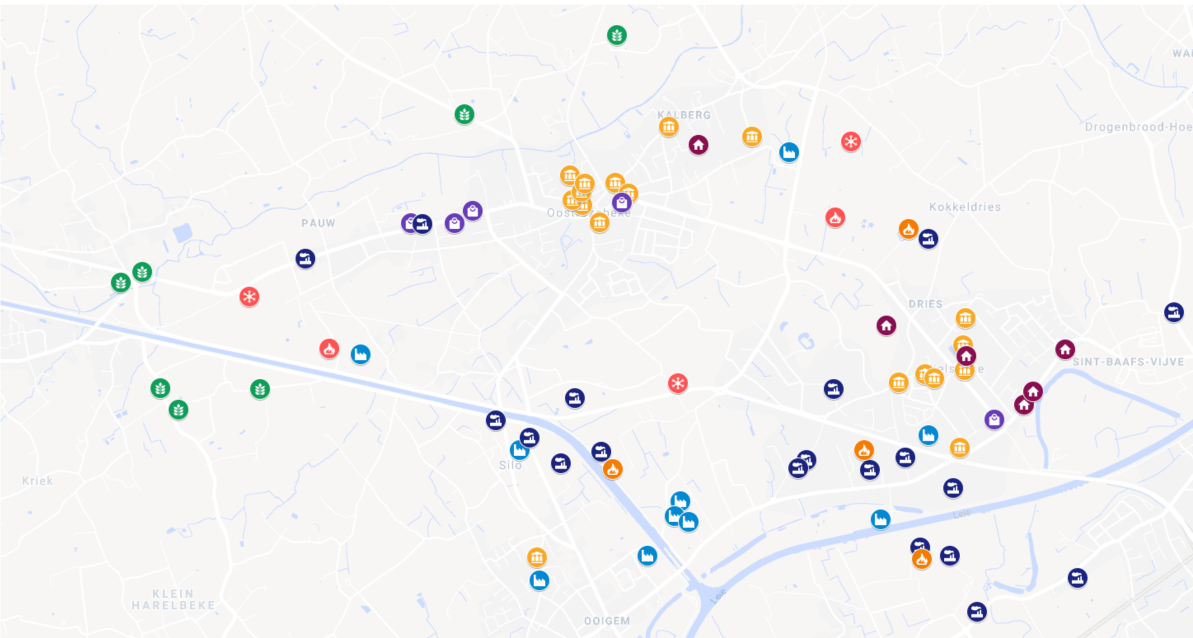
Introduction

This business case summarizes the results of a feasibility study for the use of green and waste heat within the municipalities of Wielsbeke and Oostrozebeke (Belgium).

An initial feasibility study for district heating in this region was conducted by the POM WVL in 2015 for the ARBOR project. For the BISEPS project an actualization of the inventory of potential heat producers and consumers in the region was performed and resulted in:

- A total heat demand (<100°C) of ca. 95 GWh/y
- A steam demand of ca. 200 GWh/y

The image below shows the location of the various sources of waste heat and potential heat consumers.



Legend:

- *Orange: potential suppliers of green heat (A&S + A&U), as well as current consumers of green steam (Unilin + Agristo)*
- *Dark blue: industrial heat consumer (> 100°C)*
- *Light blue: industrial heat consumer (<100°C)*

- *Yellow: public buildings with considerable heat consumption*
- *Purple: commercial buildings with considerable heat consumption*
- *Red: residential heat consumers*
- *Green: agricultural heat consumers*

Based on this inventory the POM WVL performed a scenario analysis for district heating. The most interesting scenario was then validated by the consultancy company ANTEA. Due to the high steam demand in the region, the viability of the steam network was also investigated.

Business cluster

The businesses located in Wielsbeke and Oostrozebeke are principally very large natural gas and electricity consumers. There are also some business parks with SMEs.

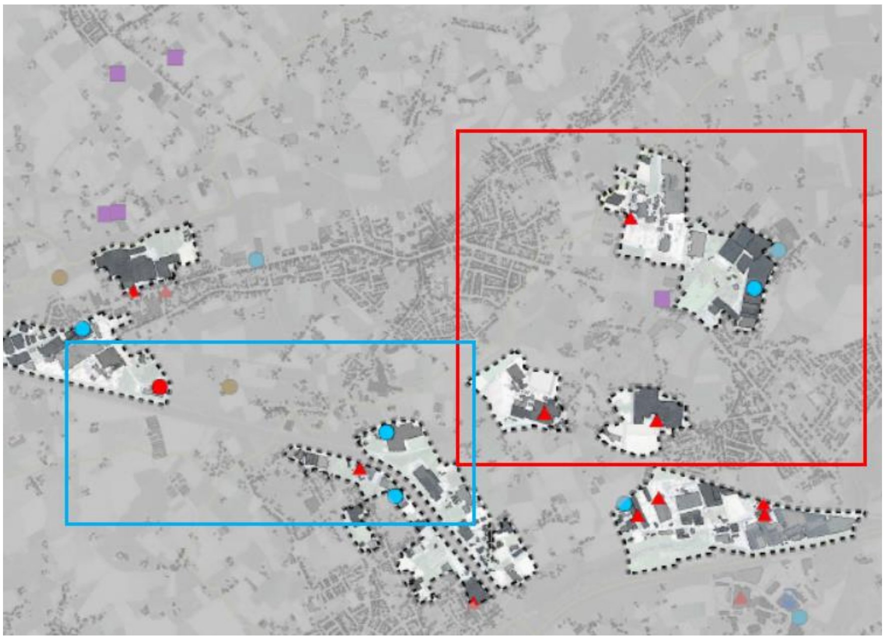
There are three production facilities of the Unilin group present in the region. These companies produce chipboard, MDF panels and flooring, thus generating large amounts of non-recyclable wood. This generated the opportunity for the construction of two biomass power plant using the waste streams of the adjacent Unilin facility, as well as other non-recyclable wood streams from nearby waste collection sites.

Given the presence of these facilities, it offers a lot of opportunities to deliver green power and heat to nearby companies and buildings.

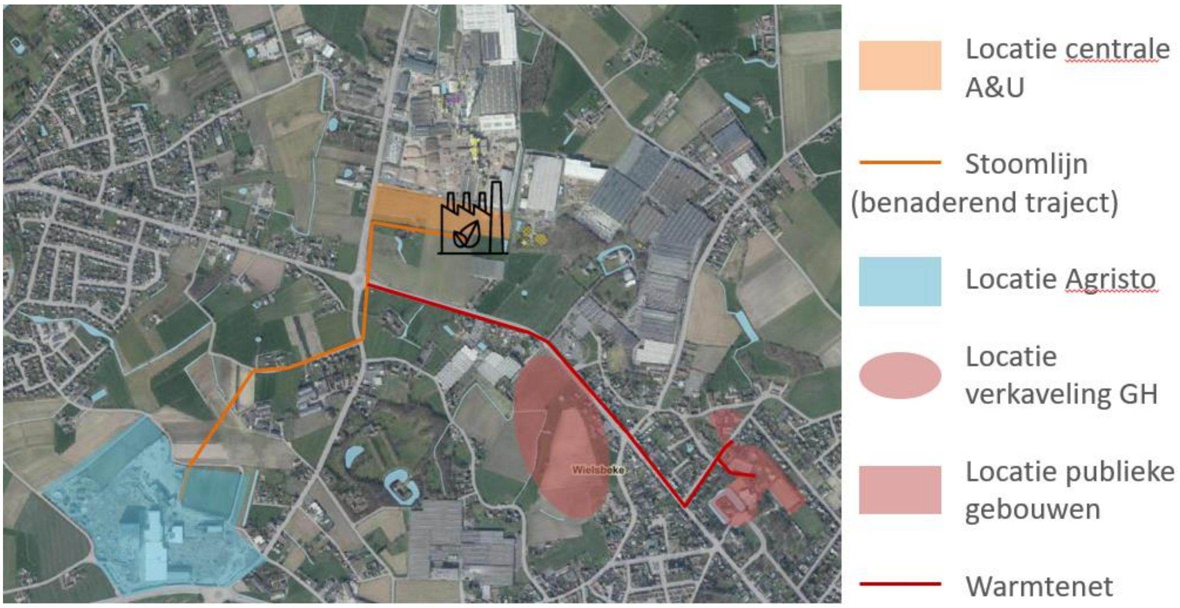
Geographical location

Business parks in Wielsbeke and Oostrozebeke - the industrial activities in the region are not clustered in 1 business terrain, but rather scattered in between housing and rural areas.

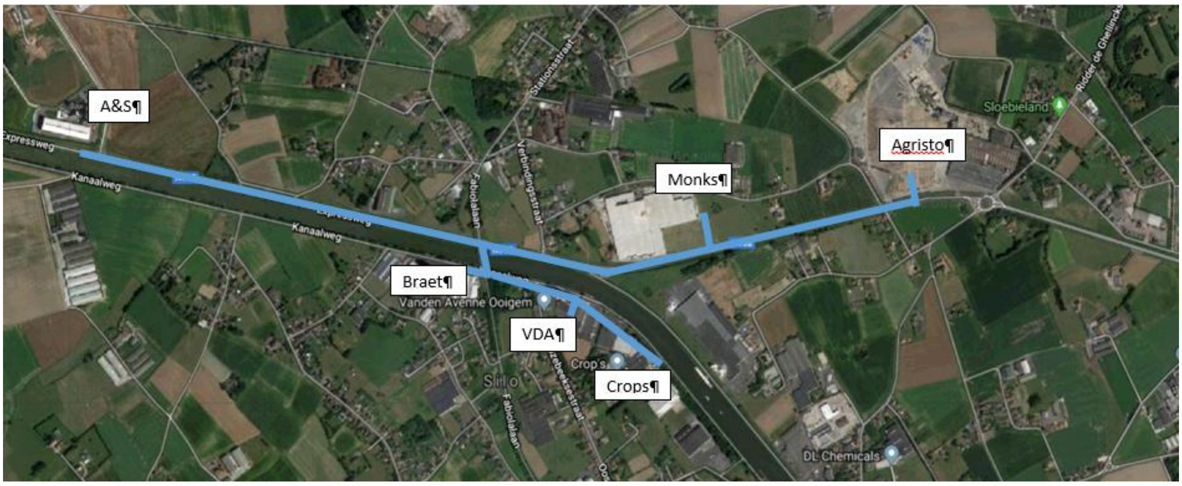
- red rectangle shows the potential area for a combined steam line and district heating network (case A)
- blue rectangle shows the potential area for a steam network (case B)



Detail Case A:



Detail Case B:



Economic activities

Case A: The business cluster involved in the steam and district heating network include A&U Energie, a biomass power plant, as the heat producer and Unilin (wood processing company) and Agristo (potato processing company) as green steam consumers. Both companies work according to a 24/24h and 7/7 days regime and are responsible for a substantial part of the employment in the region.

The green heat consumers under consideration in the business case are a large housing project of 400 houses and public buildings, such as: the public swimming pool (new), a sports complex, a retirement home, the town hall and adjacent buildings.

Case B: The business cluster involved in the steam network includes A&S Energie, a biomass power plant, as the heat producer and 5 heat consumers (4 food processing companies and 1 textile company). Two companies (including the largest steam consumer) work according to a 24/24h and 7/7 days regime. The other companies have a reduced production regime on the weekend.

Opportunities and threats to create sustainable energy synergies in the business cluster

Strengths:

- No legal challenges for developing a heat exchange project
- A&S energie is owned by the same owners as A&U energie; currently developing a steam network. Therefore, experience in developing a green steam network is already in place
- Continuous heat production and continuous heat consumption in case B, thus having a positive impact on the profitability of the project

Weaknesses:

- Uncertainty with respect to the price of the green steam or heat produced by A&U Energie and A&S Energie
- Uncertainty about the level of subsidies which can be obtained

Opportunities:

- The new energy plan of Flanders states that new housing projects will no longer be connected to the natural gas network starting from 2021, which is a very interesting incentive for developing district heating projects.
- Since the municipality has set generating "public benefit to the community" as a requirement to give a permit for the main steam line of case A, they have created a major incentive for A&U Energie to make sure a district heating project is realized either by own investment or by cooperation with a third party.
- The region has a lot of companies with waste heat, offering opportunities for adding additional heat sources and heat consumers to a district heating network.
- A&S Energie will lose its subsidies to produce green electricity by 2020. As a result, shutting down the plant is a possibility. However, as an alternative, green heat supply for the neighbouring companies should be considered and is viable.
- Oostrozebeke (where A&S Energie is located) signed the Covenant of Mayors. The municipality thus has an incentive to support projects leading to energy savings and the reduction of CO_2 emissions

Threats:

- Green heat does not create a positive effect on the energy performance of the building (as per defined by the government in the energieprestatieregelgeving for builders (EPB)) (considered to be primary energy just like natural gas). However, a reduction of the EPB factor is interesting to convince real estate developers to opt for district heating instead of a natural gas net or heat pumps.
- The municipality has an agreement with the DNO to get priority to develop district heating projects which consider the public domain. This could potentially complicate project development.
- The municipality wants free heat supply since they have been losing income resulting from an exemption of withholding taxes for new low energy real-estate

- The economic viability of case A depends on the realization of a newhousing project, but there is uncertainty about the realization of the project.

Technical case

Technical solutions

Multiple possibilities to produce sustainable energy (solar, wind, etc.) were investigated. However, given the large amount of waste heat and green heat production in the region the viability for heat exchange has always been estimated to be large.

Research:

- Initial feasibility study for district heating in 2015 for the ARBOR project.
- Actualization of the inventory of potential heat producers and consumers in region:
  - → Total heat demand (<100°C) of ca. 95 GWh/y
  - → Steam demand of ca. 200 GWh/y
- Scenario analysis for district heating by the POM West-Vlaanderen based on a calculation sheet developed by the POM analysing both technical and economic viability.
- The final most viable scenario was then validated by the consultancy firm ANTEA.
- Feasibility study for a green steam network by the consultancy firm ANTEA, including:
  - → Inventory of the steam consumption of the companies in the vicinity of the biomass power plants A&S and A&U Energie, see summary in annex 4.
  - → Quick-scan of 9 scenarios for a steam network
  - → In depth economic viability analysis for the most profitable scenario and the scenario providing the most environmental benefit

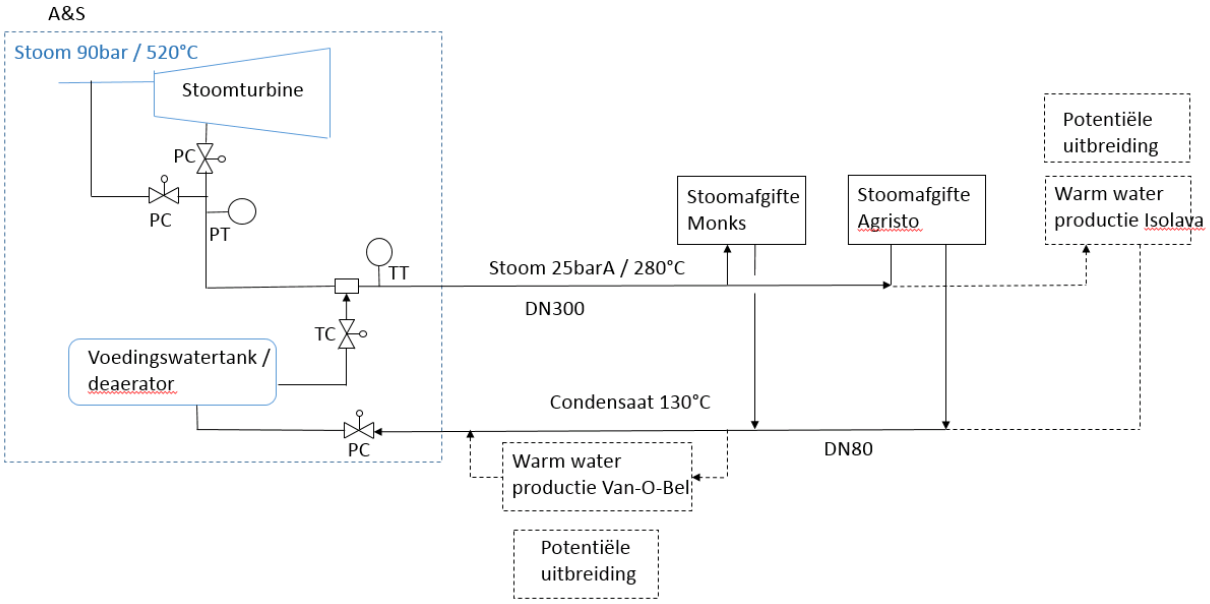
Scenarios

Case A:

The business case concerns the use of the (waste) heat of a biomass power plant (A&U energie), producing green steam for 2 nearby companies, for a district heating network. Scenarios for heat supply to nearby companies, public buildings and residential projects were investigated. The final scenario was selected as it is economically viable, and it is supported by the municipality of Wielsbeke as some of the heat consumers will be public buildings (swimming pool, town hall, retirement home).

Case B:

The business case concerns steam supply of a biomass power plant (A&S energie) to several steam consuming companies in the vicinity. Nine different scenarios were investigated using a quick calculation method. Two scenarios were evaluated in more detail, being the most profitable scenario and the scenario generating the largest energy saving. A schematic representation of the most profitable scenario is presented below:



Spatial

Case A:

- The piping of the steam and hot water supply lines are traversing public domain. The municipality has an important role in the realization of the project. The municipality is defining the conditions under which A&U Energie can obtain a permit for realizing the steam line.
- Given that the municipality has an agreement with the DNO of the natural gas network in respect to the development of district heating projects which consider the public domain, this has an important impact on the potential development of the project.

Case B:

- Production facility is located in Oostrozebeke, while almost all consumers are located in Wielsbeke
- The scenario with the largest energy savings requires traversing a river. The scenario analysis assumes that the steam pipes can be suspended from the bridge. If the piping needs to be placed underground a substantial extra cost will need to be included.
- The trajectory has not yet been evaluated, nor has the trajectory been approved by the municipality.

Energy

Case A

A&U Energie supplies steam to Agristo. After heat exchange the temperature of the condensate is approx. 100-120°C. There is about 2,135 MW of heat available for a district heating network which is available during 8300 hours per year, corresponding with 17,730 MWh of heat available per year.

The selected scenario considers a number of heat consumers including public building and a large housing project. The maximum heat demand thus corresponds with approx. 6500 MW. This implies that during peak consumption additional peak production capacity is required. Additionally, a large part of the heat consumers are new projects implying the need for (a) backup installation(s).

The yearly consumption of energy would correspond with 6550 MWh/y. Despite of the high peak demand the overall yearly energy consumption lies significantly below the total amount of heat available. This is due to the nature of the heat consumers which consume less heat in the summer months and during night time.

Case B

A&S Energie produces green steam to produce electricity. The scenarios under consideration assume that part of this steam will be delivered to nearby companies. A&S Energy produces steam 7d/7d and 24h/24h and only has one maintenance stop per year. Therefore the scenarios correspond with the following energy savings:

- Most profitable scenario : 167,900 MWh/y
- Largest energy saving : 176, 855 MWh/y

Carbon reduction

Case A:

- Net energy saving: 5,240 MWh/y (100 % renewable energy)
- CO_2-saving: 1.058 ton/y

Case B:

- Most profitable scenario : net energy saving of 167,900 MWh/y and CO2 saving of 33,899 ton/y
- Scenario largest energy saving : net energy saving of 176, 855 MWh/y and CO2 saving of 35,707 ton/y

Key figure CO2-emissions (compared to heating with natural gas): 202 kg/MWh

Conclusions

Both case A and B are technically feasible and there are no major technical barriers.

Opportunities:

- The current scenario for district heating (case A) considers a short trajectory corresponding with the heat available from A&U Energie. However, the region has a lot of companies with waste heat, offering opportunities for further adding of heat sources and heat consumers to the network.
- A&S Energie will lose its subsidies to produce green electricity by 2020. As a result, shutting down the plant is a possibility. However, an alternative of green heat supply for the neighbouring companies should be considered and is viable (case B).

Financial case

Financial, economic and commercial

Case A:

The key outputs of the financial feasibility study are summarized below (see detail in annex 1):

Investment (before subsidies)	EUR 3.692.853
Investment (after subsidies)	EUR 2.853.733
Total revenues	EUR/y 303.990
Total costs (incl. Maintenance)	EUR/y -125.000
Return on investment (30y)	16 y
IRR (30 jaar)	4,76 %
NPV (30 jaar)	EUR 177.858

Case B:

The key outputs of the financial feasibility study are summarized below (see detail in annex 2):

	Scenario 1	Scenario 2
Investment (before subsidies)	EUR 7.460.000	EUR 9.854.000
Investment (after subsidies)	EUR 6.460.000	EUR 8.854.000
Total revenues	EUR/y 3.023.000	EUR/y 3.184.000
Total costs (incl. Maintenance)	EUR/y -2.332.000	EUR/y -2.493.000
Return on investment (30y)	11 y	14 y
IRR (30 year)	9,25 %	6,43 %
NPV (30 year)	EUR 6.809.742	EUR 4.871.418

Roles

There is interest from both the energy producer (A&U and A&S Energie) and/or third-party investors (Beauvent/Eandis) to further investigate developing the project. Both private funding of investment by means of a cooperative structure are possible. We are however at a too early stage of the development of the business case to provide further details.

Conclusions

It was concluded that the financial viability of both cases seems to be interesting enough for further investigation with all involved parties and potential project developers.

Scenario 1 of Case B is particularly interesting given the heat source ensuring continuous heat production and the end user ensuring continuous heat consumption, thus having a positive impact on the profitability of the project.

However, the study is based on assumptions for the price of green heat. The actual price for the green heat is not known and has a large impact on the business case.

Since A&S Energie will lose its subsidies for green electricity production is 2020 it provides an interesting opportunity for this installation to develop a business case around green heat supply. However, as both A&S Energie and A&U Energie already received subsidies, it is unsure if more subsidies can be obtained.

Green heat does not create a positive effect on EPB (considered to be primary energy just like natural gas). However, a reduction of the EPB factor is interesting to convince real estate developers to opt for district heating instead of a natural gas net or heat pumps. If the new housing project is not part of case A, the business case will be much less interesting.

The municipality wants free heat supply since they have been losing income resulting from an exemption of withholding taxes for new low energy real-estate. This was not considered in the calculation of business case A and would have a negative impact on the financial viability.

Policies, Legal context, organizational options

Currently there is no legal framework for heat exchange in Flanders, Belgium.

On the 14th of October 2016, the Flemish government has approved a new regulatory framework for heat exchange. This happened by a change in the former ‘Energy decree’. This framework mainly gives the juridical backbone for later implementing decisions. Before it can actually be applied, it needs to be transformed into an implementing decision.

The approved juridical backbone focuses on avoiding payments, principles of public service obligation, protection of consumers, the definition of the different roles to play in the market and designating the VREG as the regulator.

Businesses who participate in the ‘Energy Policy Agreement (EBO)’ are obliged to conduct feasibility studies for heat and cold exchange.

VLAREM (the Flemish implementing decisions of the environmental license decree) states that in some cases the feasibility of heat exchange and CHP needs to be investigated. It considers license applications for big new combustion plants or electricity centrals and for heat networks. If the benefits are bigger then the costs, the energy efficient option needs to be applied.

Possible organizational models:

- Vertical integrated: 1 partner takes up all roles in the chain (feasibility, installation, production of heat, distribution of heat, role of supplier, financing, communication)

- Setting up of a consortium: Each partner takes up a role. The consortium can work in collaboration with a project developer.
- A consortium with a cooperative as partner. The cooperative as partner allows citizens to financially participate in the heat network.
- Energy manager who functions as an Energy Service Company (ESCO).

Conclusions applied on specific case

There are no legal barriers.

Strengths:

- Both the municipality of Wielsbeke and Oostrozebeke are very positive towards the development of district heating projects.
- The described cases involve A&S and A&U Energie as heat producers, both companies of the same owners. A&U Energie is currently already developing a green steam network. Therefore, there is already experience in developing a similar project and the same parties would be involved for the green steam project of A&S Energie.

Opportunities:

- The new energy plan of Flanders which states that new housing projects will no longer be connected to the natural gas network starting from 2021, which is a very interesting incentive for developing district heating projects.
- Since the municipality of Wielsbeke has set generating “public benefit to the community” as a requirement to give a permit for the main steam line of case A, they have created a major incentive for A&U Energie to make sure a district heating project is realized either by own investment or by cooperation with a third party.
- Oostrozebeke (where A&S Energie is located) signed the Covenant of Mayors. The municipality thus has an incentive to support projects leading to energy savings and the reduction of CO_2 emissions.

Conclusion & Recommendations

The technical and financial feasibility of the described business cases has been proven. However, to bring the case to further development a lot of partners are involved which each have their own interests.

To develop the business cases both the heat producers (A&U Energie and A&S Energie) and the municipalities play a key role. Further development of the project now requires:

- A clear point of view by the heat producer on the role they wish to play in the project. Do they want to develop the project themselves or can a third party develop the project?
- The heat producer to set its price for the heat they produce in case a third party will be contracted for developing the project

- Strong involvement of the municipalities as they will need to allow the project and the suggested infrastructure route of the steam line. Wielsbeke is also an important heat consumer in case A.
- Clarity about the development of a new housing project in Wielsbeke and about the development of a new business terrain next to A&S Energie
- LOI with the involved businesses and public parties

Contact

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Disclaimer

Information is partly based on feasibility studies and research, containing estimates and expectations based on the information that was available on the date of creation of this document.

List of annexes

- Annex 1 – Financieel model Case A (CONFIDENTIAL)
- Annex 2 – Financieel model Case B (CONFIDENTIAL)
- Annex 3 – Studie aanleg warmtenet POM WVL (CONFIDENTIAL)
- Annex 4 – Studie aanleg stoomnet Antea (CONFIDENTIAL)

3.2 Heat exchange on business park level (B)

Introduction

This business case summarizes the study results of 3 cases of heat exchange between 2 neighbouring companies on business parks in Harelbeke and Kortrijk (Belgium). Residual heat (exhaust gases from the drying ovens, cooling processes…) can be used for the neighbouring company. In these 3 cases, the work regime between to the 2 companies is different.

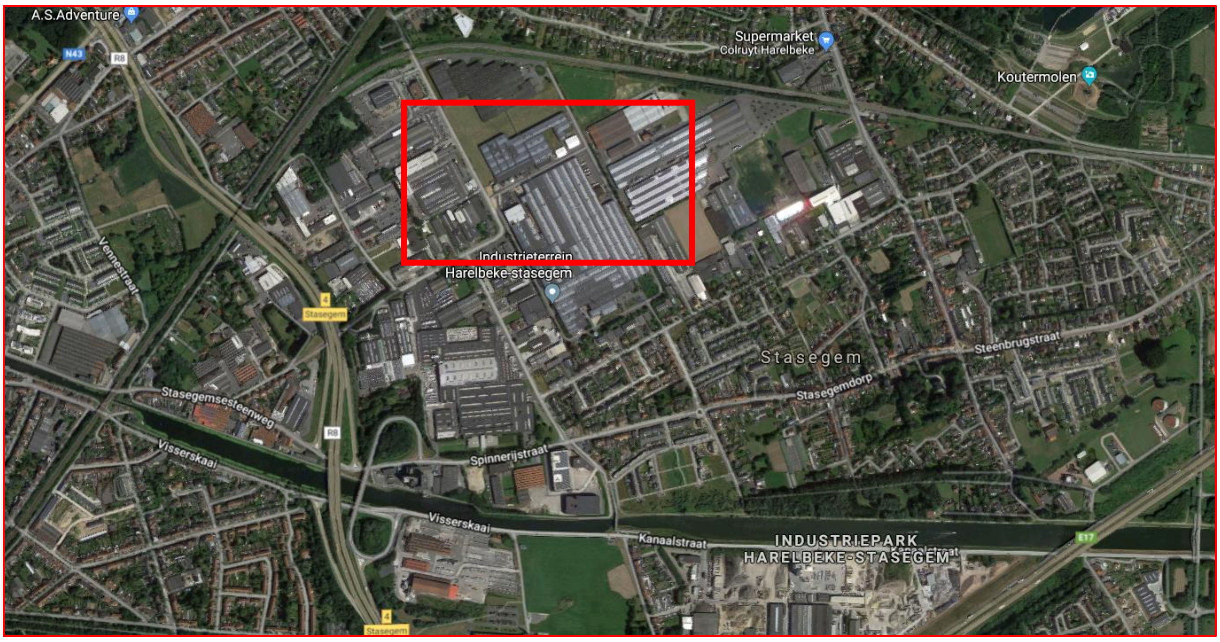
As the studies are still ongoing, the conclusions will be detailed at another date.

Business cluster

The 3 cases concern each two companies located next to each other, on 2 different business parks. A prior feasibility study on business park level identified these cases as the most promising opportunities. Heat exchange between these 2 companies are most feasible due to close proximity and heat profiles.

Case 1:

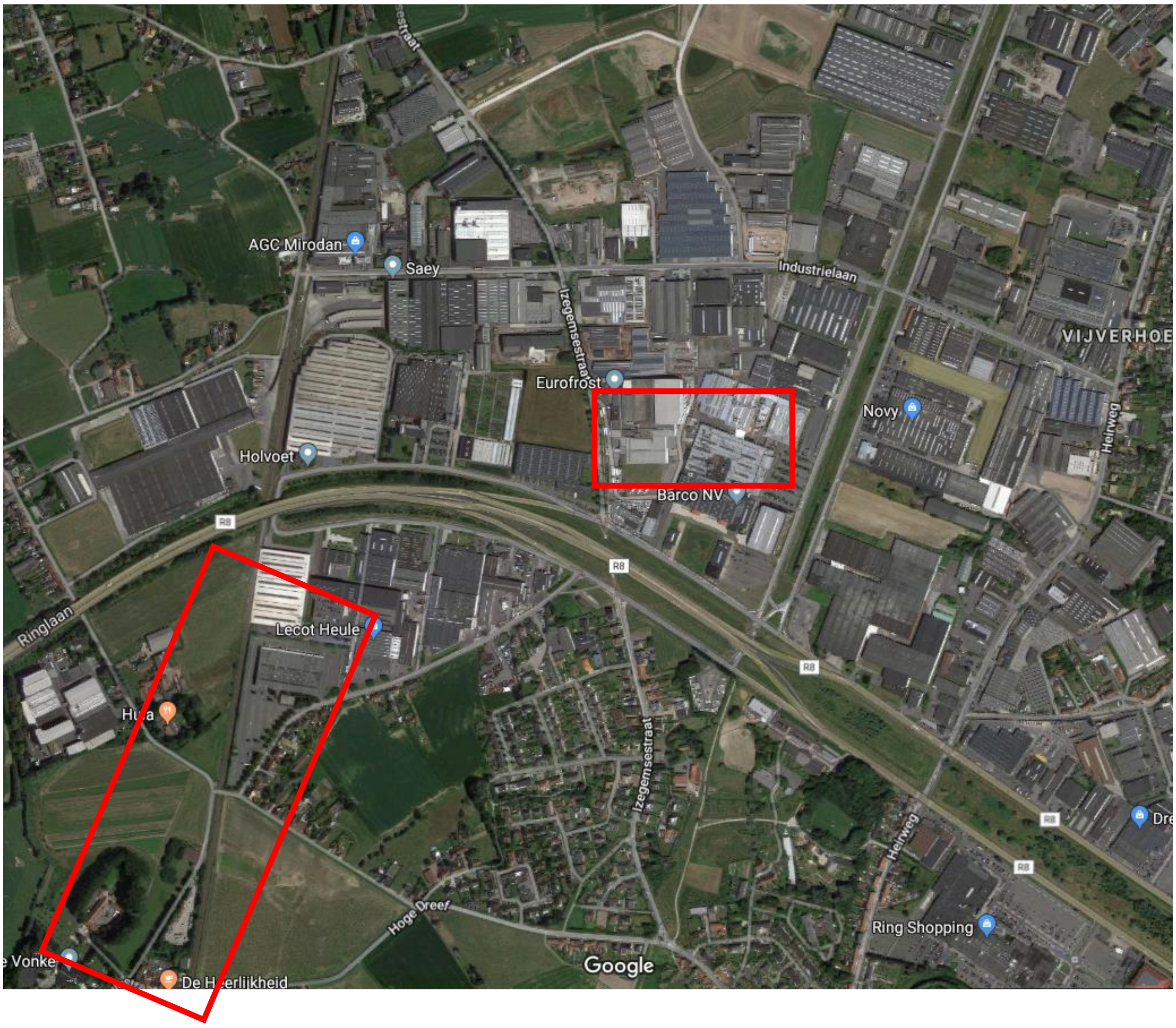
- The low temperature heat, available from the process of one factory (exhaust gases from the drying ovens), can directly be delivered to the neighbouring company for the drying of their wood. The exchange is estimated as a big potential, also because the wood-drying process is not a critical process.
- Company A manufactures tapestries and company B manufactures wooden products. Work regime of company A is 5 days/week and 24h/day, of company B 5days/week and 16h/day.



Business park Harelbeke-Zuid, case 1 (Belgium)

Case 2: one SME is logistics in frozen goods, exploiting freezing halls. It has 1MW residual heat at its disposal at 30°C, which is partially used for heating own offices. But is has the potential to heat up new buildings on the adjacent terrain where old buildings will be demolished (>10.000 m²), using heat pumps to upgrade the temperature.

Case 3: a CHP could be shared between an SME (a printing company needing a lot of electricity) and a public swimming pool operated by a private party (needing a lot of heat).



Business park Kortrijk-Noord, cases 2 and 3 (Belgium)

Technical case

Technical solutions

These steps were followed to decide the technical feasibility:

- Intake questionnaire to obtain basic information from each company of the Living lab
- Inventory of the most interesting cases or companies, based on the intake and made by an external expert (study agency)
- Feasibility study on heat exchange, made by an external expert (consultant)
- Consultation of the energy manager of the companies involved (aim: obtain all relevant energy related information and data)

Spatial

Non major spatial constraints: connectors (heat pipes) can be placed underground or above ground. But more length has a negative impact on the cost.

Energy

Heat exchange estimated is 800 MWh/year, corresponding with 162 tCO_2/year (case 1), 400 MWh/year, corresponding with 81 tCO_2/year (case 2) and 675 MWh/year, corresponding with 136 tCO_2/year (case 3).

Conclusions

In all 3 cases, there is a technical match between the two companies.

Financial case

Financial, economic and commercial

The aim is to create energetic synergies between 2 businesses. Provisional conclusion show a major financial challenge. First estimates showed a payback time of 15 years, more detailed studies estimated the payback time over 30 years, because of the small amounts of residual heat and the relative high costs of the heat piping (due to long distances).

Important parameters in this case are the distance between provider and customer, and the temperature regimes. The positive impact of subsidies has not been taken into account.

CAPEX		**case 1**	**case 3**	**case 2**
Production installation	EUR	100.000	110.000	200.000
Heatnet	EUR	140.000	170.000	270.000
connections	EUR	20.000		20.000
Other costs	EUR	104.694	115.307	198.127
TOTAL	EUR	364.694	395.307	688.127
OPEX				
Sale of heat	EUR/y	24.000	12.000	111.550
Operational costs	**EUR/y**	13.191		73.514
BALANCE				
IRR (30 year)		2,77%		2,43%
NPV (30 year)	EUR	-61.198	-440.935	-130.569

Roles

Different options are possible: direct cooperation between the 2 companies, or with involvement of third-party operator. A decision on the options is planned after the conclusions of the technical and financial studies.

Conclusions

A 30 years payback time is estimated today. The results will be communicated with the businesses, but it is expected to be a (too) long period for the involved SMEs.

Policies, Legal context, organizational options

Currently there is no legal framework for heat exchange in Flanders, Belgium.

On the 14th of October 2016, the Flemish government has approved a new regulatory framework for heat exchange. This happened by a change in the former ‘Energy decree’. This framework mainly gives the juridical backbone for later implementing decisions. Before it can actually be applied, it needs to be transformed into an implementing decision.

The approved juridical backbone focuses on avoiding payments, principles of public service obligation, protection of consumers, the definition of the different roles to play in the market and designating the VREG as the regulator.

Businesses who participate in the ‘Energy Policy Agreement (EBO)’ are obliged to conduct feasibility studies for heat and cold exchange.

VLAREM (the Flemish implementing decisions of the environmental license decree) states that in some cases the feasibility of heat exchange and CHP needs to be investigated. It considers license applications for big new combustion plants or electricity centrals and for heat networks. If the benefits are bigger then the costs, the energy efficient option needs to be applied.

Possible organizational models:

- Vertical integrated: 1 partner takes up all roles in the chain (feasibility, installation, production of heat, distribution of heat, role of the suppliers, financing, communication)
- Setting up of a consortium: Each partner takes up a role. The consortium can work in collaboration with a project developer.
- A consortium with a cooperative as partner. The cooperative as partner allows citizens to financially participate in the heat network.
- Energy manager who functions as an Energy Service Company (ESCO).

Conclusions applied on specific case

There are no major legal constraints.

Conclusion & Recommendations

Heat exchange on business parks is not evident. A first feasibility screening limited the number of potential cases: potential supply (waste heat) and demand should be close, and their energy profile should fit (working regime, temperatures, quantities…). However feasibility studies showed technical potential, the economic side of the identified cases was negative. It is unrealistic to expect that SME's would invest.

Contact

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List of annexes

- Leiedal_Case 1.pdf
- Leiedal_Case 2.pdf
- Leiedal_Case 3.pdf

3.3 Heat exchange between SMEs (B)

Introduction

The business case looks at the heat exchange between two companies and public buildings. One of the companies has a CHP (combined heat and power) with some extra capacity to feed a heat network.

The heat network would be situated in a historically developed business park. Due to an expanding city, the companies are now surrounded by residential buildings.

The main barrier for implementation of this business case is the need of a third-party investor.

Business cluster

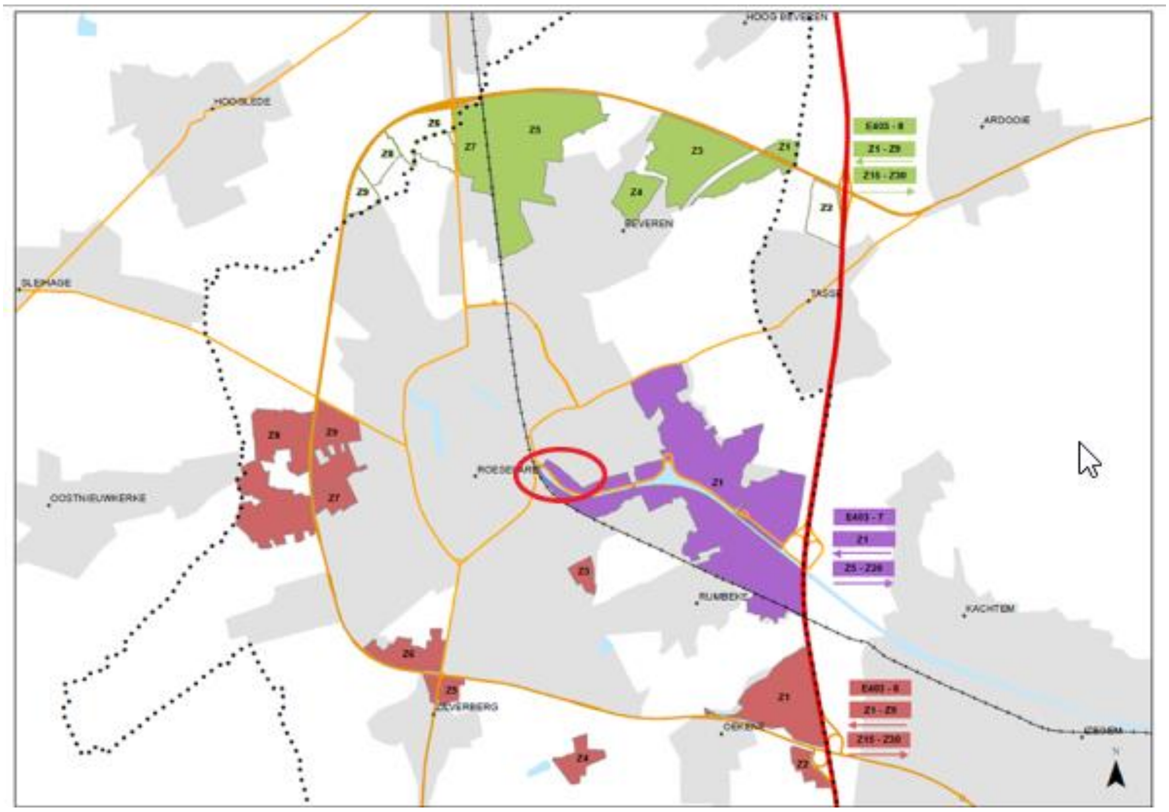
The business cluster consists of two nearby companies working in the food sector and public buildings. One of the businesses in the business cluster has a CHP that can be used more efficiently and profitably by using the residual heat for nearby buildings heating.

The companies and the public buildings make use of different types of heating. The overall heating profile of the buildings seems an interesting case that matches a CHP heat source.

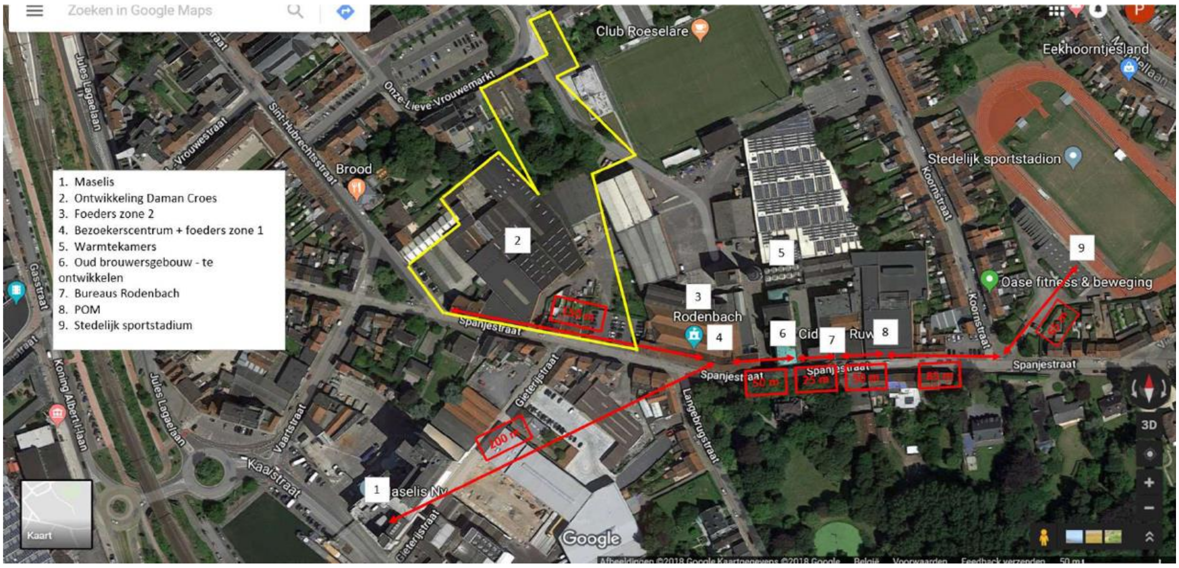
Geographical location

Location living lab in West-Flanders, Belgium:

Location of business cluster in wider region:



Map of the business cluster:



Economic activities

The business park consists of family businesses. In the past, they installed next to the canal for logistic reasons. The area is also close to the city centre of Roeselare. Most companies are active in the food industry.

As time evolved, the city centre expanded. Nowadays the companies are surrounded by residential neighbourhoods as well as public buildings and facilities.

The companies involved in this business case work 7 days a week and 24 hours a day. The heat supplier shuts down one part of the production line during the weekend. As a consequence, the CHP is not working during the weekends as well.

Opportunities and threats to create sustainable energy synergies in the business cluster

The main barrier that needs to be tackled is financial. The installation and exploitation of a heat network is expensive. A third party is needed for this. Companies won't invest themselves as this is outside their core business.

To find an investor different possible interested parties will be contacted to have a look at the business case. Possible burdens will be identified and solved.

When an investor is found, an intention agreement with the different stakeholders will be signed. This agreement shows their intent to work the business case out together until realization and beyond.

Some juridical agreements will need to be made regarding heat supply, heat demand, heat price, and back-up systems.

This agreement will have their utility when problems arise. They will help to find a clear and honest solution.

Technical case

Technical solutions

The technical concept consists of developing a heat network between the residual heat supplier and the heat users. The heat network will consist of one pipe in one street. All heat consumers can connect to this pipe.

To be able to handle the peak power, a buffer tank will need to be installed. This buffer tank will be fed during weekends or when there is a low heat demand. To realise this, the heat producer needs to agree not to switch off the CHP during the weekends.

The research started due to the question of the heat supplier. This company wanted to do something with the excess heat. A first idea of the possibilities was made by looking at the open source energy date from the grid operator. These data are on street level and give a first idea of possible big energy using companies.

A second phase of the research existed in visiting the companies to gather initial data. A first feasibility study (technical and financial) was made by a designated consultancy company.

After an interested investor is found, a detailed technical and financial study will need to be done to determine the final business case.

Energy

The CHP can deliver 250 kWth continuously during the week. During weekends 900 kWth could be delivered.

The 250 kWth delivered matches the average demand of the other company and the public buildings. To be able to handle the peak power, a buffer tank will need to be installed. This buffer can be filled with the 900 kWth delivered during weekends.

If the business case will be further developed, a technical detail study will be conducted.

Carbon reduction

The CO2-reduction realized would be 219,49 ton/year.

Conclusions

The case is technically feasible. A possible barrier is the working regime of the CHP. The heat supplying company needs to agree to turn on the CHP during weekends.

An opportunity is the planned road works in the street were the heat network will be developed.

Financial case

Financial, economic and commercial

The total cost of the heat network is estimated at 1.056.465 Euro. The details of the investment cost can be found in the table below:

Details of investment of the main heat network		
1. Disconnection of heat from supplier		€ 295 000
2. Intermediate station		€ 75 000
3. Main heat line DN100 from intermediate station to farthest user		€ 296 000
4. Buffer and accessories		€ 100 000
5. Coupling of heat user 1		€ 107 000
6. Coupling of heat user 2		€ 43 700
7. Coupling of heat user 3		€ 56 500
8. General development costs	8,5%	€ 82 765
Total cost main heat network		€ 1 056 465

The calculation below includes a depreciation of 30 years and an interest of 2,05%. This gives rise to a heat price of 62,07 Euro TVA included. The calculation can be found below.

Heat price calculation for the business cluster		
Investment		
	Total	€ 1 056 465
	Depreciation: 30 years	
	Interest: 2,05%	
	Total	€ 47 496/year

Costs		
- Right of building		- €
- electricity	17 018 kWh € 120/MWhe	€ 2042
- maintenance	1,1%	€ 4536
- general expenses		€ 3500
	Total:	€ 10 078/year
Electricity sale		
- fixed costs: CAPEX and OPEX		€ 57574/year
- Total MWh/year		1122
	Unit price/MWhth	€ 51,29
	Incl. distribution excl. TVA	
	Incl. TVA	€ 62,07

The business case can be optimised financially as no possible subsidies were included. Possible subsidies that could be included are the Call green heat, the Ecologiepremie, Subsidies for business parks and/or investment allowance.

The financial feasibility was studied by calculating the NMDA (Not More Than Usual) price. The NMDA principal explains that heat users can't pay more by using heat from a heat network than in the reference situation. The reference situation is regarded as natural gas in this case.

The NMDA prices for the different users are situated between 45 and 64 Euro/MWh TVA excluded. From the experience of the consultancy company it is known that these are normal NMDA prices.

Roles

A third party is needed for investment.

The advantages will be divided between the third party and the different stakeholders (heat supplier and heat users). The heat supplier will receive a price for each MWhth delivered. The heat users will pay a price for each MWhth used. Ideally this price paid is a certain percentage under the gas price at that moment.

The city where the heat network will be developed is in favor of a citizen cooperative as investor. In that case the citizens can invest and profit from the benefits generated by the heat network.

Conclusions

The depreciation of 30 years is too long for the companies to invest themselves in the heat network. A third party might be interested in the long term interests and therefore willing to make the investment.

The business case could be optimized by including possible subsidies. An opportunity for the development of the business case could be the road works that should take place within 5 years in the street were the heat network would be placed.

Policies, Legal context, organizational options

Currently there is no legal framework for heat exchange in Flanders, Belgium.

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Businesses who participate in the 'Energy Policy Agreement (EBO)' are obliged to conduct feasibility studies for heat and cold exchange.

VLAREM (the Flemish implementing decisions of the environmental license decree) states that in some cases the feasibility of heat exchange and CHP needs to be investigated. It considers license applications for big new combustion plants or electricity centrals and for heat networks. If the benefits are bigger then the costs, the energy efficient option needs to be applied.

Possible organizational models:

- Vertical integrated: 1 partner takes up all roles in the chain (feasibility, installation, production of heat, distribution of heat, role of energy supplier, financing, communication)
- Setting up of a consortium: Each partner takes up a role. The consortium can work in collaboration with a project developer.
- A consortium with a cooperative as partner. The cooperative as partner allows citizens to financially participate in the heat network.
- Energy manager who functions as an Energy Service Company (ESCO).

Conclusions applied on specific case

There are no legal barriers for developing heat networks.

The city of Roeselare is interested in a citizen cooperative as investor. This would suit the geographical situation of the companies. The business park is now surrounded by residential buildings due to the expansion of the city over the last decades. Giving the citizens the opportunity to invest in and benefit from the heat network will increase the support and bring the companies and citizens closer to each other.

When an investor is found, it could be a good idea to let the different stakeholders (companies, city, other public involved organizations, investor) sign a cooperation agreement. This could be coupled with a press moment.

Conclusions & Recommendations

Currently the case is on hold. The heat supplying company cannot guarantee a constant amount of heat supply during the coming years. The available residual heat depends on the production process which is optimized each year and depends on the market demand.

Before further detailed studies will be done, an interested investor should be found.

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List of annexes

Annex 1: Deel II – Haalbaarheidsstudie warmte-uitwisseling

3.4 Manor Royal Cluster 1, 2 and 3 (UK)

Introduction

Cluster 1, 2, 3 and 4 at Manor Royal were pinpointed following a high-level strategic energy study in May 2018. In addition to installing solar PV on the buildings, it was noted that a CHP (Combined Heat and Power) could be added to each cluster. The feasibility studies indicated the addition of CHP increased the IRR, reduced the amortisation, and increased CO_2 savings compared to current use, making all three clusters worthy of further investigation.

Business cluster

Each of the three clusters was selected for follow up due to the potential for PV and CHP to benefit a group of businesses with medium energy demand. Cluster 4 was excluded from further investigation due to a lack of engagement from the businesses. As Manor Royal is close to Gatwick airport, wind generation is not currently an option. Space is limited in the area so if heat pumps were used more expensive vertical boreholes would have to be used for these clusters. The CHPs could connect to a district heat network (DHN) if one is built in the future.

Geographical location

Cluster 1 is located in the central area of the business district. There are 6 companies of larger size.

Cluster 2 is located in the north of the business district. There are 7 companies, each occupying their own building.

Cluster 3 is located in the southern part of the business district. There are 13 companies of varying size and the area is mainly used for manufacturing and office space.

Economic activities

Cluster 1, 2 and 3 have a typical assortment of businesses for Manor Royal. There is some manufacturing but no heavy industry and a significant amount of office space. The buildings are not all the same age and several are due for redevelopment. Tenure is mixed with some owner occupiers and a high proportion of tenanted properties with several owners and managing agents. Hours of work are typically between 08:00 and 18:00.

Opportunities and threats to create sustainable energy synergies in the business cluster

Initially the focus will be on installing solar PV for self-supply behind the meter. In some cases, there will be opportunity to install batteries to load shift to expensive periods and take advantage of cheaper electricity overnight. If enough businesses go ahead with PV installation at the same time economies of scale will be available to all. Once sufficient generation capacity has been installed, cooperation between neighbours and trading of power within the cluster will become a real possibility either through 'private wire' arrangements or as part of a larger real-time energy trading scheme for Manor Royal.. This 'virtual power plant' should bring benefits to local energy generators (increased revenue) and local energy purchasers (reduced electricity costs) .

Technical case

Technical solutions

Rooftop PV, solar car parks, battery storage for solar power and a combined heat and power plant were considered. A conceptual layout of the energy system considering different technologies, specific requirements of individual demands (e.g. load curves) and framework conditions (e.g. tariffs, laws) was developed for each cluster. To assess the feasibility, the clusters were modelled with the software tool energyPRO for an entire reference year.

CHP combined with solar PV was investigated and both are technically and financially viable for all three clusters.

The availability of a grid connection was not tested at this stage since a high proportion is used on site and an export limitation device could be installed to manage any grid restriction.

Scenarios

A traditional feasibility study and outline business case was conducted for each cluster. Three business case variants were subsequently investigated. More detail is in the Annexes.

1. Solar PV
2. Solar PV on buildings with battery storage
3. Solar PV on buildings with CHP

Although it requires the greatest capital investment, option 3 would provide the best financial returns and CO_2 reduction scenario for each cluster.

Spatial

Installing rooftop PV would have no impact on the layout or usability of the site for businesses. A CHP plant might require an extension to the boiler house but this could be designed not to interfere with businesses.

If battery storage were to be installed, depending on its scale there may be the loss of one or two car parking spaces. There may be some opposition to this given the shortage of parking at Manor Royal.

Environmental consequences

CO_2 savings for installation of rooftop solar PV and CHP are shown for each cluster in the table below.

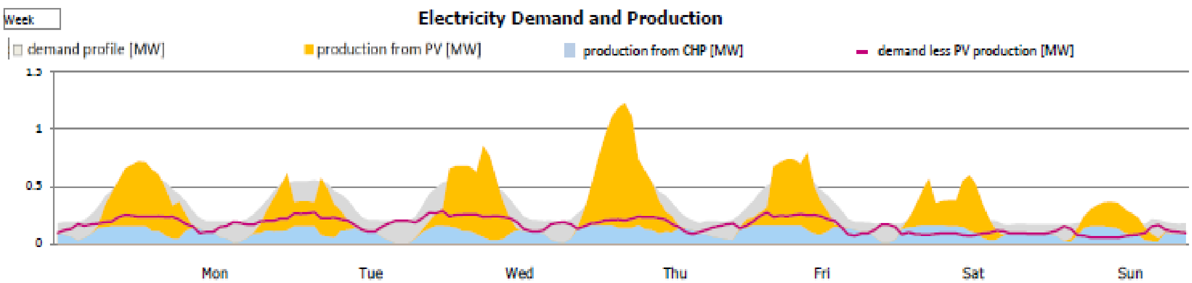
CO_2 savings per average year	CLUSTER 1	CLUSTER 2	CLUSTER 3	Total	
Savings	3,311.4	2,703.2	1,014.2	5,969.1	t/a
Relative savings	32.3	60.6	58.4	n/a	%

Energy

Option 3, rooftop PV plus a CHP, was selected as giving the best technical and financial performance for each of the three clusters. It maximises onsite renewable energy production and use and gives the best carbon saving.

OPERATIONAL DATA	CLUSTER 1	CLUSTER 2	CLUSTER 3	Total	
Installed capacity PV	2,642	4,634	1,521	8,797	kW_p
Annual yield from PV	2,238	3,926	1,307	7,471	MWh
Installed capacity CHP	674	234	157	1,065	kW_{el}
Annual yield from CHP	4,300	1,678	979	6,957	kWh_{el}
Heat Storage	81	39	32	152	m^3
El. Energy Demand	25,415	7,906	2,967	3,288	MWh/a
Electricity savings	6,515	3,348	1,340	11,203	MWh/a
Excess electricity production	24	2,257	946	3227	MWh/a

The figure below shows an example of electricity demand and production for a typical summer week from Cluster 3. Similar figures were produced for each cluster.



Carbon reduction

Expected electricity generation from solar and CHP would be 14,428MWh annually. Installing rooftop solar PV and CHP would save 5,969 t/a CO_2. This would be a relative saving of between 32% and 61% compared to business as usual (BAU) for the clusters.

Conclusions

The solar PV with CHP is technically feasible. The main barrier would be identifying a location for the energy centre required. The potential unsuitability of the roofs for solar PV is a risk.

The opportunity to save 5,969 tonnes per annum of CO_2 would be welcome and improve the reputation of Manor Royal as a sustainable place for businesses to locate.

Financial case

Financial, economic and commercial

The profitability was calculated using the financial framework parameters, CAPEX and OPEX outlined in the tables below.

FINANCIAL FRAMEWORK PARAMETERS	
discount rate	3.50%
period under consideration	25 years
O&M cost (share of invest)	0.8%
O&M cost increase	0.2%
Financing Period	25 years
interest rate on outside capital	3.5%
equity share	30%
Inflation	2.0%
Energy price increase	5.3 % (year 1-2) 2.6 % (year 3-25)

Technology	CAPEX
Rooftop PV	900 £/kWp
CHP 10-100kW	CAPEXs = 6,145 x Pel $^{-0.351}$£/kWel + 50% [£/kWel]
CHP 100-1000kW	CAPEXs = 5,545 x Pel $^{-0.352}$£/kWel + 60%
Heat storage 1m³ – 1,000 m³	230 – 1,200 £/m³

TECHNOLOGY	OPEX	DESCRIPTION
ROOFTOP PV	= 1.6% of invest	Cleaning, reserves for change of inverter, insurances, periodic inspection parts
CARPARK PV	= 1.6% of invest	
CHP 10 -100KW	= 5.5% of invest	Periodic inspection, change of wearing parts, reserves for change of CHP
CHP 0.1 – 1MW	= 4.7% of invest	

BATTERY	340 – 570 £/kWh	change of inverter, insurances, periodic inspection, change of cells

The profitability for each cluster is detailed in the table below.

PROFITABILITY	CLUSTER 1	CLUSTER 2	CLUSTER 3	Total	
Total Investment	3,232,200	4,668,500	1,824,500	9,725,200	£
average of discounted real net savings & revenues	436,700	409,600	151,000	997,300	£/a
NPV	8,118,600	6,196,700	2,195,400	10,314,000	£
IRR	43.7	23.9	21.2	n/a	%
ROI	290	153	139	n/a	%
Amortisation	2.2	4.0	4.6	n/a	A

The table below shows the CAPEX for solar PV, CHP and heat storage for each business in Cluster 1.

CAPEX PER BUSINESS/BUILDING								
#	PV Rooftop		CHP				Heat Storage	
	P [kWp]	CAPEX [£]	P_{el} [kW]	P_{th} [kW]	P_{Fuel} [kW]	CAPEX [£]	C [m³]	CAPEX [£]
1	206	184,950	64	93	177	107,520	9	11,523
2	302	271,440	25	50	78	58,250	5	8,011
3	1,420	1,278,000	360	389	847	316,800	39	35,395
4	440	396,360	120	147	309	154,800	15	15,918
5	274	246,960	105	128	270	141,750	13	14,374
6	206	184,950	64	93	177	107,520	9	11,523

The table below shows the CAPEX for solar PV, CHP and heat storage for each business in Cluster 2.

CAPEX PER BUSINESS/BUILDING								
#	PV Rooftop		CHP				Heat Storage	
	P [kWp]	CAPEX [£]	P_{el} [kW]	P_{th} [kW]	P_{Fuel} [kW]	CAPEX [£]	C [m³]	CAPEX [£]
1	1,020	918,000	20	40	63	50,400	4	7,193
2	609	547,830	40	66	119	79,200	7	9,295
3	1,240	1,116,000	54	84	147	96,120	8	10,789
4	851	766,080	20	39	62	50,400	7	9,295
5	354	318,240	50	95	147	91,500	4	7,111
6	561	504,540	50	95	147	91,500	9	11,654
7	unknown	unknown						

The table below shows the CAPEX for solar PV, CHP and heat storage for each business in Cluster 3.

CAPEX PER BUSINESS/BUILDING								
#	PV Rooftop		CHP				Heat Storage	
	P [kWp]	CAPEX [£]	P_{el} [kW]	P_{th} [kW]	P_{Fuel} [kW]	CAPEX [£]	C [m³]	CAPEX [£]
1	227	203,940	9	20	30	28,985	2	5,562
2	94	84,150						
3	540	485,820						
4	79	71,100	15	30	49	41,850	3	6,374
5	68	61,470	12	28	40	36,240	3	6,169
6	66	58,950	15	30	49	41,850	3	6,374
7	47	41,850	25	50	78	58,250	5	8,011

8	512	461,160	35	60	112	72,450	6	8,829
9	89	80,370	6	15	22	23,100	1	5,136
10	57	51,660	6	15	22	23,100	1	5,136
11	31	27,720	20	39	62	50,400	4	7,111
12	179	160,740	6	15	22	23,100	1	5,136
13	166	149,670	8	17	29	27,840	2	5,324

Roles

Businesses have been advised by the Manor Royal BID to wait for the outcomes of the funding and governance options appraisal (due in January 2019) before deciding on the funding arrangements.

Conclusions

The project is financially feasible. There is a significant opportunity to save money on energy bills and reduce CO_2 emissions by between 32% and 61%. There remains a risk that, at Board level, the businesses may decide not to participate in the project.

Policies, Legal context, organizational options

Details of the current policy and legal environment for businesses installing renewable energy systems at Manor Royal are given in Annex 6.3. The key points for this proposal are:

- The Feed in Tariff (FiT) scheme closes to new registrations after March 2019. This removes income from FIT payments, reducing project returns but not altering the conclusion that the project is viable.
- The default payment for power exported to the grid will also cease from April. The PV system owner will have to join the market and agree a Power Purchase Agreement (PPA) with a buyer for the exported renewable power. This is a rapidly developing market in the UK.
- Current legislation and regulation makes it difficult to trade electricity directly between businesses (peer to peer (P2P) trading) all trading has to be done using a registered electricity supplier or by direct wire (connection). Several trials of P2P trading are underway and it is expected that changes to regulation will be made to facilitate wider P2P trading in the near future.
- The UK's Climate Change Levy (CCL) will increase by 68% for electricity and 59% for gas in April 2019. Use of electricity generated on site which reduces power and gas drawn from the grid will reduce CCL payments.

Conclusions applied on specific case

The withdrawal of support for solar PV installations through the closure of the Feed in Tariff (FIT) scheme to new registrants after March 2019 would negatively affect a site wide energy trading model and may lead to systems being sized so that a higher proportion of generated power is used on site. It would make it harder to establish a viable inter-Manor Royal electricity trading scheme as there will be less surplus electricity available.

The loss of FIT is, however, offset by the continuing drop in installation costs for solar PV and the emergence of an active power purchase market for exported renewable electricity in the UK. This could support installations until a critical amount of power is available for trading within Manor Royal.

Incentives and the regulatory environment are changing rapidly and will have to be carefully considered in any full business case.

Conclusion & Recommendations

Finalising the energy trading model is on hold until the conclusion of the funding and governance options appraisal which is due for completion in January 2019. The business must then decide whether or not to invest, or to invite a third party to take up the opportunity or not to proceed.

Creating a larger aggregated demand in several businesses and group buying may reduce costs.

The ability to develop the project in stages (self-supply only followed by cooperation with neighbours and finally full, real-time energy trading across Manor Royal) provides a low-risk way to progress with additional benefits at each stage.

Contact

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Disclaimer

Information is partly based on feasibility studies and research, containing estimates and expectations based on the information that was available on the date of creation of this document.

List of annexes

3.4.1 BISEPS Re-Energise Project Report v5.0.pdf (published on the Manor Royal website)
3.4.2 1620005393_BISEPS_FS_Cluster1_Final-Report_181126_v5.pdf (confidential)
3.4.3 1620005393_BISEPS_FS_Cluster2_Final-Report_181126_v05.pdf (confidential)
3.4.4 1620005393_BISEPS_FS_Cluster3_Final-Report_181126_v06.pdf (confidential)

4. Solar energy

The creation of synergies between SMEs is also facilitated by engaging SMEs into joint processes. For example, if SMEs have facilitation services provided on a business park level for the installation of solar PV.

4.1 Solar PV for business park (B)

Introduction

This business case summarizes the unburdening process for the installation of solar PV (photovoltaic panels) for about 53 companies situated in the business parks Harelbeke-Zuid, Kortrijk-Noord, Waregem-Zuid, Roeselare, Lichtervelde and the canal zone Roeselare - Leie (Belgium). Leiedal, POM and WVI started with a feasibility study for those companies. Practically all reports mentioned payback periods from 5 to 10 years. But on the other hand, as we are dealing with old buildings, the study couldn't confirm for most of the cases that the roof will measure up to the recommended amount of solar PV.

As the project is ongoing, final conclusions will be drawn at a later date.

Business cluster

An investment of an industrial sized installation in solar PV gives a payback time that is acceptable for most of the companies. Payback time is helped on one hand by the Flemish green power certificates and on the other hand by basing the investment on a maximum self-consumption of the solar electricity by the company itself.

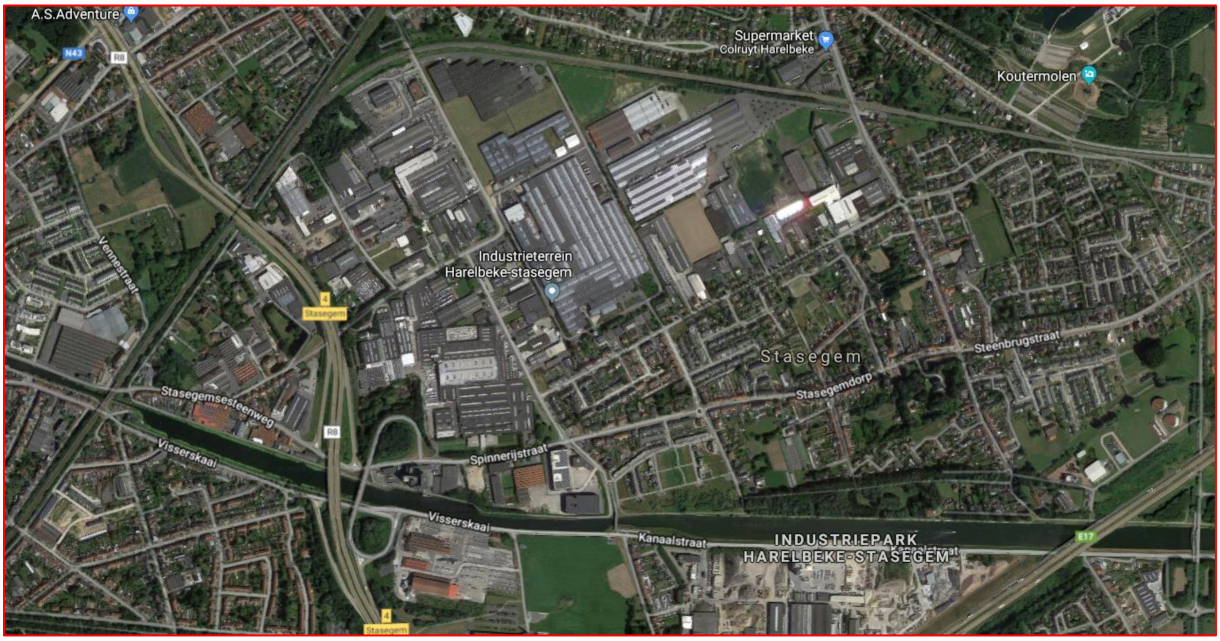
Self-produced electricity is an important issue for companies, as the prices are rising and the guarantees of delivery by the Belgian energy producers is becoming uncertain.

Most of the businesses don't have the time or knowledge to focus on renewable energy. The guidance Leiedal , POM and WVI offer them during this process is regarded to be very helpful.

Geographical location

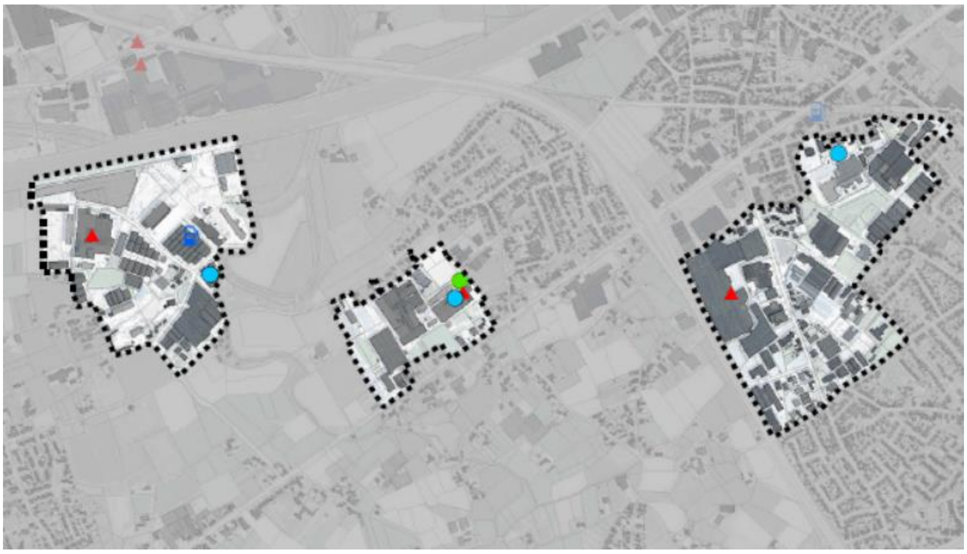
The living lab of South West Flanders consists of three big business parks in the South of West-Flanders: Kortrijk-Noord, Harelbeke-Zuid and Waregem-Zuid.

Business park Harelbeke-Zuid (Belgium):

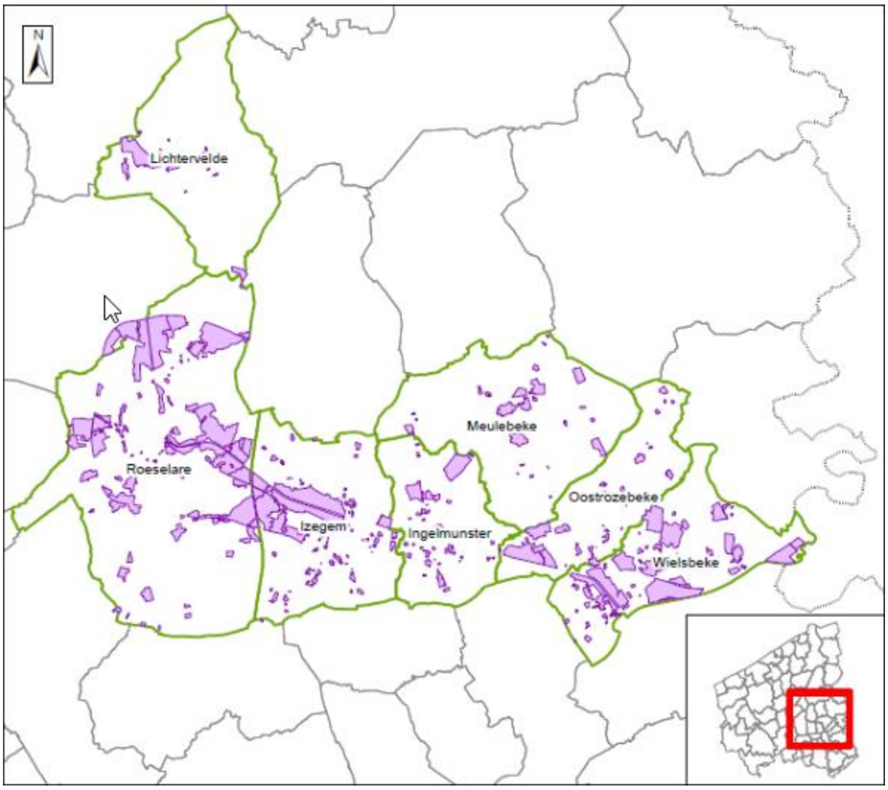


Business park Kortrijk-Noord (Belgium):

Business parks Waregem-Noord en Waregem-Zuid (Belgium):



The living lab of Mid-West-Flanders contains the business parks in Lichtervelde, Roeselare and the canal zone Roeselare – Leie:



Economic activities

In Kortrijk-Noord, Harelbeke-Zuid and Waregem-Zuid we mainly encounter small and medium enterprises, only a small number of big companies are situated in these business parks. The activities from these businesses are very diverse, going from production enterprises to assembly or installation companies to wholesalers.

The living lab Mid-West-Flanders has small, medium and large enterprises. The activities from the businesses are very diverse. In Roeselare there is a focus from the big enterprises in the food sector. In the canal zone there are also companies active in the textile and wood processing sector.

Opportunities and threats to create sustainable energy synergies in the business cluster

The biggest bottleneck is the stability of the roof. For most of the cases, the feasibility study couldn't confirm that the roof will measure up to the recommended amount of PV panels. Therefore, the focus is on working together with different installers and third-party investors that offer stability studies for a reasonable price.

Another bottleneck is that the user of the building is not the owner, but a tenant or leaseholder. This means the owner of the estate needs to be convinced to make the investment in solar PV.

We also deal with some multi-company buildings. In these cases, we have the advantage of a big roof, but the disadvantage of many small energy users that, in according to the legislation, are to be seen as separate investors. For these cases, but also in general, electricity sharing would be a better or feasible business case, but is not allowed in Belgium for the moment (except direct lines, but this concept isn't practicable in our living lab). Europe is creating a possibility of electricity sharing in the near future (2021) by working on legislation for Local Energy Communities.

Lastly some buildings have asbestos roofs. In this case a roof renovation is required prior to installing PV. The profit of the PV installation can then be used for financing the roof renovation.

Technical case

Technical solutions

These steps were followed:

- Intake (questionnaire to obtain basic information and interests from each company of the Living lab)
- Feasibility study for 53 cases, made by an external expert (consultancy agency)
- Tender analysis executed for one enterprise, made by an external expert (consultancy agency)

Next steps (on demand of the company):

- Stability study
- Tender analysis & advice with the aim to optimize the investment
- Project preparation
- Project follow-up
- Unburdening trajectories for specific cases: roof renewal (asbestos) and facilitating third-party investment
- Experience exchange

Energy & Carbon reduction

Feasibility studies were carried out with 53 companies in total (see table below). If all would be implemented (which will not be the case), 83.363 solar PV-panels would be installed, for a total production of 20.734.060 kWh/year, resulting in a carbon reduction of 9.036 tCO_2/year.

Company #	energy use (kWh)	number PV panels	peak power (kWp)	solar PV production (kWh)	CO2-reduction (ton)
1	1 106 570	1 100	297	241 238	110,97
2	1 174 399	1 500	405	321 651	147,96
3	352 164	800	216	184 680	84,95
4	945 088	1 250	338	253 465	116,59
5	329 493	650	176	138 739	63,82
6	1 439 451	850	230	191 862	88,26
7	33 264	105	28	4 118	1,89
8	130 000	244	66	55 218	25,40
9	411 078	900	243	192 991	88,78
10	304 028	450	122	101 574	46,72
11	211 913	375	101	80 413	36,99
12	440 412	1 250	338	282 878	0,13
13	513 027	900	243	192 991	88,78

14	81 604	149	40	30 347	13,96
15	24 330	92	25	22 418	10,31
16	684 785	1 200	324	270 864	124,60
17	67 991	114	31	25 732	11,84
18	534 011	900	243	192 991	88,78
19	166 879	375	101	80 413	36,99
20	267 006	575	155	123 300	56,72
21	2 563 375	2 500	675	564 300	259,58
22	54 479	160	43	34 309	15,78
23	394 604	490	132	105 073	48,33
24	1 583 396	2 250	608	483 722	222,51
25	646 729	1 500	405	321 651	147,96
26	126 000	306	83	69 070	31,77
27	31 023	72	19	15 439	7,10
28	318 319	675	182	131 585	60,53
29	809 000	878	250	237 500	47,30
30	286 000	1 087	310	294 500	58,60
31	6 300	21	6	5 700	1,10
32	223 000	701	200	190 000	37,80
33	32 350	95	27	25 650	5,10
34	25 000	63	18	15 390	3,10
35	1 034 000	1 400	400	380 000	75,60
36	208 000	469	134	127 300	25,30
37	227 000	490	140	133 000	26,50
38	41 000	53	15	12 113	2,40
39	296 383	541	154	146 481	67,38
40	875 000	3 523	1 004	953 852	438,75
41	14 629 000	17 574	5 009	4 758 161	2 188,67
42	11 476 579	2 964	845	722 253	332,22
43	459 333	786	200	190 000	87,40
44	92 077	250	75	71 250	32,77
45	255 524	351	100	95 000	43,70
46	195 278	288	82	76 000	34,96
47	78 310 000	6 448	1 838	1 694 849	779,60
48	191 000	252	72	68 229	31,38
49	320 000	1 056	300	285 000	131,09
50	1 408 737	1 414	403	382 850	176,10
51	15 100 000	17 720	5 050	4 292 670	1 974,55
52	7 682 000	2 342	667	634 097	291,67
53	1 396 000	865	247	229 183	105,42
Total	**150 513 979**	**83 363**	**23 414**	**20 734 060**	**9 036**

Conclusions

For most of the cases, and as we are dealing with old buildings, the feasibility study couldn't confirm that the roof will measure up to the recommended amount of PV panels. The focus is now on delivering stability studies for those companies, by working together with different installers and third-party investors (that offer stability studies for a reasonable price).

Financial case

Financial, economic and commercial

Feasibility studies were carried out with 53 companies in total (see table below). If all would be implemented (which will not be the case), an investment of €20.730.250 would be necessary, with an average IRR (investment return rate) of 10,7% and an average payback time before investment allowance of 8,1 years. The figures differ case by case. The best and worst case have an IRR of 18,3%, and 5,9%, respectively.

Company #	peak power (kWp)	investment amount (€)	IRR before taxes	payback time before investment allowance
1	297	331 224	7,20%	8,6
2	405	423 324	5,90%	10,1
3	216	236 524	8,10%	8,1
4	337,5	352 324	7,90%	10
5	175,5	187 924	10,00%	8,1
6	229,5	243 724	12,60%	7,1
7	28,4	45 599	10,60%	8,4
8	65,9	90 356	16,90%	5,9
9	243	258 924	8,20%	9
10	121,5	135 624	11,70%	7,5
11	101,3	115 074	8,20%	9,1
12	337,5	354 824	12,20%	7,3
13	243	263 924	10,00%	8,1
14	40,2	59 196	15,00%	6,5
15	24,8	40 984	11,30%	8
16	324	346 124	10,90%	7,7
17	30,8	48 794	7,10%	11,3
18	243	258 924	9,90%	8,2
19	101,3	115 074	8,90%	8,8
20	155,3	169 874	9,20%	8,6
21	675	707 324	9,20%	8,4
22	43,2	65 124	11,70%	7,7
23	132,3	144 584	7,50%	9,6
24	607,5	633 824	10,80%	7,8
25	405	423 324	8,10%	9
26	82,6	96 168	17,50%	5,7
27	19,4	33 884	10,30%	8,6
28	182,3	199 774	8,50%	9
29	250	242 500	12,30%	7,8
30	310	293 650	8,10%	10,8
31	6	7 440	16,90%	5
32	200	200 000	8,70%	10,2
33	27	27 000	17,90%	4,6
34	18	19 910	18,00%	5,1
35	400	362 000	14,10%	7,2
36	134	145 340	9,80%	9,4
37	140	150 000	9,90%	9,3
38	15	15 750	7,00%	9,7
39	154	113 000	17,90%	5,2
40	1 004	875 000	10,60%	7,4
41	5 009	3 775 000	9,60%	7,8
42	845	749 375	9,90%	7,8
43	200	200 000	11,00%	7,4
44	75	85 750	8,20%	8,8
45	100	110 000	8,90%	8,3
46	82	90 800	18,30%	5,3

47	1 838	1 504 000	8,30%	8,1
48	72	82 720	6,40%	9,7
49	300	284 500	8,60%	8,3
50	403	370 000	12,60%	6,8
51	5 050	3 807 500	9,30%	8,1
52	667	596 960	10,80%	7,3
53	247	239 710	8,30%	8,5
TOTAL	**23 413,8**	**20 730 250**	**10,69%**	**8,1**

Roles

For most of the cases, the investment will be made by the company (user and owner of the building). In case of larger projects, the interest and benefit of third-party investment is increased.

If the user of the building is not the owner, we try to convince the owner of the estate by accepting an investment from a third-party investor. In this case, we offer the owner and the user the same unburdening trajectory as defined for own investments. The same process counts for installations of solar PV that are preceded by roof refurbishment. As the project is still ongoing, the cooperation model will be detailed at a later date.

Conclusions

The 53 cases make clear that the investment in solar PV differs for every company. For some companies this will be far more interesting than for others. Payback times vary between 4,6 years and 11,3 years. This might be not in line with the expectations. Third party investment can offer a solution.

Final conclusions will be drawn at a later date.

Policies, Legal context, organizational options

PV installations installed on roofs cannot be higher than 1 m, otherwise a building permit is needed. For other installation (i.e. on the ground), a building permit is needed.

PV installations that are connected to the grid must be requested or mentioned to the distribution system operator (DSO). Installations with an inverter up to and including 10kW maximum power must only be reported after installation is completed. These installations will make use of a revolving counter.

Installations with an inverter bigger than 10 kW, must be requested in advance. These installations make use of two counters. One counter measures the electricity extracted from the grid. The second one measures the electricity injected into the grid. The rate received per kWh into the grid is not equal to rate paid per kWh extracted from the grid.

When the electricity produced by PV on the roof is consumed in the same building, the following financing models can be applied:

- The owner invests.

- A third party invests. Special forms can be a cooperative as third-party investor or an entity where the employees of the company can invest
- Energy service company (ESCO): The investment is paid with the realized energy savings. At the end of the contract, the profit is for the client of the ESCO company (owner or renter of the building).
- Crowdfunding
- Crowd lending

Electricity sharing can happen through one of the following models:

- Direct line:
  - A direct connection between the production installation and the electricity consumer is installed. The electricity won't be injected in the existing grid operated by the DSO.
  - If the direct line crosses parcels of different owners, an approval of the VREG (Flemish regulator of the electricity and gas market) is needed.
- Sun sharing:
  - This form of electricity sharing is only in pilot phase. For the pilots, roofs of public buildings are used. Citizens can invest in PV on the roof of the public building. The produced energy by the owned PV on the public roof is deducted from the citizen's electricity consumption from the grid.

Conclusions applied on specific case

Electricity sharing can result in a feasible business plan for a lot of companies (e.g. multi-company buildings), but is not allowed in Belgium for the moment.

Conclusion

Many businesses/SMEs are interested in installing solar PV on their roof. As an overall conclusion over 53 cases, it becomes clear that even with a standard product like solar PV, a wide array of results in business cases is generated, with payback times that can be double as long. Leiedal, WVI and the POM try to take the process further, but encountered major barriers:

1. roof stability and necessity for roof refurbishment
2. willingness of the companies to invest with own financial means or proceed via third-party investment
3. longer payback times than expected.

Final conclusions will be drawn at a later date.

Contact

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Disclaimer

Information is partly based on feasibility studies and research, containing estimates and expectations based on the information that was available on the date of creation of this document.

4.2 Solar car park (B)

Introduction

This business case checks the option to cover a carpark with a solar PV pergola, with option to combine with battery storage and/or charging point for electric vehicles.

Business cluster

The business case was developed for a site called "Transfo", a former electric power plant that now is re-developed as a site for business, adventure and culture. The carpark is linked with a building that will host 5 businesses. The electricity produced by the solar carpark also could be used to supply a diving tank or other energy consumers on the site. It is the vision to create a smart grid in the future (local energy community).

Geographical location

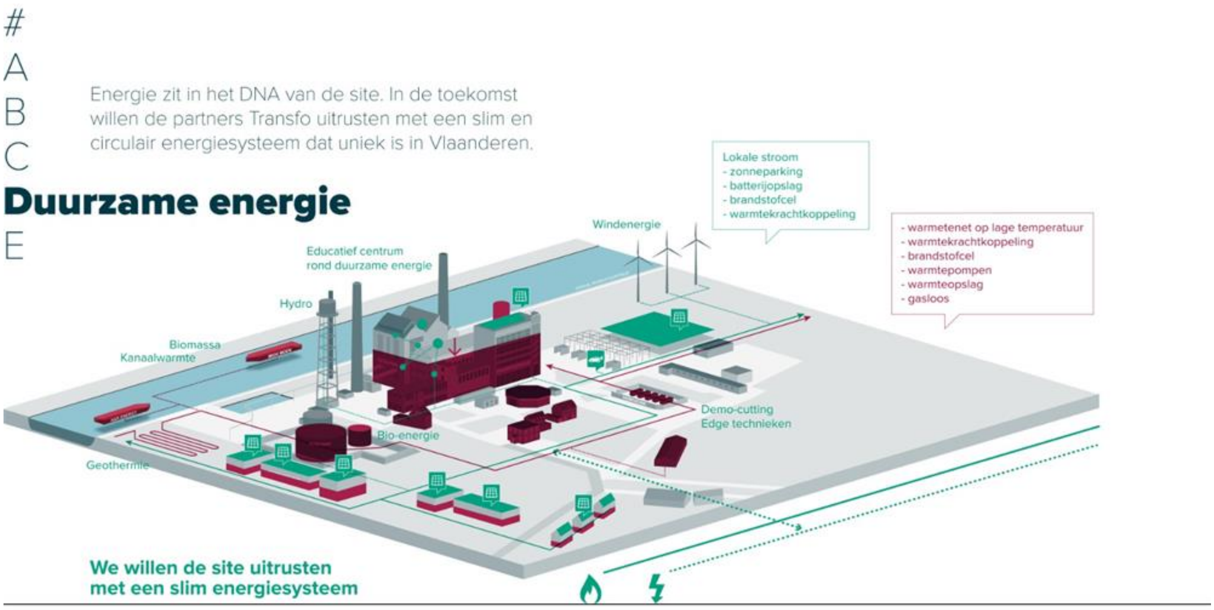
The site Transfo is situated in the municipality of Zwevegem, near the city of Kortrijk (Belgium).

Economic activities

On the Transfo site, there are 3 types of activities: adventure (most important from energy perspective is the diving tank, with energy use 24/7), culture (most activities during the weekend) and businesses (offices are planned, activities will be on weekdays).

Opportunities and threats to create sustainable energy synergies in the business cluster

It is the ambition to develop the site into a showcase of the future energy system. In future, a Local Energy Community (LEC) will be developed when legally possible (expected 2021). A smart grid will allow all energy users on the site to make use of the collectively produced energy on the site. Energy will be stored and shared, and will be managed by the LEC.



Vision on the future energy system Transfo

However, today a LEC is not possible yet. Therefore, measures need to be taken to avoid lock-ins: the chosen options today should be compatible with the future energy system. But with a lot of uncertain parameters (e.g. a lot of cost parameters are unknown), it is not obvious to make the right decisions today. However, as the development of the 5 business units is ongoing, decisions need to be made.

As a result, the business case was developed with the assumption of low self-consumption, which has a negative impact on the profitability of the project under current Belgian regulations.

The parking lot is newly developed, thus the design is adaptable. Existing parking lots might have constraints, such as limited room for the columns of the pergola, could require large spans in the pergola (higher cost) to secure the function as parking, or simply has trees that can not be combined with solar PV.

Technical case

Technical solutions

A solar car park is regular parking that is covered with a pergola, with solar PV on top (2.328 panels in total, installed power of 628 kWp). It is not a “regular” solar carport, for which all-in packages are on the market, but a tailor-made solution. An architect designed the pergola (various options) for different orientations of the PV-panels and different organisations of the parking spaces. A building permit is required.

Different options were researched with or without battery system (40,5 kWh) and a charging point for an electrical car.

The case presented here is the optimum of all different options, thus with battery system and charging point for EV.

Energy & Carbon reduction

With an installed power of 628 kWp, a yearly energy production of 582 MWh is expected. This would result in a carbon reduction of 115,8 tCO_2/year.

Conclusions

Technically, it is feasible to cover parking lots with a solar pergola. A tailor-made design allows the optimization of both solar energy production and the organization of the parking spaces underneath. A combination with charging points for electric vehicles and battery storage is obvious.

Financial case

Financial, economic and commercial

The financial case is not evident. In the current context, it is not possible to bring the energy "behind the meter", which is in Belgium the economically most interesting option. Therefore, it is assumed that most of the energy is directly injected into the grid, except the energy that is used to charge electric cars (and to charge the battery system). Together with the income from green energy certificates, a yearly income of 65.500 is estimated.

The total investment is €628.000 for PV, €19.500 for the battery system, and €276.094 for the construction of the pergola. The battery will need replacement after 10 years, the system converter after 15 years. The total investment during the lifespan of 25 years will be €840.000, plus the cost of the pergola.

The payback time is estimated at 12,8 years. The cost of the pergola increases this by 4,2 years, to 17 years.

Roles

A third party investor will be involved to realize the solar car parking. The municipality of Zwevegem, owner of the Transfo site, has appointed a citizen cooperative to invest in municipal solar PV-projects. The Province of West-Flanders owns the diving tank, and granted subsidies to realize the solar car park. Leiedal develops the 5 business units and the parking.

Conclusions

The financial case in the current scenario is not convincing, with a total payback time of 17 years. However, this must be substantially optimised:

- if the Local Energy Community is realised,
- if (parts of) the energy is (temporarily) consumed behind the meter with use of a direct line.

For a company with a lot of energy consumption and a lot of parking, this should be a feasible case. At the Transfo site, due to the demonstrative character, subsidies will reduce the payback time to an acceptable level.

Policies, Legal context, organizational options

PV installations installed on roofs cannot be higher than 1 m, otherwise a building permit is needed. For other installation (i.e. on the ground), a building permit is needed.

PV installations that are connected to the grid must be requested or mentioned to the distribution system operator (DSO). Installations with an inverter up to and including 10kW maximum power must only be reported after installation is completed. These installations will make use of a revolving counter.

Installations with an inverter bigger than 10 kW, must be requested in advance. These installations make use of two counters. One counter measures the electricity extracted from the grid. The second one measures the electricity injected into the grid. The rate received per kWh into the grid is not equal to rate paid per kWh extracted from the grid.

When the electricity produced by PV on the roof is consumed in the same building, the following financing models can be applied:

- The owner invests.
- A third party invests. Special forms can be a cooperative as third-party investor or an entity where the employees of the company can invest
- Energy service company (ESCO): The investment is paid with the realized energy savings. At the end of the contract, the profit is for the client of the ESCO company (owner or renter of the building).
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- Crowd lending

Electricity sharing can happen through one of the following models:

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  - If the direct line crosses parcels of different owners, an approval of the VREG (Flemish regulator of the electricity and gas market) is needed.
- Sun sharing:
  - This form of electricity sharing is only in pilot phase. For the pilots, roofs of public buildings are used. Citizens can invest in PV on the roof of the public building. The produced energy by the owned PV on the public roof is deducted from the citizen's electricity consumption from the grid.

Conclusions applied on specific case

In this case, legislation does not facilitate the realization of the solar car parking: a building permit is required, and the financial case is worse due to the high proportion of less profitable energy that is directly injected into the grid. Today, a direct line and battery storage can improve the business case. In future, the option of the Local Energy Community will be favourable.

Conclusion

Parking lots offer many chances for solar PV, if no high vehicles need to cross the parking lot, if it has no trees, and if the lay-out allows an economic construction of a pergola. Today it is not very likely to find good business cases. The cost of the pergola reduces the profitability, and a high share of electricity should be used “behind the meter”. But in future, with the implementation of the Local Energy Communities option in legislation, this will become viable.

Contact

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Disclaimer

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List of annexes

business case solar car park.pdf

5 Collective approach for business clusters

5.1 Doornbos and Platform BV Breda (NL)

Introduction

The Platform BV Breda –an association of businesses an energy stakeholders- cooperates with the municipality of Breda to unburden companies to realize rooftop solar PV. This chapter summarizes the unburdening process for solar PV for a multi-business building situated in the Doornbos business park. Doornbos is a first testcase; the Platform BV Breda- approach will be rolled-out in all industrial areas in Breda.

Living Lab Breda

The Platform BV Breda develops breakthrough scenarios and innovative concepts. It unburdens companies to invest in sustainable energy or improve energy efficiency, to enable their energy transition towards fully sustainable buildings. The Platform BV Breda facilitates the foundation of cooperative overarching multiple business clusters, including Doornbos.

Platform BV Breda holds the support of the grid owners, energy producers, (local) advisors, energy cooperatives, the region and the provincial fund raiser. Policy makers design, explore, experience and refining new policies and regulations in real-life scenarios.

The Doornbos case (light industry cluster) is an example of how to unburden an owner association that is not well organized. Together with the municipality of Breda, the Platform BV Breda set up 3 trajectories:

1. The “Solar PV SDE” subsidy. The first round has allocated 4502 kWp (39 companies), one third is realized. The second round has identified 3600 kWp (in progress).
2. “Klimaatroute” advises and unburdens companies with climate measures (obligatory and optional), such as solar PV. Already 150 sites were visited, and 15.003 ton CO_2 reduction is identified. 504 ton of CO_2–reduction is realised.
3. Converting to “all electric”, thus implementing the exit-from-natural-gas-strategy. 3 companies join the trajectory.

Geographical location of the Business areas and their projects.

The map shows all business parks of Breda (in purple and blue). The cluster of Doornbos is indicated by the red rectangle.

Economic activities

Doornbos is, like most business parks of Breda, mainly occupied by SMEs.

Technical case

Technical solutions

Whereas Platform BV Breda supports multiple sustainable energy solutions, an example is given for solar PV. Today, 39 companies are in a trajectory to install solar PV with the "Solar PV SDE" subsidy, for a total of 4502 kWp installed power.

However, an assessment is necessary to check roof stability in order to carry the weight of the solar PV-panels.

Spatial

There are no spatial consequences.

Energy

As an example of a typical solar PV-installation for one SME:

- poly crystalline (blue) solar panels of 98.182 Wp
- yearly energy production: 74.822 kWh
- yearly carbon reduction of 39,4 ton CO_2

Conclusions

Solar PV is a very common and solid technology solution. Roof stability is the major technical barrier.

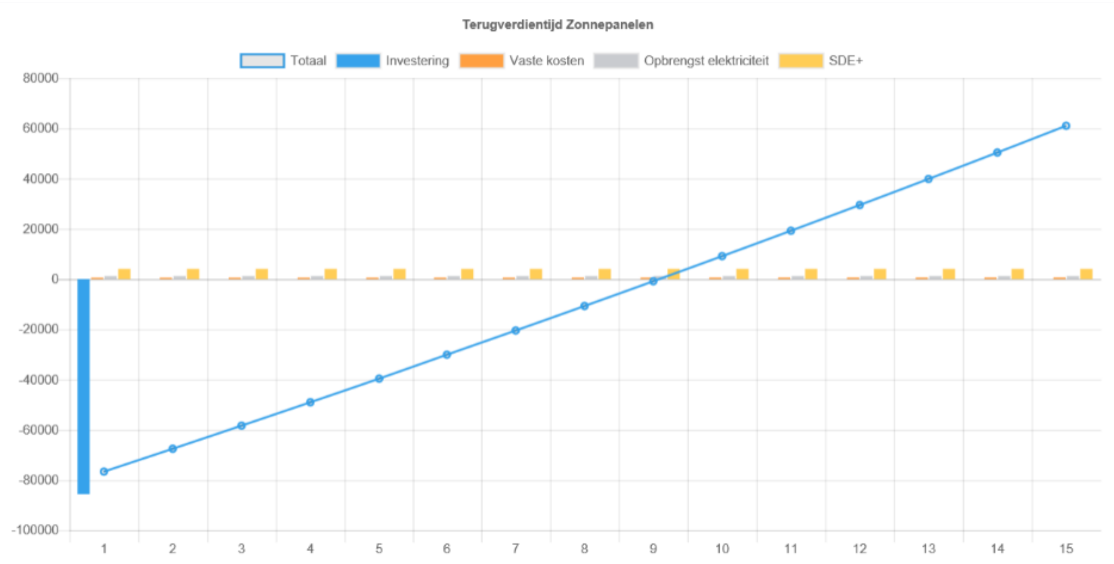
Financial case

Financial, economic and commercial

For the example given, a total investment of € 85,611.75 (ex. VAT) is needed for Investment in solar panels € 83.113.75 (including maintenance costs in future), and the investment in a stronger electricity connection to grid € 2.498,00.

The total yearly savings are € 10,593.50 (ex. VAT), consisting out of yield sale electricity and "Solar PV SDE" subsidy: net supply of electricity of € 1,208.75, use of own solar PV-electricity valued at € 2,158.26, saving energy tax € 3,047.88, sales of GVO's € 134.31, and "Solar PV SDE" € 4,044.30.

The payback time is 10 years (see table below).



Roles

The innovation in this case is how the Platform BV Breda cooperates with the municipality of Breda to unburden companies to become energy neutral. An Energy Breda foundation (in progress) will continue to implement this standard method. The method was developed in a green deal between the municipality of Breda, The Platform BV Breda and other partners such as Hezelaer Energy (energy services company), the BOM (provincial development agency) and Enexis (grid owner) all of whom signed a letter of intent for the BISEPS project. The objective is to develop new business cases in a revolving way.

Conclusions

The payback time in this case is quite long, but differs from business case to business case. This quick scan of solar PV gives an honest insight into the payback time and should be used in the Netherlands as an initial scan.

Policies, Legal context, organizational options

The SDE-subsidy ("support sustainable energy") is a national subsidy scheme. In short, the subsidy works as follows: on the basis of a number of assumptions, the government determines the cost price of a generated kWh. This is currently far above the market price of energy (the so-called APX price). The government subsidizes the difference between cost price and market price (with a maximum of 13 cents). The subsidy is determined every 15 minutes.

Conclusions applied on specific case

The SDE-subsidy makes the investment in solar PV financially feasible for SME's.

Conclusion & recommendations

To maximize energy generation on roofs, following action points were taken:

- Founding of "Energy Breda foundation" in cooperation with the business, in order to unburden businesses and finance sustainable energy investments.
- Approach companies via a physical visit on behalf of the Platform BV Breda and municipality of Breda, to check if they want to make their roofs available for solar PV for other companies.
- Offer companies feasibility studies on energy saving measures with short payback times (5 years); renewable energy production (https://quickscan.platformbvbreda.nl/); studies on how to exit from natural gas (optional).
- Create agreements for renting the roof and selling energy.
- Recruitment and selection of companies for "SDE + projects" and cooperative projects under the subsidy reduced tax scheme.
- Support the companies through the process, including to realization. Most SMEs don't have employees specialized in sustainable energy transition and need unburdening.

Contact

Case Doornbos

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Case Green Deal Roll out

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Information is partly based on feasibility studies and research, containing estimates and expectations based on the information that was available on the date of creation of this document.

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1. Concept Green Deal for the roll out with the tool

2. Quick Scan Sun Panels https://quickscan.platformbvbreda.nl/

3. Agreement between Platform BV Breda and Municipality Breda

4. Klimaatroute https://quickscan.klimaatroute.nl/accounts/profile/

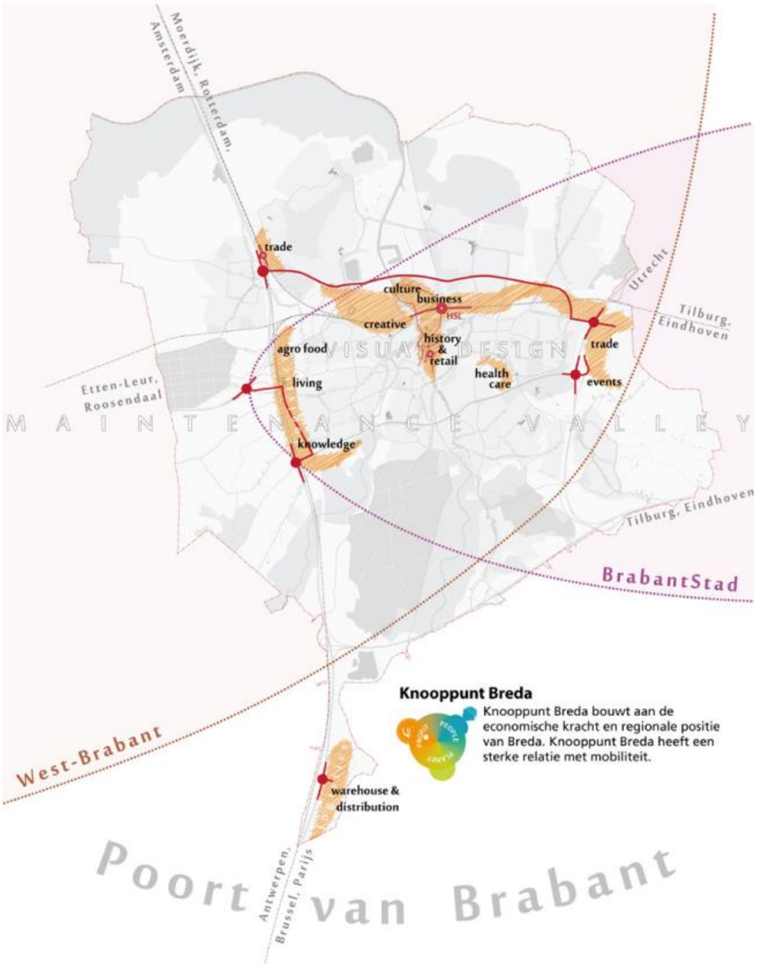
5.2 3-BO Breda

Introduction

Business cluster

This business case focuses on business clusters: 3-BO (which has light industry). The business cluster is well organized and has a high level of centralized management structure. The clusters maintain the safety and public space at their own expense. Sustainable development is their next project. On the business areas in Breda there are 2 Business Improvement Districts (BIDs). 3-BO and the business park Steenakker make up one BID. In cooperation with the Platform BV Breda, Breda municipality is setting up 6 more BIDs. Well organized business associations can speed up the energy transition.

Geographical location



Economic activities

The Business Improvement District "3-BO" consists out of 3 industrial areas called "Hoogeind", "Bijster" and "Takkebijster / Moleneind". This makes 3-BO a mixed business area with offices, trades, logistics and light industry.

Opportunities and threats to create sustainable energy synergies in the business cluster

The BID 3-BO has 500 businesses and budget to invest. The 500 companies work together under a BID Board. The companies previously worked together in the fields of safety and green maintenance. The BIDs, industrial sites and business parks are an important target group in the policy of the municipality of Breda. The BID 3-BO is part of the “Platform BV Breda”. The Platform BV Breda, supported by the Municipality of Breda, provides policy development and cooperation in the area of sustainability.

The BID is keen to use the energy of 3 planned wind turbines, as part of the sustainability strategy, as well as the energy of a large scale solar PV-plant on the landfill called “Bavelse Berg”. The grid owner is willing to cooperate. This led to a feasibility study of wind turbines on the site. Consultations were held with the associations of citizens in the neighbourhood, the province, the Ministry of Defence, the local energy supplier, the provincial development agency BOM (development society and financier) and the grid network manager. The three wind turbines have been regulated in the municipal zoning plans.

Technical case

Technical solutions

In this case, several technical solutions will be combined:

- Wind energy of 3 big wind turbines. Here the most important barrier are:
  - the radar detection of a military airport which might make wind energy at this site impossible. As a result, only 1 wind turbine might be realized. Or 3 smaller, mid-size wind turbines might be realized instead.
  - The connection needed to the grid, which needs an investment of €2,7 million.
- The ambition is to distribute the energy from the wind turbines and solar PV locally, and let businesses of the 3-BO BID benefit. This is the biggest challenge.
- Solar PV on a landfill
- Energy storage

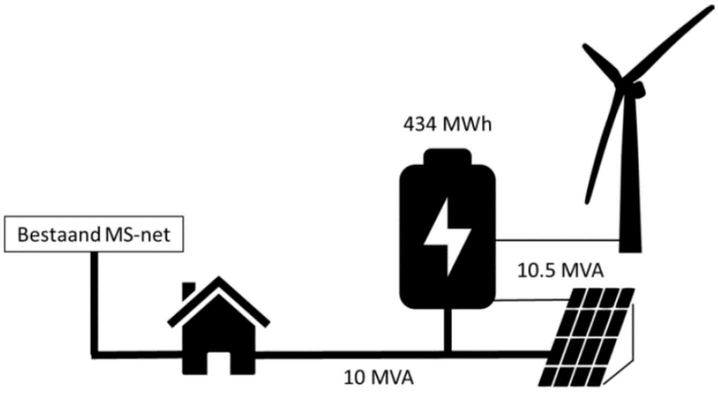
Scenarios

There are 2 scenarios on how to connect the sustainable energy infrastructure (wind, solar, storage) with the businesses on one hand, and with the electricity grid on the other side.

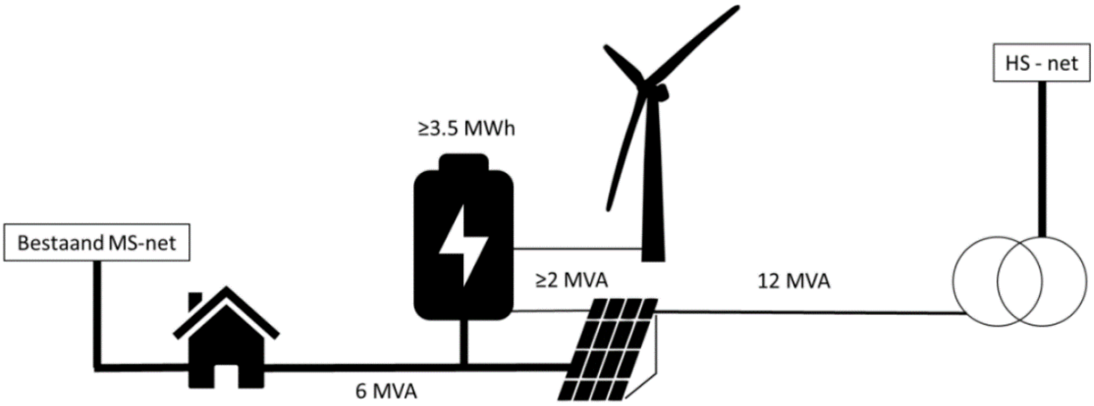
An energy analysis will be carried out via data from grid operator Enexis, analysing the power consumption per hour. In addition, the yield data of wind and solar will be yielded to make clear at which moments and how much is being overproduced.

In scenario 1 (see scheme below), the energy infrastructure is first connected to the businesses of 3-BO, and the balance (production – consumption of businesses) will be supplied to the mid-voltage grid. A 2,7 million cost for connection to the high-voltage grid is not needed. The mid-voltage grid is strengthen.

A big battery storage is foreseen for balancing and avoiding overload of the grid. Further research is needed on the energy storage options: 1 shared battery or 1 per company, hydrogen production. It is researched how energy can be used for street lighting, to create a DC network, loading public transport buses, driving electrically…



In scenario 2, there is a connection to the high voltage grid. In this case, there will be €1,5 million left for energy storage.



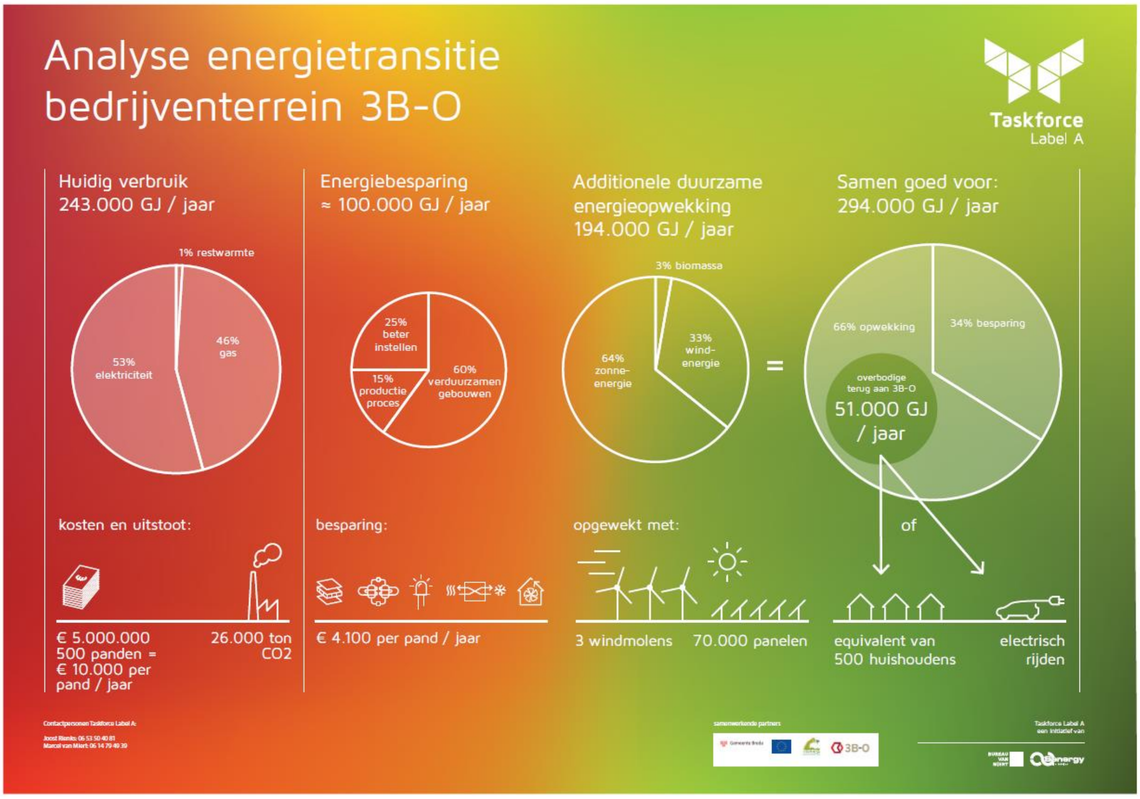
Spatial

Wind turbines are possible according to the municipal spatial development plan, but the military radar might cause restrictions. External studies are carried out, in particular wind study. An applying for an environmental permit (is happening but further investigation into radar disruption military base is ongoing).

Energy

Together there will be 54,000MWh/year.

- Wind turbines: a maximum of 16,700 MWh/year
- Solar PV on the landfill: 16,700 MWh/year



Carbon reduction

There will be a reduction of 23,220 tCO_2 when realizing the wind energy and the solar PV project.

Conclusions

There are no technical barriers. The only risk is the difficulty with the military radar of the nearby airfield. One of the solutions is to change the exact location and position of the 3 wind turbines.

Financial case

Financial, economic and commercial

The major financial parameter, beyond the investment cost in wind turbines and solar PV, is the cost of connecting 3 big wind turbines to the high voltage grid, estimated at €2.7 million. This cost largely becomes available when connecting to the mid-voltage grid, which only costs €0.7 million: €2 million comes available for the energy storage that then is needed for grid balancing.

Business cases for solar PV and wind energy are being made via the SDE subsidy (national subsidy scheme for sustainable energy):

- SDE-subsidy for the land fill project has been approved for 2019.
- The total investment for 3 wind turbines amounts to approx. €10 million. This is based on the nine following assumptions:
    1. Profit wind BV 11.4%

2. Investment turbine € 1,200 per kW installed capacity
3. Variable operation & maintenance € 12.30 per kWh generated
4. Storage for transaction costs, basic price premium € 0.0122 per generated kWh
5. Maximum SDE-subsidy for the Breda wind area: 7.2 cents per kWh generated (the wind turbine has been chosen and the SDE subsidy is confirmed)
6. Land allowance € 0.0032 per kWh generated.
7. Economic term 15 years.
8. Yield losses 13%.
9. Inflation 1.5%

Roles

Generally, wind turbines are 80% financed by banks and 20% with equity capital (in this case the BOM). This is, among other things, a requirement to receive SDE subsidy. This means that € 2 million must be contributed as equity (via BOM) or as a subordinated loan. The equity can be contributed in various ways:

1. 100% by investor(s), who also have 100% ownership. Usually the generated energy is then connected to the grid and sold to an energy supplier who resells it to companies and consumers.
2. 100% by the cooperative society as a whole.
3. 100% by individual members of the cooperative association.
4. 100% as a subordinated loan in, for example, a foundation, association or cooperative association.

The development costs to up to financial close amounts to approx. € 300,000. This € 300,000 must be made available in advance. The cooperative has procured a “payment upon successful project delivery” contract, where if the project does not go ahead there will be no cost to the cooperative. The above development cost of € 300,000 is included in the investment budget and reimbursed at the time of Financial Close.

Conclusions

The case seems financially feasible, but several options need to be considered. After the development phase the decision is taken if the project is feasible or not. When the options are selected, all agreements are recorded and execution can begin.

Policies, Legal context, organizational options

The SDE-subsidy scheme is important to make the project financially feasible. The SDE-subsidy (“support sustainable energy”) is a national subsidy scheme. In short, the subsidy works as follows: on the basis of a number of assumptions, the government determines the cost price of a generated kWh. This is currently far above the market price of energy (the so-called APX price). The government subsidizes the difference between cost price and market price (with a maximum of 13 cents). The subsidy is determined every 15 minutes.

The big challenge is to get 500 companies and the housing districts using this local energy to help reduce cost of the mid-scale and high scale grid connection. The savings on grid connection can then be invested in storage.

Conclusion & recommendations

The process is ongoing, but very important in this business case. The project is lead by the BIS 3-BO, covering 500 companies, in close cooperation with other stakeholders such as the municipality of Breda. The approach is to have a maximum involvement of all stakeholders in all stages of the project.

The case seems technically and financially feasible, but some options need to be taken. It is the ambitions to maximise local consumption of local production, but legal and financial barriers might block the implementation of this ambition. The options are still in research, in cooperation with the stakeholders.

This insight from the approach will is being rolled out to all the Business Parks in Breda. Discussions to implement the process are underway with the region of West-Brabant.

Contact

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List of annexes

1. Report & PowerPoint presentation: inventory of energy transition business park 3BO by Joost Rienks of BOnDS.

2. Association Cooperative Association Breda East 2050

3. Agreement on sustainable energy Breda Oost between the municipality and Breda Oost BV

4. Global investment budget 3 windmills. Source Izzy Projects.

5.Investigating the ice landing (local distribution and use) of the 3 wind turbines and Land fill sun panel project (CroonWolter&Dros).

6. Geothermal

6.1 Manor Royal Cluster 5

Introduction

In this case geothermal refers to near surface inter-seasonal heat recovery using a heat pump and not deep geothermal using heat from rocks 400m and more below ground level.

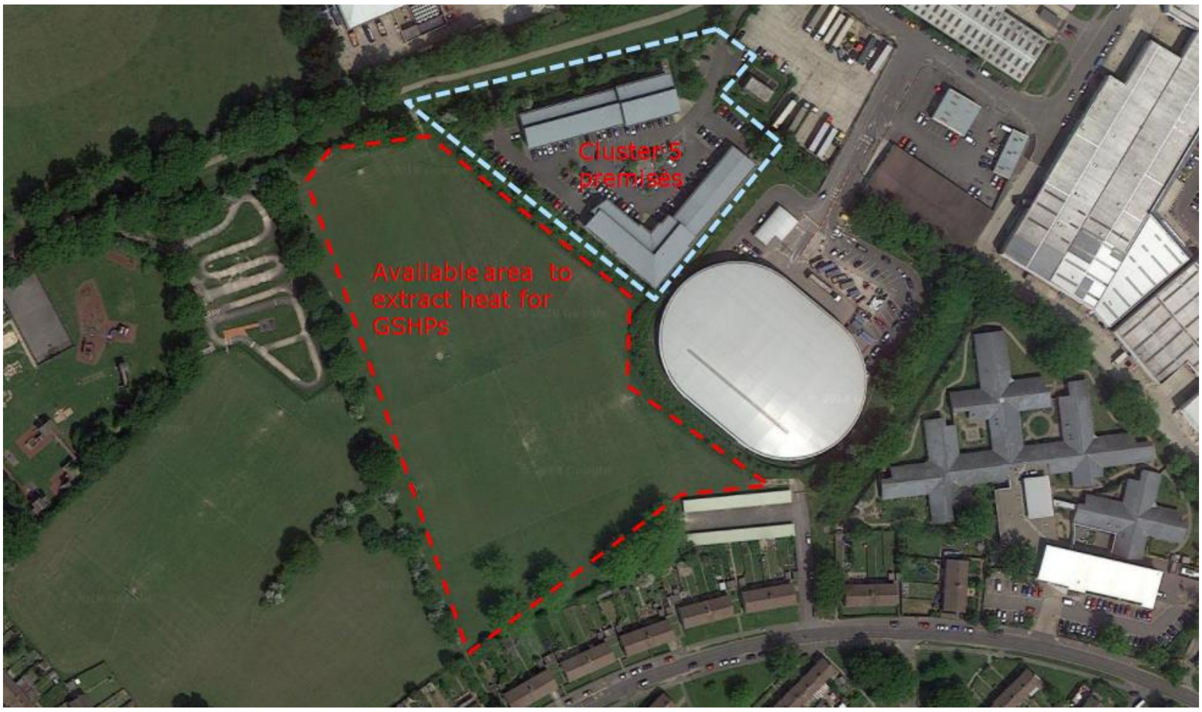
Cluster 5 at Manor Royal was pinpointed after the high level strategic energy study was completed in May 2018. In addition to installing solar PV on the buildings, it was noted that a ground source heat pump (GSHP) could be added to cluster 5 utilising the adjoining park. The feasibility studies indicated the addition of a GSHP would increase the IRR from 16% to 28%, reduce amortisation from 5.8 to 3.2 years, and increase CO_2 savings from 45% to 95% compared to current use.

Business cluster

Cluster 5 was selected for follow up as it has the opportunity to explore solar PV, CHP and a ground source heat pump (GSHP). As Manor Royal is so close to Gatwick airport, wind generation is not currently an option. Space is limited in the area, so investigating a heat pump as part of the renewable energy regime was too good an opportunity to pass up. The GSHP could connect to a district heat network (DHN) if one is built in the future.

Geographical location

There are two buildings, with one owner. 60-80 SMEs will benefit from renewable energy.



Economic activities

Cluster 5 provides a wide range of business units from small one to two-person offices, through to larger units and suites, as well as drive-up studios and workshops. There is communal meeting space and a staffed reception. Businesses currently on site include a gymnasium, a solar thermal & PVT start-up, a physiotherapist, a healthcare business, a business offering technology solutions, accountancy services, and design and marketing companies. Operating hours vary, although the majority open between 8am and 6pm.

Opportunities and threats to create sustainable energy synergies in the business cluster

Challenges to be overcome and key factors for a successful project include:

- Negotiation with the local council to use the field for a heat pump
- Engaging landlord and subsequently tenants (who are often short term)
- Quality of roof for PV
- How to equitably share savings on energy generation between to tenants and the landlord

Each building has its own electricity supply and the simplest way to maximise benefits from the PV is to install a single electricity supply for the whole site so the solar power can be used anywhere there is demand. The use of an electrically driven heat pump for space heating creates additional demand which can be met in part from the solar power installed, further reducing CO_2 emissions from the building.

Technical case

Technical solutions

Rooftop PV, solar car parks, battery storage for solar power, a combined heat and power plant and ground source heat pumps were considered. A conceptual layout of the energy system considering different technologies, specific requirements of individual demands (e.g. load curves) and framework conditions (e.g. tariffs, laws) was developed for the cluster. To assess the feasibility, the cluster was modelled with the software tool energyPRO for an entire reference year.

Combined Heat and Power (CHP) and GSHP were investigated combined with solar PV and it has been established that both are technically and financially viable. The GSHP would use (some of) the electricity produced by the solar PV. Solar PV on both buildings will produce 169,000 kWh/annum.

The availability of a grid connection was not tested at this stage since a high proportion of the electricity generated (68%) would be is used on site and an export limitation device could be installed to manage any grid restriction.

The results for rooftop PV from the HelioScope software tool for each building are given below:

Building 1

Components

Component	Name	Count
Inverters	Sunny Tripower 20000TL-US (SMA)	2 (40.0 kW)
Inverters	Sunny Tripower Core1/IEC (SMA)	1 (50.0 kW)
Strings	10 AWG (Copper)	18 (487.8 m)
Module	Trina Solar, TSM-PD05 280 (280W)	368 (103.0 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	17-23	Along Racking
Wiring Zone 2	12	5-23	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
B- 1	Flush Mount	Portrait (Vertical)	20°	130°	0.0 m	1x1	94	94	26.3 kW
B- 2	Flush Mount	Portrait (Vertical)	20°	220°	0.0 m	1x1	172	172	48.2 kW
B- 3	Flush Mount	Portrait (Vertical)	20°	130°	0.0 m	1x1	102	102	28.6 kW

Building 2

Components

Component	Name	Count
Inverters	Sunny Tripower 20000TL-US (SMA)	4 (80.0 kW)
Strings	10 AWG (Copper)	20 (499.0 m)
Module	Trina Solar, TSM-PD05 280 (280W)	300 (84.0 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	5-23	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
B-3	Flush Mount	Portrait (Vertical)	20°	165°	0.0 m	1x1	110	110	30.8 kW
B-4	Flush Mount	Portrait (Vertical)	20°	165°	0.0 m	1x1	190	190	53.2 kW

Scenarios

A traditional feasibility study and outline business case was conducted. Seven outline business case variants were investigated. The details are in Annex 6.2.

1. Solar PV Building A
2. Solar PV Building B
3. Solar PV on both buildings and carpark PV
4. Solar PV on both buildings with battery storage
5. CHP
6. Solar PV on both buildings with CHP
7. Solar PV on both buildings with GSHP

The easiest options are #1 and #2, the best CO_2 reduction is #7, whilst #6 makes a good balance between investment cost and CO_2 reduction.

Option 7 was selected to pursue due to the CO_2 reduction, IRR and interest to trial a GSHP.

Spatial

Installing rooftop PV or GSHP would have no impact on the layout or usability of the site for businesses. A CHP plant might require an extension to the boiler house but this could be designed so as not to interfere with businesses.

If car park PV were installed, there would be an obvious visual impact. There would be a potential positive benefit from having covered parking spaces, including the possibility of incorporating EV charging infrastructure.

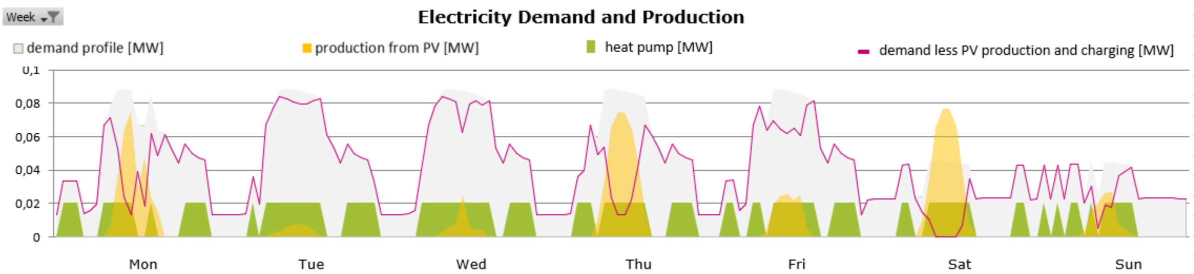
Environmental consequences

Installing the GSHP would save CO_2 of 119.8 t/a. This would produce a relative savings of 95% compared to Business As Usual (BAU).

Energy

Option 7, rooftop PV plus a GSHP, was selected as giving the best technical and financial performance. It would maximise onsite renewable energy production and use and give the best carbon saving. GSHP would be particularly attractive due to the availability of Renewable Heat Incentive (RHI) payments from central government.

OPERATIONAL DATA		
Installed capacity PV	187.0	kWp
Annual yield from PV	169.8	MWh
Installed capacity heat pump	116.0	kWth
Heat storage	30.0	m³
El. Energy Demand	269.9	MWhth/a
Electricity savings	114.9	MWh/a
Excess electricity production	54.9	MWh/a



Carbon reduction

The expected electricity generation from solar PV would be 169.8 MWh annually. Installing the GSHP would provide 96% of the heating requirement for the building and give CO_2 savings of 119.8 t/a. This would produce a relative saving of 95% compared to BAU.

Conclusions

The GSHP with solar PV is technically feasible. The main barrier is negotiating the use of the park land with the local council and planning authority. A risk is unsuitability of the roof for solar PV.

The opportunity to make a 95% savings for CO_2 is a great opportunity.

Financial case

Financial, economic and commercial

The profitability of Option 7 was calculated using the financial framework parameters, CAPEX and OPEX outlined in the tables below.

PROFITABILITY		
Total Investment	298,500	£
average of discounted real net savings & revenues	23,600	£
NPV	331,100	£
IRR	28.3%	
ROI	128%	
Amortisation	3.2	£/a
Production cost PV	46.9	£/MWh

FINANCIAL FRAMEWORK PARAMETERS	
discount rate	3.50%
period under consideration	25 years
O&M cost (share of invest)	0.8%
O&M cost increase	0.2%
Financing Period	25 years
interest rate on outside capital	3.5%
equity share	30%
Inflation	2.0%
Energy price increase	5.3 % (year 1-2) 2.6 % (year 3-25)

TECHNOLOGY	CAPEX	COSTS
ROOFTOP PV	900 £/kWp	£168,300
HEAT PUMP	CAPEXs = 3,245 x $Pth^{-0.558}$ £/kWth + 150%	£94,966
HEAT STORAGE 1M³ – 1,000 M³	230 – 1,200 £/m³	£904

TECHNOLOGY	OPEX	DESCRIPTION
ROOFTOP PV	= 1.6% of invest	Cleaning, reserves for change of inverter, insurances, periodic inspection parts
HEAT PUMP	= 6.7 % of invest	Periodic inspection, leakage tests, reserves for change of heat pump

Roles

Businesses have been advised by the Manor Royal BID to wait for the outcomes of the funding and governance options appraisal (due in January 2019) before deciding on the funding arrangements.

Options include direct investment by the business, landlords investing, a third party ESCO, or partnership with a community energy group.

Conclusions

The project is financially feasible. There is a significant opportunity to save money on energy bills and reduce CO_2 emissions by 95%. However, while local managers of the buildings may understand the project benefits and be keen to develop a full business case, there is a risk that their boards may not approve the capital expenditure.

Policies, Legal context, organizational options

Details of the current policy and legal environment for businesses installing renewable energy systems at Manor Royal are given in Annex 6.3. The key points for this proposal are :

- The Feed in Tariff (FiT) scheme closes to new registrations after March 2019. This removes income from FIT payments, reducing project returns but not altering the conclusion that the project is viable.
- The default payment for power exported to the grid will also cease from April. The PV system owner will have to join the market and agree a Power Purchase Agreement (PPA) with a buyer for the exported renewable power. This is a rapidly developing market in the UK.
- The UK's Climate Change Levy will increase by 68% for electricity and 59% for gas in April 2019. Use of electricity generated on site which reduces power and gas drawn from the grid will reduce CCL payments.
- The site owner would have to consider how to change billing to tenants and whether the terms of their tenancy need amending. Some of the cost savings could be shared with the SME tenants benefiting both them and the reputation of the landlord.

Conclusions applied on specific case

The withdrawal of support for solar PV installations through the closure of the Feed in Tariff (FIT) scheme to new registrants after March 2019 would negatively affect a site wide energy trading model and may lead to systems being sized so that a higher proportion of generated power is used on site. It would make it harder to establish a viable inter-Manor Royal electricity trading scheme as there will be less surplus electricity available.

The loss of FIT is, however, offset by the continuing drop in installation costs for solar PV and the emergence of an active power purchase market for exported renewable electricity in the UK. This could support installations until a critical amount of power is available for trading within Manor Royal.

Incentives and the regulatory environment are changing rapidly and will have to be carefully considered in any full business case.

Conclusion & recommendations

Finalising the energy trading model is on hold until the conclusion of the funding and governance options appraisal which is due for completion in January 2019. The business must then decide whether or not to invest, or to invite a third party to take up the opportunity or not to proceed.

The stated policy of the building owner to promote low carbon ways of working is a key success factor.

Creating a larger aggregated demand in several businesses and group buying may reduce costs.

The ability to develop the project in stages (self-supply only followed by cooperation with neighbours and finally full, real-time energy trading across Manor Royal) provides a low-risk way to progress with additional benefits at each stage.

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Disclaimer

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List of annexes

6.1. BISEPS Re-Energise Project Report v5.0.pdf
6.2. 1620005393_BISEPS_FS_Cluster5_Final-Report_181122_v05.pdf
6.3. BISEPS UK Legal and policy considerations for renewable energy projects.pdf