Smart Energy Region

Cluster Application

Collaborating on the energy cluster

September 29, 2016

Executive Summary

The Flemish Energy Cluster is formed in response to an urgent 'need' or call-to-action from the Flemish industry, that wants to see Flanders positioning itself as a top-level smart energy region. Over 60 companies have taken up an engagement in the Cluster. Some of these companies are large, established ones (ABB, Proximus, Port of Antwerp, Ghent Port Company, ESAS, Niko Group…), others are ambitious start-ups (Enervalis, Condugo…). All members of the Flemish Energy Cluster want to maximize their innovation and valorisation capacity by collaborating in the Cluster with each other, with Flanders' high level (energy) research institutes EnergyVille, iMinds and UGent and with policy makers (*triple helix industry – research – policy),* this all seen in an international context.

Chapter 1 and 2 provide the key elements of the energy transition we are witnessing today, the unique position of the Flemish energy sector in this transition and the mission and vision of the Flemish Energy Cluster:

In the new energy landscape, we are shifting away from a one-way power system relying upon large centralized generation plants and conventional transmission and distribution (T&D) infrastructure, and we are moving towards a highly networked ecosystem of two-way power flows, an increased penetration of renewable energy sources with prosumers, digitally enabled intelligent grid architecture and flexibility as key features.

Today's worldwide energy transition, gives rise to immense opportunities for economic growth. The International Energy Agency (IEA) predicts that **the full implementation of the post 2020 climate pledges will require $13.5 trillion in clean energy and energy efficiency technology deployment investments**, and another $8 trillion to accommodate emerging areas like distributed intelligence and data analytics. The Flemish Energy Cluster intends to facilitate our companies so that they can fully seize these international opportunities.

Representing 400 companies/15.000 FTE (strict estimate) or 1000 companies/ 110.000 FTE (broader perspective), the energy sector in Flanders is a key sector with an **important and fast growth potential**. It The Flemish partners can build on their added value of energy system integration. For this they can rely on the densely populated urban area of Flanders as a unique context for market take-off and on strong international positions and research infrastructures of e.g. the Flemish research institutes, Flanders' strategic role in the Global Smart Grid Federation and the KIC InnoEnergy network to give the Cluster a head start on the international scene.

For the Cluster it is clear that energy innovation today requires an integral approach. **Companies from the Energy, ICT and Building sectors** need to collaborate and develop systemic solutions. And this ambition to enable and foster collaboration forms the basis of the Energy Cluster.

The cluster believes that a key differentiator to enhance the international impact of the Flemish energy industry is their ability to develop innovative solutions drawing from **cross-disciplinary expertise,** by mobilizing and integrating a whole chain of companies, knowledge institutes and other stakeholders from different sectors (thus creating an '**ecosystem**')

Smart cities and communities are important living labs for such solutions and the Covenant of Mayors (signed by over 150 Flemish cities and communities) is an important lever. **A coherent portfolio of living labs** in this context can provide strong competitive advantages.

With dedicated actions the Cluster focus to resolve the most important market failures (see 1.2.4) currently encountered a) the access to state of the art living labs, apt regulation and information, (b) value chain building and (c) capital market barriers e.g. based on innovative business cases.

With this ambition, the Flemish Energy Cluster can build on the foundations laid by Smart Grids Flanders and the other eight 'founding' organisations of the Cluster, as well as the network of sustainable cities and communities in Flanders.

Chapter 3 takes a look at 6 crucial moments in the creation of the Cluster. It illustrates how an engaged consortium of companies and content priorities were formed in a step-wise process initiated by eight 'founding organisations': Smart Grids Flanders, Agoria, VOKA, Living Tomorrow, EnergyVille, iMinds, Ghent University and PIXII.

The **4th Chapter**, on the Cluster's 'Innovator Zones' is of special importance, since the concept of innovator zones is a key element in the Flemish Energy Cluster. Indeed, an innovator zone, being a coherent programme of activities leading to a common commercial breakthrough, defines the content focus of the Cluster and lies at the core of the 'valorisation' package in the Cluster's services (chapter 5).

Based on market opportunities and Flemish strengths 5 innovator zones have been selected:

- Energy harbors
- Microgrids
- Multi-energy solutions for districts
- Energy cloud platforms
- Intelligent renovation

First (in 4.1), we take a closer look at the context of each of the five innovator zones the Cluster has decided to focus on. What are the **market opportunities and challenges** within each innovator zone? What are **the specific strengths of Flanders** – why does the Energy Cluster expect Flemish companies to achieve a breakthrough in each of these innovator zone? Which **relevant knowledge partners** are present? **The value chain** of companies required to achieve such a commercial breakthrough is identified and **target companies** of the Flemish Energy Cluster for this specific innovator zone are presented**.**

Then (in 4.2), we zoom in on the (sub)program of the Flemish Energy Cluster per innovator zone. What is **the content focus** of the Cluster's program? What are **the ambitions?**

For each innovator zone, at least one key project idea is presented that cluster partners are working on at the moment. These projects are summarised in Chapter 4.2 and further documented in Annex 4.

At present, the five zones and their respective projects are to be considered as 'works-in-progress' and a process for maturing the project ideas is running.

1.1. ENERGY HARBORS

Harbor areas play a crucial role in the energy transition: they are at the crossroads of multiple energy vectors, they have a high energy intensity and they put sustainability at the top of their agendas.

At present, the Flemish ports of Antwerp and Ghent are the leading Cluster partners for this innovator zone.

The focus will be on the following breakthroughs: flexible thermal power stations and heat networks, demand side management for cooling installations, bi-directional shore power, storage of energy (by power-to-products); sustainable harbor infrastructure and the harbor area as a power station.

Specific project ideas are elaborated on pilots for 2 types of electricity storage in the harbors of Antwerp and Ghent.

1.2. MICROGRIDS

Microgrids are groups of interconnected consumers, distributed renewable sources and energy storage solutions, within well-defined electric perimeters. Essentially, microgrids manage their own production, storage and demand facilities and are less depending on the distribution grid.

Microgrids are growing rapidly worldwide, especially in the US. The potential in Africa and Asia is huge.

Flanders has a strong competence base, established international ties and an interesting energy landscape for test-driving new microgrid solutions.

In this innovator zone, the Flemish Energy Cluster will focus on on scalable hybrid microgrids for a wide range of residential and industrial settings. As the large multi-national technology providers are often not well-placed to offer competitive solutions for those smaller types of microgrids, there is an entire market segment open for Flemish companies to seize.

A specific activity is currently under development with companies involved as Eandis, ABB, Triphase, Enervalis, Van Wingen, Vyncke, Engielab and potential pilots in the city of Kortrijk.

1.3. MULTI-ENERGY SOLUTIONS FOR DISTRICTS

Energy solutions at district level offer scale benefits and allow for (1) an optimal integration of sustainable energy sources, (2) optimal energy storage, (3) a reduced energy demand and – when the site combines different functionalities – (4) great exchange opportunities between energy flows.

Today, the market of district deployment and renewal, is at the beginning of a spectacular phase of growth – in Europe and worldwide. Flanders is an intensively urbanised area with over 150 cities engaged in the European Covenant of Mayors, and is therefore an ideal take-off market for multi-energy solutions on a district level. Trumps of the Flemish region include (a.o.) a growing number of SME's with energy integration as their core business.

The value chain of the multi-energy solutions innovator zone partially builds on that of the innovator zone 'microgrids'. Complementary to the latter, the multi-energy value chain focuses more on the integration of heat and electricity as well as on the demand side management and on infrastructure aspects. HVAC, heating & cooling, construction companies are completing the value chain.

In this innovator zone, the Flemish Energy Cluster will focus on solutions for the integration and flexibility of heat, cold, electricity and other energy carriers on district level. This is a multi-energy carriers approach, with the interaction between electricity and e.g. heating grids and the integration of local renewable energy sources (e.g. geothermal energy).

Section 4.2.3 gives (a.o.) a schematic overview of the Cluster's ambitions and summarizes two projects. The first one is **'The Thor-site: enhancing multi-energy technology'**, with a potential of 14 relevant industrial companies equally distributed over 3 parts of the value chain (components, IT, energy services), with about half of them SME's. The second one is **'A business case for a local smart grid – De Nieuwe Dokken, Ghent'**, initiated by DuCoop…

1.4. ENERGY CLOUD PLATFORMS

A crucial question in today's energy landscape is how to provide (big) data towards third parties in a uniform, transparent, qualitative and legally correct format. To this end a multitude of (intelligent) energy apps and services are being developed and rolled out. With its focus on energy cloud platforms, the Flemish Energy Cluster is in line with the transition area 'Digital Society', put forward by the Flemish Government.

Flanders has strong ICT expertise in the domain of Internet technology, data security, interdisciplinary approach and digital real-life labs. Our digital start-up culture gets international recognition. The open data initiatives of the current Flemish government, as well as the research strategy of iMinds, create a positive context for the development of new, integrated applications.

The value chain in this innovator zones consists of energy providers & grid operators, Telco operators, IoT & data platform providers and automation providers.

In this innovator zone, the Flemish Energy Cluster will focus on the following breakthroughs:

- Realising an energy cloud with open interfaces for stimulating the creation of new intelligent apps and services
- Improving robustness, scalability and self-configurability of wireless communication networks to connect buildings, industrial plants and grid assets in a reliable way.
- Making building systems and appliances connected, smart and self-learning, by adding cheap sensors and machine-learning capabilities.
- Guaranteeing the reliability of our energy system and protecting privacy sensitive data by adding capabilities to the energy cloud that can realise cyber security and trust.

Section 4.2.4 gives a schematic overview of the Cluster's ambitions and presents in a nutshell the project **'The IoT Energy Cloud Accelerator'**, a proposal initiated by Condugo, Eandis, ESAS, IncubaThor, Niko and Proximus.

1.5. INTELLIGENT RENOVATION

In Europe almost 40% of the building stock predates 1960. Therefore, intelligent and 'deep' renovation of buildings (both of the envelope and its installation) makes considerable energy and emission reductions possible. The fragmented market and lack of 'renovation packages', however, make it a challenge to reach European and national goals.

Flanders has a tradition of active participation in European research projects, some strong living labs and an 'early adopter'-mentality among home owners. This makes our region an ideal testing ground for solutions for intelligent renovation.

Companies like Think E, ABB, NIKO and Siemens have engaged themselves in the Flemish Energy Cluster and are well-positioned to contribute to the innovator zone 'Intelligent Renovation.

In this innovator zone, the Flemish Energy Cluster will focus on techniques that are both feasible within the Flemish building context and scalable to an international level. The main focus lies on deep renovation with integrated energy systems.

Section 4.2.5 summarizes the project **'The power backbone for IoT devices – Intelligent low voltage direct current distribution network within a building with broadband data communication capabilities',** initiated by Matthys&Partners (MaPa), Triphase, Enervalis and EnergyVille..

<u>Chapter 5</u> gives an overview of the service offering and the governance structure of the Flemish Energy Cluster Companies, engaging in the Flemish Energy Cluster. They can participate at **three levels: talent, business and valorisation.** A higher level of engagement corresponds to a higher level of service by the Cluster.

The Cluster aims to fulfil **four roles** for its members (a) be a central actor in the energy playing field, (b) create sector collaboration (both roles are offered to members in all packages), (c) facilitate internationalisation (in business and valorisation package), (d) manage cluster specific resources (in valorisation package only).

There are **eight 'building blocks' of service offered by the Cluster**. The first three – **(1) education, (2) dissemination, (3) networking** – are common to all packages. In the business package three more 'blocks' are added: **(4) SME support, (5) business model innovation and (6) internationalisation**. At valorisation level the final two come in: **(7) active participation in the innovator zones and (8) access to the Cluster's resources.**

Chapter 6 highlights the additionality of the Flemish Energy Cluster to existing platforms in the energy field due to its focus on the value chain creation and on the pilot/demonstration phase. The Energy Cluster will actively seek collaboration with other thematic clusters in Flanders.

Finally, the Flemish Energy Cluster presents its workplan in **chapter 7** and financial plan in **chapter 8.** In the first phase a major effort will be dedicated to making the innovator zones operational. From financial perspective a solid base of EUR 435.000 is covered with the LOI's of the currently engaged partners. It is however the intention to grow and at the same time increase the self-sufficiency level.

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1.1 Present Flemish Energy Scene

Summary:

(1.1.1) Today's worldwide energy transition gives rise to immense opportunities for economic growth. The International Energy Agency (IEA) predicts that the full implementation of the post 2020 climate pledges will require $13.5 trillion in clean energy and energy efficiency technology deployment investments, and another $8 trillion to accommodate emerging areas like distributed intelligence and data analytics.[1] The Flemish Energy Cluster intends to facilitate our companies so that they can fully seize these international opportunities.

(1.1.2) Today, the energy sector in Flanders represents 400 companies/15.000 FTE (strict estimate) or 1000 companies/ 110.000 FTE (broader perspective). It is a strong sector with an important growth potential.

(1.1.3) In the sector of renewables alone, Agoria anticipates an increase in employment from 15.000 FTE today (strict estimate) to 23.000 FTE by 2020.

(1.1.4) However, energy innovation today requires an integral approach. Companies from the Energy, ICT and Building sectors need to collaborate and develop systemic solutions. A key differentiator among companies and organizations that are thriving in the new energy system, is their ability to develop innovative solutions drawing from cross-disciplinary expertise. Smart cities and communities are important living labs for such solutions and the Covenant of Mayors (signed by over 150 Flemish cities and communities) is an important lever.

(1.1.5) In the new energy landscape, we are shifting away from a one-way power system relying upon large centralized generation plants and conventional transmission and distribution (T&D)

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[1] Navigant, 3Q 2016 Report: *Navigating the Energy Transformation, Building a Competitive Advantage for the Energy Cloud 2.0,* p 4

infrastructure, and we are moving towards a highly networked ecosystem of two-way power flows and digitally enabled intelligent grid architecture. The Flemish Energy Cluster will help local companies focus on systemic, internationally competitive innovations by mobilizing and integrating a whole chain of companies and other stakeholders from different sectors (thus creating an 'ecosystem'). The Cluster focuses on 5 carefully selected thematic priorities ('innovator zones') to bring solutions to three most promising market segments: (1) energy-efficient industry, (2) sustainable communities and cities and (3) smart homes.

(1.1.6) The Flemish Energy Cluster was formed in response to a real 'need' or call from the industry, that wants to see Flanders position itself as a top-level smart energy region. More than 50 companies have taken up an engagement in the Cluster.

(1.1.7) Some of the companies in the Cluster are large, established ones (ABB, Proximus, Havenbedrijf Antwerpen, Ghent Port Company, ESAS, Niko Group…), others are ambitious start-ups (Enervalis, Condugo…). In order to maximize their innovation capacity, they want to collaborate in the Cluster with each other and with Flanders' high level (energy) research institutes EnergyVille, iMinds and UGent.

1.1.1 The Energy Sector in Transition : New opportunities

The value chain in the energy sector traditionally consisted of four parts (figure 1). First, there is the *generation of electricity*, in the form of classical power plants and nuclear installations, or all the different forms of renewable energy generation (photovoltaic, hydroelectric, geothermal, biomass or wind power systems). Secondly, there is the *transmission of electricity*, generated by classic power plants and injected into the high-voltage grid. And then there is the *distribution of electricity* through low and medium voltage grids towards the end consumer. The *supplier* is in charge of the commercial handling and administrative processing *directly with the customer*.

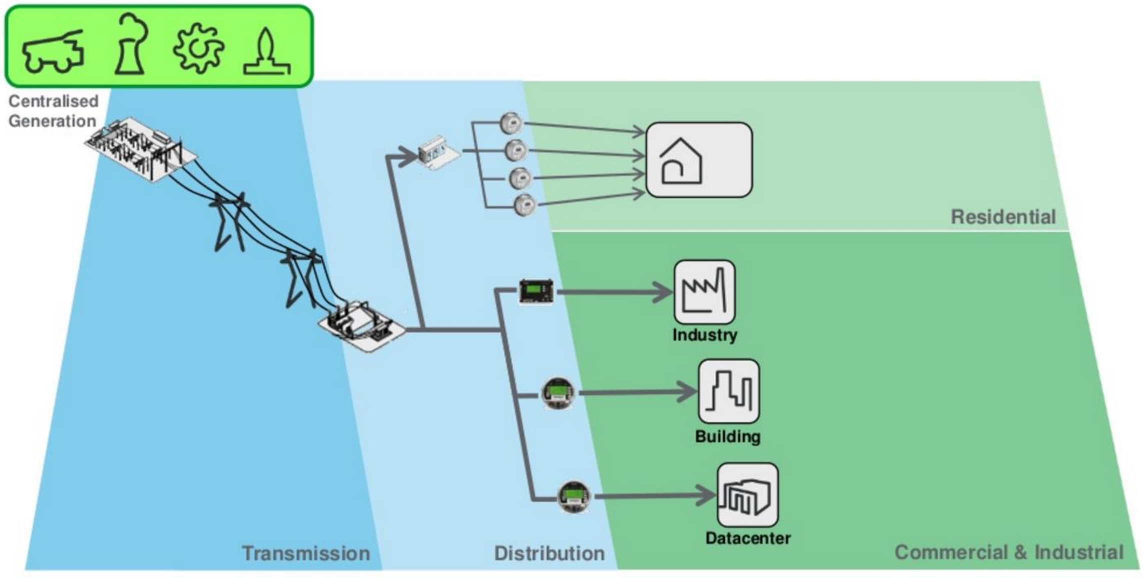

Figure 1: Traditional energy system

Today, the consistency of the energy system has become more complex, due to the breakthrough of renewables and the fact that more and more consumers also produce energy, albeit in lower quantities and intermittently. As a result, there is a growing concern about the stability of the grid and the ways of exploitation. The roles and responsibilities of existing players are shifting and opportunities emerge for new players on the market. The Flemish Energy Cluster intends to help our companies fully exploit these new markets and possibilities, also internationally.

Global clean energy investment, including renewable energy, totaled more than $329 billion in 2015.[2] The International Energy Agency (IEA) predicts that the full implementation of the post 2020 climate pledges will require $13.5 trillion in clean energy and energy efficiency technology deployment investments over the next 15 years. Also according to the IEA, another $8 trillion we be required over the next 25 years to accommodate emerging areas like distributed intelligence and data analytics.[3] Flemish companies need to be facilitated so that they can fully seize on these possibilities for economic growth.

The industry realizes that cooperation and focus are essential to flourish in the new energy system. As Bart Boesmans (CFO, ENGIE) said at the launch event of the Flemish Energy Cluster on May 26, 2016: “The worldwide energy transition that we’re witnessing today, offers great opportunities for

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[2] http://trade.gov/topmarkets/pdf/Renewable_Energy_Top_Markets_Report.pdf

[3] Navigant, 3Q 2016 Report: *Navigating the Energy Transformation, Building a Competitive Advantage for the Energy Cloud 2.0,* p 4

sustainability and economic growth. Flemish companies and knowledge centers can play an important role in this, if they join forces and show a clear, joint focus."[4]

Features of the new energy system

The new energy system is characterized by:

- Companies and individuals not only consuming but also generating energy ('prosumers'). In this context many (new or renovated) buildings become 'energy active buildings'.
- A combination of several energy sources (heat, cold, electricity, …) offered as a service instead of a commodity. The heating industry or the electricity sector, operating autonomously for decades, are being increasingly integrated. Control systems are adopting new functions.
- A strong integration of IT possibilities such as the Internet of Things (IoT) in energy applications.
- New technologies, such as storage techniques, ensure that injection into the grid or extraction from the grid are more leveled out, thus guaranteeing the stability of the net. Also, inverters, smart meters and smart sensors, cogeneration or HVAC applications such as heat pumps, have built-in smart technology and are Internet connected.
- New business models emerge: aggregators function as an 'in between' for users/producers and grid operators to manage surplus and shortages of electricity, depending on market prices, in the economically most interesting way. Both existing players and new companies (SME's) can take up the role of Energy Service Companies (ESCOs).
- System integration requiring a new approach by and competence in consultancy and engineering.

These key challenges were identified by experts, including industrials, during the focus groups 'Flanders in transition 2025'[5] of the VRWI (Flemish Council for Science and Innovation) on the topic of making the Flemish energy system more sustainable. They are supported by several surveys among the members and stakeholders of the organizations behind the Flemish Energy Cluster.

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[4] http://www.smartgridsflanders.be/persbericht/als-we-samenwerken-kan-vlaanderen-internationaal-scoren-als-smart-energy-region

[5] http://www.vrwi.be/pdf/Flanders%20in%20transition_web.pdf

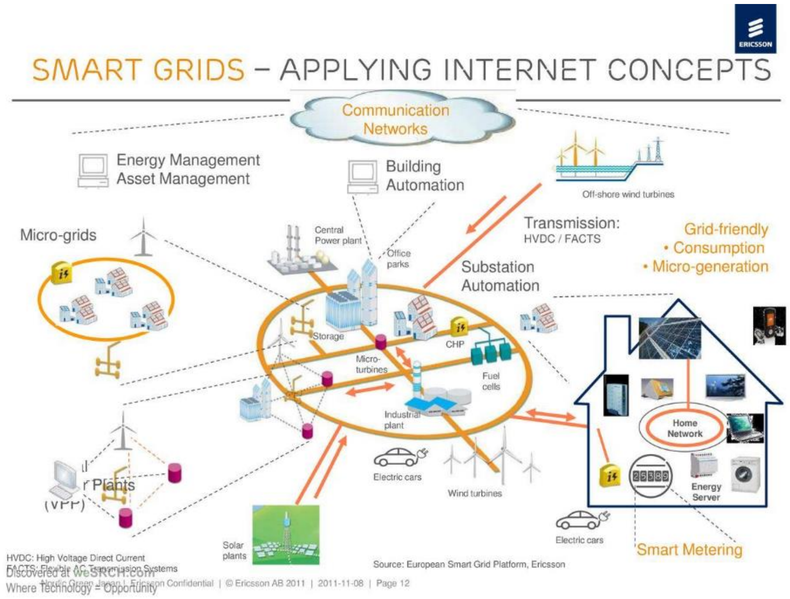


Figure 2 Extension in scope and impact of the energy sector - In the energy value chain of the future, smart grids play a central role and different energy sources and energy vectors complement electricity

1.1.2 Size and impact of the energy sector in Flanders

The sectors of energy generation, transmission, distribution and delivery have always been important providers of jobs and economic added value. In Flanders, producers and suppliers represent more than 5.000 FTE. If we include the sector of distribution (both ELIA and the grid operators) employment goes up to at least 10.000 FTE.

Of course, the industrial supply chain for the energy generation is also crucial. For this segment, Agoria, the federation of the Flemish technology industry, estimates the total revenues for the Flemish Region on EUR 1.4 billion with an impact on job creation of about 5.900 FTE. This industrial supply chain consists of companies producing industrial systems and solutions for the traditional companies in energy generation: on the one hand the conventional power plants on coal and gas, on the other hand nuclear power plants and finally the grid operators (transmission and distribution). Renewables are a growing market and they create jobs, added value and revenues at an increasingly fast pace.[6] Within Europe, Belgium ranks 7th for job creation in the sector (see. below).

[6] See: http://trade.gov/topmarkets/pdf/Renewable_Energy_Top_Markets_Report.pdf

The core industrial players to be represented by the Flemish Energy Cluster consist primarily of companies directly or indirectly active in the sector of renewable energy and smart grids. According to statistics of 2012 by the Flemish administration (Environment, Nature and Energy Department, LNE) and the Flemish Council for Science and Innovation about 400 companies are involved, responsible for a total revenue of EUR 5 billion and employing 15.000 FTE. These numbers account for all the activities of the said companies and not only for their renewables related activities. Almost 88% of these companies is identified as an SME. Characteristic for these companies are high dynamics. A recent study performed by Agoria corroborates this trend. The Belgian renewables sector *strictu sensu*, is good for up to 15.000 FTE in 2014. If we include new activities on grids and alike, the number increases to 20.000 FTE.

Start-up companies generate an increasing amount of initiatives on data management, applications, Internet of Things, etc. For the moment – with the market being so new - it is difficult to estimate the impact on job creation and revenue, but the expansion in this sector is significant.

If we consider the sector in a broader sense, and include companies who actively produce or implement renewable energy in their operating processes, then Flanders has over a 1,000 companies with full or partial activity in the renewable energy sector. Job employment increases to 110.000 FTE or 6% of the total employment in the Flemish Region. This puts Belgium on 7th place in Europe for job creation in this sector.

1.1.3. Growth expectations

For renewables alone, a further increase in employment to 23.000 FTE by 2020 is anticipated[7]. The strong growth in the sector of the last few years will continue in the following years, supported by the increasing global attention for greener and more ecological measures.

Market studies on the growth and impact for sectors such as IT, Building, HVAC and grids are scarce, since energy is not a vertical but a horizontal action. Simply taking all ICT, Building and HVAC companies into account, would be a misrepresentation. Moreover, the Flemish Energy Cluster focuses on specific aspects of the energy system with high growth potential: therefore, a correct growth analysis should focus on these niches. In the description of each of innovator zones (Chapter 4, p. 35 and onwards) a

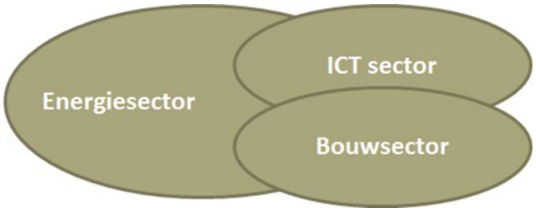
[7] Source: Agoria

first attempt is made. During the operationalization phase of the Cluster, this aspect will be worked out in each of the innovator zones as part of the business plan.

1.1.4. Integration of Energy, ICT & Building sectors, facilitated by smart cities and communities

Foreign examples and demonstration projects show that one way to boost employment, is to enhance commitment to develop smart communities (or smart cities) and to increase implementation efforts on building projects on community level. The Helsinki project 'smart community Kalasatama' already operates on an intelligent energy system, controlling buildings in a smart way and involving infrastructure for electric cars and energy storage for years. According to estimations this project will generate 100.000 jobs in new energy applications and associated activities in the following 15 years.

The integral approach of the Kalasatama project was an inspiration for the Flemish Energy Cluster to realize a link between the energy sector and the building sector.



Energy is crucial for the building sector since Europe has set very high ambitions for Net or Nearly Zero Energy buildings. The European 'Roadmap for a Low Carbon Economy' sets as target for the building sector CO_2 savings of no less than 88-91% by 2050 compared to 1990[8]. The latest report 'Doorbraken 2015' from the Flemish Building Confederation underlines the importance of Energy and ICT for the future of the sector: '*Today, buildings are complex and dynamic interconnections of systems, structures and technologies offering users an optimal thermal comfort, lighting, safety and air quality at the lowest cost and smallest environmental impact.*'[9]

Companies in the building sector obtain a crucial competitive advantage when they're able to align and integrate building and energy components into efficient overall systems. This implies an adapted IT approach and an effort to create realistic business models. One of the goals of the Flemish Energy Cluster is to unite companies from the Energy, Building and IT sectors to help them realize integrated solutions, thus achieving the above mentioned competitive advantage.

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[8] http://www.eurima.org/uploads/ModuleXtender/Publications/128/Ecofys_XII_Report_final_13_10_2015.pdf

[9] Doorbraken 2015, Hoofdstuk 3 Energie, p 41

Also in Flanders, smart communities and smart cities are important living labs, where new technologies can be demonstrated and innovation can be valorized. Cities often provide bottom-up initiatives with the necessary support to grow, so they can upscale their solutions and make them replicable for (inter)national valorization. Cities can play the role of initiator, facilitator or broker in quite a few domains of the energy transition. For example, one can see a growing interest from the municipalities to realize energy efficient projects. They also put increasingly stringent requirements forward when redeveloping existing brownfields such as 'Petroleum Zuid' in Antwerp or 'Nieuwe Dokken' in Ghent.
An important lever here, is the Covenant of Mayors (see also 4.1.3: Multi-energy solutions at district level in their context). The Covenant of Mayors is the mainstream European initiative, launched in 2008, involving local and regional authorities in the fight against climate change and developing a more sustainable energy future for our cities. It is a voluntary commitment by signatories to meet and exceed the EU 20% CO_2 reduction objective through increased energy efficiency and the development of renewable energy sources. In Flanders, over 150 cities and communities have engaged themselves in the Covenant, and they are important partners for the Energy Cluster. Contacts have been made with the VVSG (Flemish Association of Cities and Municipalities) as well with the cities of Ghent and Antwerp. These contacts will be further deepened once the Cluster is operational.

1.1.5 Systemic innovations in 3 market segments and 5 innovator zones

Energy innovation is currently moving beyond one-off, standalone technologies (e.g., renewables) and the pairing of these technologies (e.g., solar plus storage) toward the orchestration of complex ecosystems of technologies working in concert to deliver more flexible, responsive, and customer-centric services. A key differentiator among companies and organizations that are thriving in the new energy system, is their ability to collaborate and develop innovative solutions drawing from cross-disciplinary expertise.[10]
Therefore, the Flemish Energy Cluster helps companies focus on systemic innovations by mobilizing and integrating a whole chain of companies and other stakeholders from different sectors such as energy generation, grids, energy storage and energy use. The Cluster will operate in three - carefully selected

[10] Navigant, 3Q 2016 Report: *Navigating the Energy Transformation, Building a Competitive Advantage for the Energy Cloud 2.0,* p 7 and p 25

and most promising - market segments: (1) energy-efficient industry, (2) sustainable communities and cities and (3) smart homes.

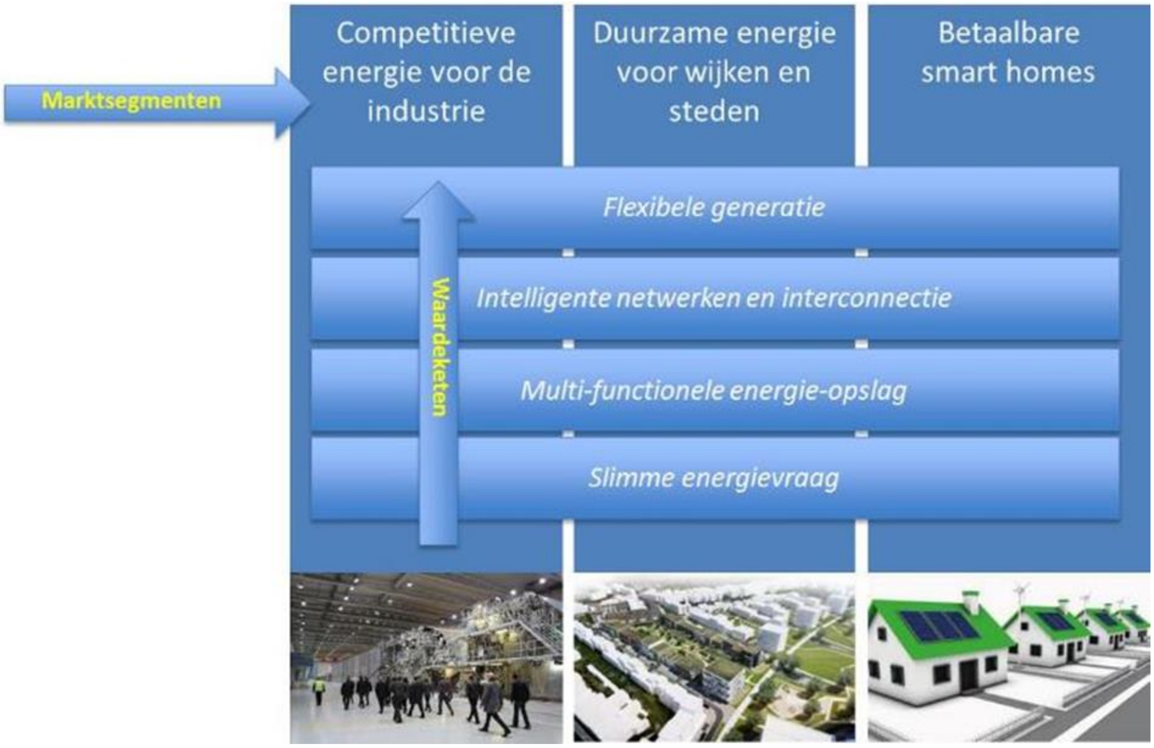

Figure 3: Targeted market segments for the Energy Cluster

From a different – thematic - perspective, the Flemish Energy Cluster focuses on 5 priorities or 'innovator zones' (see chapter 4 for more details): (1) energy harbors, (2) microgrids, (3) multi-energy solutions for districts, (4) energy cloud platforms and (5) intelligent renovation. Within each zone an appropriate industrial value chain is identified: a complete industrial ecosystem of new and existing players (see 1.1.6, below).

There is no 1-on-1 relation between companies and innovator zones. A company active in one zone, can easily contribute in another zone where it might be targeting different markets with other products or services. However, the double axis innovator zone/market segment does guarantee a clear focus of efforts. The Flemish Energy Cluster focuses on five thematic priorities (innovator zones) in order to bring integrated solutions to these three well-defined market segments.

Chapter 4 offers a more detailed look on *which companies* have engaged themselves to work together on *what sort of projects* within each innovator zone of the Flemish Energy Cluster. At this point, we give a single example to make things more tangible. Within the innovator zone 'Microgrids', the companies ABB, Triphase, Eandis, Van Wingen and others will work on an open system for microgrids, with a self-learning capacity, via a building block concept. After tests in a lab environment, the city of Kortrijk will provide a real life test environment. The solution will finally be brought to the – internationally booming - market segment of 'sustainable communities and cities'. Says Peter Vanden Heede (ABB): '*The total package we want to develop, is much more effective than the existing solutions today. In a market with an annual growth rate of +17% this will offer the Flemish companies involved a unique possibility to play an important role on a world scale level. Locally in Flanders the new system can be used for regions or quarters with high risk on grid congestions, for high penetrations of RES sources and or for balancing support in the grid*.'

(See chapter 4 for more details and other examples.)

1.1.6 Companies within the Energy Cluster

The Flemish Energy Cluster is based on the engagement of more than 50 relevant industrial companies and supported by nine major organizations (see Chapter 3, 'Cluster Creation Process'). The Cluster was formed in response to a real 'need' or call from the industry. From the start, companies had a pivotal role. As Kris Van Daele, managing director of Fifthplay said at the launch event on May 26: "*The ICT and the 'smart' world are coming together, especially in our neighboring countries. All Flemish actors will have to work together in order to act upon this positive, macro-economic trend. Fifthplay wants to collaborate with industrial partners, knowledge centers, energy providers and grid operators to make sure Flanders can position itself as a top-level smart energy region. The Flemish Energy Cluster is the platform and living lab where we will be able – both on a social and on a project-based level – to test new business models and technologies.*"[11] Koen Van Peteghem (CG Power Systems) was on the same page when he declared in an interview, early 2016: "*Innovation is the key to job creation and economic growth. Smart Grids Flanders (through the Flemish Energy Cluster, ed.) will tear down the walls between the (energy, ICT and building, ed.) sectors. The platform unites people and companies with different ideas and complimentary competences in order to launch innovative projects in the energy world.*"[12]

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[11] http://www.smartgridsflanders.be/persbericht/als-we-samenwerken-kan-vlaanderen-internationaal-scoren-als-smart-energy-region

[12] http://www.smartgridsflanders.be/nieuws/5-snelle-vragen-aan-koen-van-peteghem-cg-power-systems

May 26, 2016: The Launch Event of the Flemish Energy Cluster at Living Tomorrow attracted 180 attendees

It cannot be stressed enough that industrial players – companies from the energy, ICT and building sectors - have the pivotal role in the Flemish Energy Cluster. The list of targeted companies consists of an essential cross section of the Flemish Industrial system:

- Producers of energy systems and components (and their integration): classic or renewable energy generation systems - e.g. wind turbines, PV installations and cogeneration -, energy distribution and grid operators, producers and assemblers of new types of equipment such as smart meters.
- Aggregators: these indispensable players in the prosumer value chain manage under the best possible conditions temporary energy shortages or surpluses.
- ESCO's and consultancy and engineering companies: energy service companies or ESCO's take up an important role in the new ecosystem. They deliver overall services including redesigning the energy household with the aim of improving energy use and decreasing energy costs but with a certain contractual commitment in efficiency enhancement. ESCO's are an important complement to the activities of engineering and consultancy companies.
- IT, data and applications: crucial to a smart approach of energy production and use is the intelligence of the energy systems and a correct information flow to the prosumer, allowing him

to take the necessary steps in energy production and use. Existing companies and start-ups play a very important role, as do telecom operators.

- Building companies and district developers working on innovations in (deep) renovation and intelligent buildings.

For a further detailing of the value chains per focus area, see Chapter 4.

The Launch Event of the Flemish Energy Cluster, on May 26, 2016 attracted 180 attendees. In a full auditorium Erik Hendrix (Marketing Manager Smart Energy, Proximus), Lieven Kenis (BU lead Digital Grid in the division Energy Management, Siemens) and Cedric Dejonghe (responsible for the energy activities of Actility Benelux) demonstrated their enthusiasm for the Flemish Energy Cluster in a panel discussion.

Proximus was one of the first large companies to join the cluster at the highest level of engagement (for the different levels of engagement, see Chapter 5: roles of the cluster/ service offerings, p 85 and onwards). Erik Hendrix explains: *'In Belgium, the energy transition is not happening as fast as in our neighboring countries. The industry is giving a clear signal today that Flanders needs to step up its game! Sensor communication is one of the absolute priorities for Proximus in the coming years. Most technological solutions in the energy sector need communication platforms. Through the Internet of Things millions of objects and sensors are going to exchange information. We need to create the right business models, perhaps by making data available to new, third parties. This requires openness and trust, in a rather conservative (energy ed.) sector. That's why Proximus believes in the idea of a Cluster. We share the ambition to work together. At this moment, it is not yet completely clear how the five innovator zones of the Flemish Energy Cluster will function, but we believe Proximus can play a role in several of them. We are exploring new grounds, but this is the only way to make progress. We need to show initiative in Flanders, or foreign players will define our future business models. And we can't have that."*[13]

[13] http://www.smartgridsflanders.be/nieuws/proximus-kiest-voluit-voor-de-vlaamse-energiecluster

Erik Hendrix, Proximus (right): "The Flemish Energy Cluster is exploring new ground and this is the only way to make progress."

By September 25th, 2016 the Flemish Energy Cluster had received over 50 Letters of Intent, while at least an additional 10 companies were in the process of writing their letter of engagement. Once the Cluster is in operation and the projects in each innovator zone become more concrete, other companies are expected (and will be actively invited) to join. The companies that have formally engaged themselves in the Cluster differ strongly in size (employees/annual revenue), range of activity, background and even in the type of service offering they are looking for in the Cluster (see chapter 3). Since the Flemish Energy Cluster aims to form a complete value chain and ecosystem within each innovator zone, this variety is a trump. For a full list of the engaged companies see Annex 1.

This list of companies results in a substantial financial commitment by a variety of companies of all sizes, as you can see in the figure below. It is obvious that not only the big companies are engaged but also a considerable number of small and medium enterprises, more representative for the Belgian industrial scene.

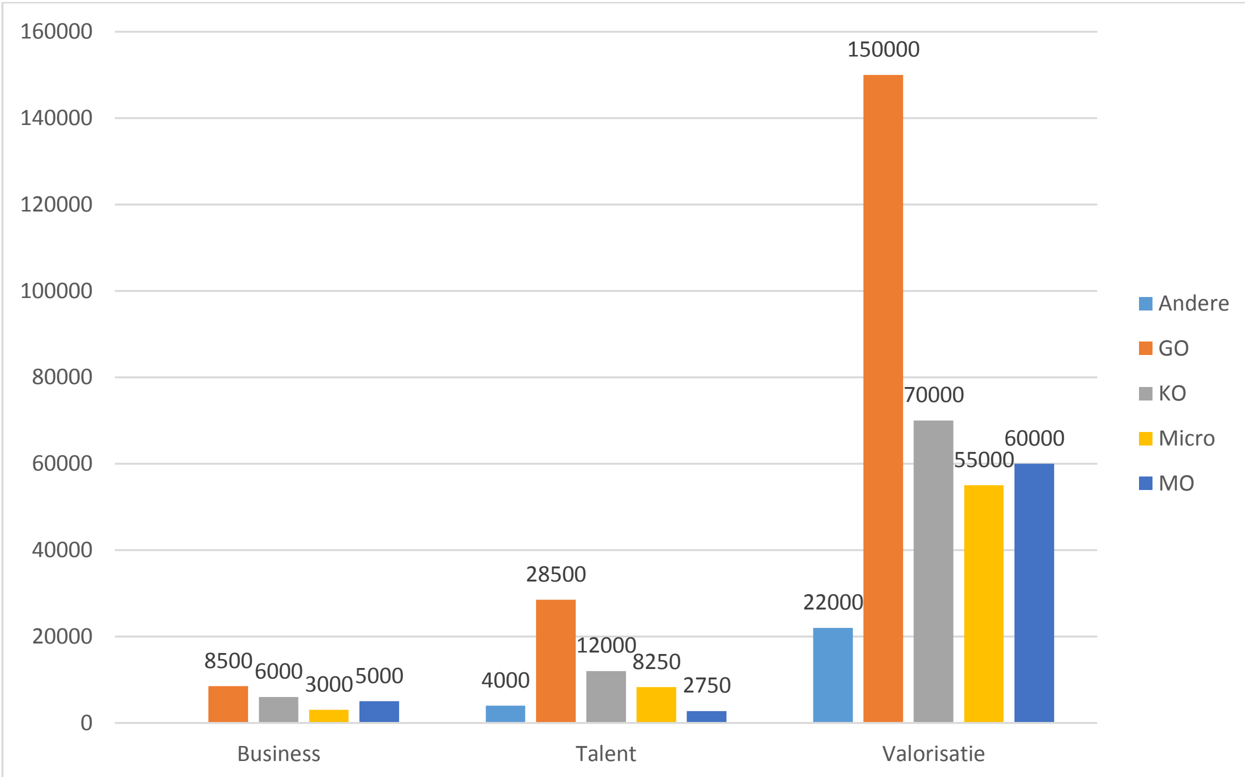

Figure 4 financial commitment (in Euro) of the companies engaged by undersigning a Letter of Intent.

May 26, Launch Event Flemish Energy Cluster/Vlaamse Energiecluster VLEC

1.1.7 The Flemish Innovation Capacity

1.1.7.1 The innovation capacity of the companies engaged in the Flemish Energy Cluster

Innovation is key to economic growth. And as growth is precisely what the Flemish Energy Cluster is aiming for, it is no wonder that the companies engaged in the Cluster – especially at the highest level of engagement (see chapter 5, service offerings) - show substantial innovation capacity.
In the Flemish Energy Cluster complete value chains/ecosystems of companies (large vs. small, internationally renowned vs. local start-ups, cross-disciplinary and cross-sectoral) will work on integrated solutions, thus combining – from an innovation perspective - 'the best of both worlds'. Ambitious, flexible start-ups and large companies with substantial R&D departments will work together on solutions that are internationally competitive.

Large companies that have engaged themselves at valorization level in the Flemish Energy Cluster (for a full list, see annex) include: **Havenbedrijf Antwerpen** (1500+ employees, R&D hub), **Ghent Port Company** (160 staff members, responsible a.o. for creating a favourable social and economic climate for the companies active in the port), **ABB Benelux** (1500+ employees, 3 R&D centra in the Benelux), **Niko Group** (700+ employees, R&D department in Sint-Niklaas), **ESAS** (1000+ employees).

Ambitious start-ups that have engaged themselves at valorization level in the Flemish Energy Cluster (for a full list, see annex) include: **Enervalis** (creates cloud-based software for electricity producers, storage providers & consumers to save or make money, ed.) and **Condugo** (Condugo's platform connects industrial companies to each other and to the energy markets, so they can fully exploit the benefits of professional energy management – at a fraction of the effort that is normally required and without risks to their core business, ed.). Stefan Lodeweyckx, founder and CEO of Enervalis, one of the Flemish start-ups with international potential in KIC InnoEnergy's Highway Program[14], explains why Enervalis believes that the Flemish Energy Cluster creates the right environment for ambitious, Flemish energy companies with international innovation potential. Stefan Lodeweyckx: *"You cannot compare the current transformation of the energy sector with other innovations taking place e.g. on a pure consumer level. The new energy system is a complex B2B2C eco-system, that was traditionally dominated by big corporate companies. However, most of these 'colossal enterprises' now understand very well that to*

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[14] http://www.kic-innoenergy.com/case-study/creating-more-value-with-energy-solutions-for-electric-vehicles-buildings-and-smart-microgrids/

deal with the disruption in the sector, they need a lot of agility and trial and error. Of course, small companies and high tech start-ups like Enervalis are good at that, and they embrace the opportunity to collaborate with large, established companies as it is the most promising route to get their dreams and innovations into the real commercial energy world. Enervalis has already applied this methodology and has seen the positive results of collaborations with companies like ABB and BAM. In the Flemish Energy Cluster Enervalis hopes to uncover new important collaborations and we have already some very concrete ideas and initial discussions going on at smart eco-district level." Stefan Lodeweyckx is referring to the project 'Architec' that Enervalis wants to set up with Lampiris, ABB and Think E! The project addresses the optimization of the capacity network distribution fee, the surplus of electricity that should be bought on the electricity market and remuneration coming from the flexibility services provided to the grid by the microgrid and therefore an ideal future energy system in a decentralized energy production market. The results of 'Architec' , the algorithms and web platform being developed throughout the project, could provide a household or even a community with a simulation tool concerning the ROI by revamping a complete neighborhood towards a near zero carbon emitting one.

In the second part of Chapter 4 ('The program of the Flemish Energy Cluster per innovator zone') other concrete project examples are presented. See chapter 4 for a definition of the concept 'innovator zone' and a presentation of the context and content of each of the five zones.

Annex 4 provides no less than 7 project proposals, to indicate the type of concrete projects the Flemish Energy Cluster will carry out. Seven projects – that means one per innovator zone, with an exception for the multi-energy innovator zone and the intelligent renovation zone with two projects:

1. Energy harbors: Presentation of project "Demonstration of different storage solutions in a future electricity system" (see 4.2.1.5)

2. Microgrids: Presentation of project "Microgrids used as a local grid with a minimum dependency on fossil sources and the distribution grid by surveillance of maximizing the local energetic balance immediately." (see 4.2.2.5)

3. Multi-energy solutions at district level – Presentation of project “The Thor-site: enhancing multi-energy technology” as well as of the project “A business case for a local smart grid – De Nieuwe Dokken Gent” (see 4.2.3.6)

4. Energy Cloud Platform – Presentation of project “The IoT Energy Cloud Accelerator” (see 4.2.4.5)

5. Intelligent Renovation towards Energy Neutral Buildings with building integrated energy storage and productions – Presentation of project “The power backbone for IoT devices – Intelligent low voltage direct current distribution network within a building with broadband data communication capabilities”. (see 4.2.5.4) as well as deep renovation of collective buildings with focus on social housing.

1.1.7.2 Innovation capacity through integration with scientific research – the Cluster’s Triple *Helix*

Of course, companies within the cluster can rely on other partners than their industrial peers. When it comes to innovation capacity, also knowledge centers play an important role. **The Flemish Energy Cluster brings together the triple helix (1) industry, (2) scientific research institutes and (3) policy makers** in order to maximize the Flemish innovation capacity. Industrial companies take the lead in the Flemish Energy Cluster, but they receive input and support from Flanders’ world class research institutes with a focus on energy.

As summarised below, each of the knowledge partners has a significant track record of collaboration with the industry. With the Energy Cluster the knowledge institutes can take a next step in delivering to more integrated value chains of industrial companies and further align their scientific roadmaps with a broader consortium of industrial players. The access to living lab infrastructure is also an important element of interaction.

To this end the knowledge partners engage to play a (pro)active role in the energy cluster. Each knowledge institute appoints a contact person in charge of exploring the specific collaboration opportunities.

EnergyVille

EnergyVille (www.energyville.be) is one of the leading energy knowledge collaborations in the EU, with a staff of over 200 FTE, all focussing on smart energy systems for the urban environment – a priority for the Flemish Energy Cluster. All energy related competences of KU Leuven (university of Leuven) and VITO

(Flemish institute for technological research) are combined in EnergyVille. Together with IMEC, EnergyVille offers a specific competence on photovoltaics and energy storage.

It has a collaboration with over 70 different companies in the energy field. Together with the Flemish smart grid industry it was involved in setting up and expanding the Smart Grid Flanders initiative to a successful organisation of about 100 industrial partners.
In EnergyVille about 30 EU projects are in progress with Flemish and EU industrial partners, in the context of H2020, Interreg, SBO… Several of these projects can provide relevant input for the Energy Cluster innovation zones as specified in Chapter 4. Energyville also acted as coordinator of the largest Flemish research initiative on smart grids, LINEAR: a EUR 40 million project, with 10 major industrial partners as EANDIS, Infrax, Fifthplay, Viessmann, Miele, Telenet, Belgacom, Engie, Edf Luminus, Siemens. This resulted in first business cases selections and working conditions for demand side response in the residential sector. The project ended as a finalist in the ISGAN (International Smart Grid Action Network) Award of 2013, earning global recognition. On customer side, EnergyVille set up the Flemish Smart City Network with 13 Flemish “centrum steden”.

A total of 95 EnergyVille PhDs is working on smart energy systems. Through KIC InnoEnergy more and more the PhD’s are performing activities in close collaboration with the industry.

Several spin-offs of the EnergyVille partners are active on the market both in the thermal energy sector (e.g. Terra Energy) as in the electricity domain (e.g Triphase). With respect to SME’s, the Incubathor gebouw, next to Energyville Campus, hosts several start-ups in the field of smart energy.

In the EU EnergyVille partners have been managing the European Techology platform for the European smart grid industry and are working in close collaboration with major European industrial organisations as EDSO and ENTSOE, the EU organisations for distribution and transport networks. Internationally EnergyVille is also active with industrial cooperation in China and the Middle East.

Ghent University

Ghent University’s energy related departments (www.energy.ugent.be, www.set.ugent.be) have four focus areas, two of which are (1) energy efficiency in industry and (2) energy efficiency in the building environment. The department’s key competences relate to:

- efficiently managing energy flows at industrial sites through the development of energy systems: heat exchangers, waste heat recovery, electrical machines, internal combustion engines, intelligent power electronics…)
- improving the energy performance of new and renovated buildings connected to the local grid, by implementing (local) storage, evaluating/monitoring the performance of buildings, …

In the category **challenge driven research**, Ghent University Energy is tackling the challenges presented by industrial partners, e.g. projects funded by VLAIO-O&O, KMO, H2020-EU…

As a university its interaction with industry is supported by technology transfer professionals, so called **Business Development Managers** (BDM), funded by the Flemish IOF-fund. They are technology transfer professionals with a relevant technical background but also with a business orientation, promoting the clusters. One of the clusters is UGhent-Sustainable Energy Technologies (SET). Examples of technology transfer in SET:

- TETRA projects include “Decongestion of the Distribution Grid by Decentralized Storage”, “Implementation of innovative renewable energy sources and their interaction on the distribution grid”, “Using thermography for building assessments”, “Post-insulation of cavity walls: performance evaluation of insulation materials and installation procedures”.
- In the SBO project ORCNext it studies the improvement of ORC waste heat recovery systems. This also led to the involvement in an IWT O&O project with BEP Europe and Timmerman and an FP7-SME project on Solar ORC.
- Recently, two new SBO projects were recently filed, one on power quality of the distribution grid with 10 companies in the industrial advisory board and one on building assessment methods with 15 members of the social user field, including governments and fully in line with the triple helix approach.
- Ghent University is the project coordinator of the EU Project FP7-Smartcities-2013 “INCREASE” INCreasing the penetration of Renewable Energy sources in the distribution grid by developing control strategies and using Ancillary Services, with a.o. the DSO of Belgium (EANDIS), Austria, Slovenia and the Netherlands. Ghent University is furthermore involved in the EU projects, e.g. QualiCheck (building performance), Eco-Life (building performance), INPATHES (thermal storage).
- It has bilateral contracts with EANDIS related to the evaluation of the energy performance of buildings. We are member of the ‘Scientific support team of the EPB-platform for the development

and improvement of the EPB calculation methods –EPB consortium'. We are involved in many of the 'proeftuinen woningrenovatie'.

SET has on average about 6 PhD's per year, about 3 new inventions per year that are being evaluated, a yearly budget of about EUR 4 million on industrially relevant projects and since its start in 2008 has led to 5 spin-offs. Mind4Energy is a **spin-off** working on the monitoring of solar power plants. Karybel is a spin-off active in in-the-field activities related to power quality problems in electrical grids.

iMinds

iMinds (http://www.iminds.be) is Flanders' digital research & entrepreneurship hub, driving digital innovation for society and economy through strategic and applied research on key digital technologies, with a special focus on the domains of Internet of Things, Data Science and Digital Trust. Over 900 researchers join forces with industry and SMEs in cooperative research projects to turn digital know-how into future-proof products and services.

Over the last 10 years, iMinds has collaborated with more than 1000 companies to define and evaluate next-generation digital technologies. Through our incubation program, more than 75 digital technology companies have been founded. The majority of these companies succeeded to secure follow-up financing from venture capitalists. Considering also the first successful exits, iMinds' incubation program is now recognized by UBI Global as top 5 incubation research accelerator worldwide.

In the broad field of smart grids, smart buildings, home networking, cloud and IOT, an eco-system has been established of about 200 companies. iMinds' experts closely interact with industry groups such as Smart Grid Flanders, EnergyVille, GreenBridge, Agoria, Vlaamse Confederatie Bouw, FEEBEL, etc. The companies it collaborates with range from small, export-oriented SMEs (Smappee, ReStore, Condugo, eNovates, …) to international, large companies (SIEMENS, GE, NIKO, RENSON, TELEVIC …).

PIXII (formerly known as Passiefhuis-Platform vzw)

Pixii, the member platform for all building actors, has a broad access to the professional building sector. Its engagement in the Flemish Energy Cluster is essential for the cluster's ambition to unite the Energy and ICT sector with the Building sector (see 1.1.4)

Pixii (2016) (www.pixii.be) is an independent non-profit research and education institute, founded in 2002. The platform aims at diffusing and transferring knowledge and research results in the field of applied technology and services for the realisation of buildings with highly efficient energy performance thus resulting in a decreasing pressure on the environment. All types of buildings are included and in all cases the building envelope as well as everything concerning techniques, interaction with the grid, renewables, etc. are concerned. Pixii also supports and guides building companies in business modelling and strategic decision making on products and services.

A further description of the laboratory facilities and international positioning of the knowledge partners can be found in Annex 2.

1.2 Impact

Summary:

(1.2.1) The Flemish Energy Cluster does not have to start from scratch and will build on the foundations laid by Smart Grids Flanders, Agoria's 'Generations' platform and the network of sustainable cities and communities in Flanders. It will accelerate, develop and embed existing ties and create a strong, mature Flemish Cluster with the triple helix industry, policy, research.

(1.2.2) The Flemish Energy Cluster will work to strengthen the existing international ties of our companies and innovation initiatives. The strong international position of our research institutes and Flanders' involvement in the Global Smart Grid Federation and the KIC InnoEnergy network give the Cluster a head start on the international scene.

(1.2.3) The true impact of the Flemish Energy Cluster will be measured in the number of innovative solutions its companies manage to bring to the market, the revenue they will generate, the growth they'll realize and the jobs they'll create. A realistic impact estimation is based on the specific projects targets in the innovator zones (see Chapter 4) and needs to be regularly re-evaluated. An example of such an impact shows an individual project with an ambition of about 5.000 extra jobs.

(1.2.4) The Flemish Energy Cluster will carry out essential actions, that are currently not undertaken by commercial companies nor by any other actors, although they respond to important market failures. These market failures are (a) the under provisioning of public goods like access to state of the art living labs, apt regulation and information, (b) co-ordination and (c) capital market barriers. The actions are part of the Cluster's service offering (see chapter 5).

1.2.1 Clustering

A solid base

The Flemish Energy Cluster does not have to start from scratch. It can build on the consolidation work that was done in the past five years by **Smart Grids Flanders**, the membership organization that aims to facilitate the roll-out of intelligent electricity networks or 'smart grids', both in Flanders and internationally. Smart Grids Flanders brought together relevant players from industry, academia and government and provided them with a knowledge sharing platform and networking opportunities. Smart Grids Flanders took the lead in the cluster formation process (see chapter 3). Its dynamic network of almost 100 companies is a solid base for the Flemish Energy Cluster.

Through the **platform 'Generations', Agoria** merged strengths around production of renewable energy and gave a considerable impulse to new developments within the concerned industrial partners. Agoria also hosts the **Belgian community on smart cities**, and counts upon the Energy Cluster to sustain the energy pillar in this community.

On the scientific side, the **knowledge institutes EnergyVille, iMinds and Ghent University** (see also 1.1.7) worked to integrate initiatives on energy, build up world-class research infrastructure and avoid fragmentation of competencies.

Moreover, half of the Flemish cities and communities have signed the **Covenant of Mayors** and are working on practical implementation of action plans **towards sustainable cities and regions** (see also 4.1.3). Passiefhuis-Platform (Pixii), Vlaamse Confederatie Bouw, UGent and EnergyVille have been working with these actors in living labs and/or European projects.

An ambitious consolidation

The Flemish Energy Cluster means to build on these foundations in order to accelerate, develop and embed.

Accelerate

The Cluster will accelerate the transfer of knowledge and expertise to marketable products and services, partly by facilitating consortia of end users and suppliers of systems and solutions with the aim to realize light house projects, and partly by creating an environment with low regulation zones and living labs.

In this respect, the Flemish Energy Cluster will:

- Engage at least 50 companies actively in pre-competitive projects
- Introduce 5 pathways to introduce new combinations of products and services to the market (linked to the 5 innovator zones)
- Set up 5 relevant international partnerships and 5 projects with international participants in order to enhance export opportunities and commercial strengths

Flemish research is often excellent and therefore deserves excellence in valorization and marketing.

Develop

The Flemish Energy Cluster will expand existing networks and intensify the knowledge-sharing between partners. In order to create critical mass and generate impact, cluster partners will aim to establish a cooperation that isn't limited to the timing of any actual project. Sustainable collaboration can be achieved through trainings, coaching and feedback sessions.

Embed

The one ambition of the Flemish Energy Cluster is to position Flanders as a Smart Energy Region par excellence, an environment where companies active in sustainable energy and flexible systems can thrive. In order to achieve this, the Cluster has a triple helix (industry, policy makers, research) structure – see also 1.1.7.2. The Cluster will:

- Embed itself in a broader community. The Cluster - as an active network of companies, involved in 5 innovator zones – will reach out to companies that haven't formally joined the Cluster, although they are part of its target group (see also 1.1.6). A fruitful exchange will be sought with this broader community and network. **(Industry)**
- Ensure focused policy frameworks. When it comes to regulations and legislation (incl. on tariffs), internationalization and financing it is important to have a coordinated, focused and predictable approach to stimulate innovative initiatives in Belgium and keep companies here. The Energy Cluster will actively engage in cooperation with the concerned governments and policy makers, by helping to draw the framework, to apply it in practice and to guarantee the appropriate follow-up. **(Policy makers)**
- Align the industry with knowledge partners, in order to be able (a) to market - and put to good use - promising research results and (b) supply scientific input and support for company

priorities. Cooperation should be on the agendas of all concerned parties (e.g. co-creation) and the Flemish Energy Cluster will facilitate this through meetings and fora. (**Scientific research)**

- Ensure **appropriate follow-up**, dissemination and data access once projects are finished. By doing so, the Cluster guarantees **continuity** in each innovator zone. Too often, there are no 'next steps' to ensure infrastructure and knowledge acquired during a project are passed on to (and built upon by) relevant stakeholders. The Flemish Energy Cluster will make sure there are long term achievements and continuous progress.
- Most importantly, the Energy Cluster will realize **real-life lighthouse projects** providing infrastructure accessible to all project partners for marketing purposes, as well as living labs allowing producers of new components to test the behavior of their systems in real-life environments.
- Engage the financial markets. The new energy system involves drastic changes both in the energy infrastructure as in the way consumers and prosumers pay for their energy consumption. New paradigms such as energy-as-a-service are popping up. The **technology sector will need to team up with the financial sector** in order to mobilize enough financial means. Together new financing schemes and business models will need to be put in place, mitigating the risks associated with disruptive changes patterns.

1.2.2 International positioning

In recent years, energy(related) companies and innovation initiatives in Flanders have found their way to European and international organizations and platforms. The Flemish Energy Cluster intends to build on this basis and strengthen the position of Flanders (as a smart energy region) on the international scene.

On company level the participation of Smart Grids Flanders (as founding partner) and EnergyVille (as chair) within **the Global Smart Grids Federation (GSGF)** is important. Over the past few years, GSGF has put a flexible and integrated energy system high up on international agendas, thus creating a leverage for Flemish breakthroughs and research results. Through GSGF, Flanders has managed to create international visibility for its innovative products and research results (e.g. the international attention for the project results of LINEAR, 'Bringing 240 families to flexible electricity consumption'[15], by EnergyVille). GSGF creates a worldwide benchmark, so that members (like Smart Grids Flanders) can put local realizations in a global perspective.

In fact, **all of the nine founding partners** of the Flemish Energy Cluster are **actively involved in** small and larger **international initiatives**. Passiefhuis-Platform for example is linked to the international Passiv Haus institute and the Dutch Stichting Passiefbouw. Another example is the Agoria Renewable Energy Club (AREC). These groups are specifically targeting international business development and are crucial for stimulating revenues and export.

The Flemish Energy Cluster will build on these foundations and is also mapping out a **sustainable collaboration with a consortium of mainly Dutch companies and grid operators** active in setting up big scale pilot projects on energy distribution and production. The collaboration will translate itself into demonstration projects of companies in close concertation with the Dutch initiatives, such as the 'Stroomversnelling' initiative and the renovation of Southern Randstad. Exchange between Dutch and Flemish companies on best practices and parallel or concerted communication will be the core of such collaboration. In this respect, Smart Grids Flanders is, in collaboration with the TKI Urben Energy on energy and the Dutch distribution grid operator Alliander, involved in signing a Letter of Intent on collaboration within the energy sector.

With the co-location of Smart & Energy Efficient Cities & Buildings **within the KIC InnoEnergy (EIT) Flanders holds a strong position**. This renowned European valorization pool around smart cities gives the Flemish Region a strong advantage in supporting market driven innovations and in providing a unique dissemination potential for this sector, complementary to the professional courses of the IVPV (Institute for Permanent Education) of Ghent University.

1.2.3 Impact of the Flemish Energy Cluster

What impact will the Flemish Energy Cluster have? The true impact of the Flemish Energy Cluster will be measured in the number of innovative solutions its companies manage to bring to the market, the

[15] http://www.globalsmartgridfederation.org/2015/02/26/member-of-the-month-sgf-flanders-belgium/

revenue they will generate, the growth they'll realize and the jobs they'll create. Even before the Cluster is operational, the more than 50 companies engaged in the Cluster have concrete ideas to work together on a number of most promising systemic solutions (see chapter 4.2 for a brief presentation of each of these 6 projects or Annex 4 for the full project proposals – one per innovator zone, with the exception of two projects for the multi-energy innovator zone).

At this point it is tempting to make strong numeric claims about the impact of the Cluster. During the projects in the innovator zones the Energy Cluster will accompany the project consortia in a gradual specification and revision of its direct impact.

As an example we will try to assess the impact of the project 'The IoT Energy Cloud Accelerator' (see 4.2.4.5) in the innovator zone 'Energy Cloud Platforms'. See Annex 4 for a full presentation of this project. ESAS, Proximus and Condugo have teamed up to work on **a solution in the innovator zone 'Energy Cloud Platforms'**. The idea is that Flanders can capitalize on its (knowledge) potential in this field if it manages to become a large-scale staging ground for launching IoT applications and end-to-end solutions easily, quickly and decisively. By unifying its fragmented internal market and infrastructure for energy data and services, Flanders can become the area where the commercial validation takes place before blanket roll-outs across Europe are started. There is very significant potential in a well-functioning, large-scale IoT cloud and supporting infrastructure, both in terms of job creation as in terms of export potential.

The global market for IoT in smart homes alone has been growing by 27% annually since 2012 and is expected to continue along this trajectory until at least 2022. Its total market size will reach EUR 240 billion, half of which is made up of services - ranging from installation over servicing and maintenance to monitoring. This brings a wealth of lower and medium-skilled jobs with it, in addition to the high-skilled jobs that are needed for designing, implementing and operating the systems behind the cloud and related IoT.

The presence of a well-functioning, large-scale cloud in Flanders is a major trump card to attract the kind of advanced manufacturing that is needed for integrated IoT solutions (i.e. setups of connected devices).

Flanders, which on a global level is akin to a larger city presents the ideal environment for IoT to take hold. In line with the forecasts mentioned above, the market size could grow to EUR 375 million by 2022 - **equivalent to 5.000 new, direct jobs.**

In terms of export potential the value of having a staging platform for rapid deployment and validation cannot be overestimated. Both domestic companies as well as international players will use it as their entry point to the whole of Europe.

1.2.4 The Energy Cluster as a response to market failures

What is the added value of a cluster? Why does Flanders need an Energy Cluster? Why would the market be incapable of handling the activities that the Cluster proposes to do?

Experience and history has shown that for different reasons the activities that the Cluster intends to carry out, are not undertaken by commercial companies nor by any other actors, although they respond to important market failures. In Annex 3 we deal with these market failures in great detail, with elaborate problem statements. Here we focus on the solutions the Cluster proposes to resolve the following market failures:

- The under provisioning of public goods (access to living lab infrastructure; regulation and information)
- Collaboration
- Capital market barriers

The Cluster will deal with the under provisioning of three public goods of particular interest to the energy sector (see Annex 3 for definitions). The Cluster will **(1) grant access to state of the art living lab infrastructure.** The Flemish Energy Cluster intends to scale up lab-level technology to real-life pilot systems, tested in a real-life environment. The aim is to have several operational sites in each of the innovator zones, acting as living labs. These living labs will be used to show-off the capabilities of the Flemish energy sector on a local as well as an international level. More-over, emphasis will be put on the openness of the system, enhancing the possibilities for Flemish companies to introduce and test their technology into the living lab system.

The Cluster will also **(2) take actions with regards to legislation.** The Cluster will provide guidance to the regulator, by presenting him with a comprehensive view on the impact of today's regulations. The energy Cluster considers apt regulation as an essential factor in all of its innovator zones (see chapter 4.2). Three phases can be distinguished:

1. **Identification of the hurdles caused by legislation**. Each organization has a good view on the show-stoppers due to legislation for his own technology. The Cluster will group these show-stoppers per innovator zone and discuss them with DSO's, regulators as well as government in order to find acceptable solutions.
2. **Introduction of areas with alternative regulatory conditions**. When necessary for the operation of an innovator zone, the Cluster will strive to create a temporary zone with supportive legislation for the energy system/living lab that will be deployed. This supportive legislation will be introduced in close collaboration with the government. Recent actions have been undertaken on a political level in order to enable such regulatory exceptions.
3. **Feedback to the government**. At the end of the living lab projects, a report will be created showing the effect of the changes in legislation and/or energy policy that were under scrutiny. As such, it will be easier to evaluate potential modifications in legislation.

The Energy Cluster has involved the DSO's from the very start. They have helped defining the innovator zones in order to ensure their collaboration in each of the living labs. They have expressed their interest to investigate new business models in order to accommodate the changes in the market.

Finally, the Cluster also wants to **(3) make information accessible**. The Cluster wants to share the information and insights gained in its living labs as broad as possible using different mechanisms (website, apps, newsletters, events, yearly symposium – see Annex 3 for the full list). The Cluster will make optimal use of the living labs as a show case. This is essential to trigger people, to inform them and create enthusiasm and awareness. Raising awareness is the best way to ensure a new energy system will be accepted by a large community.

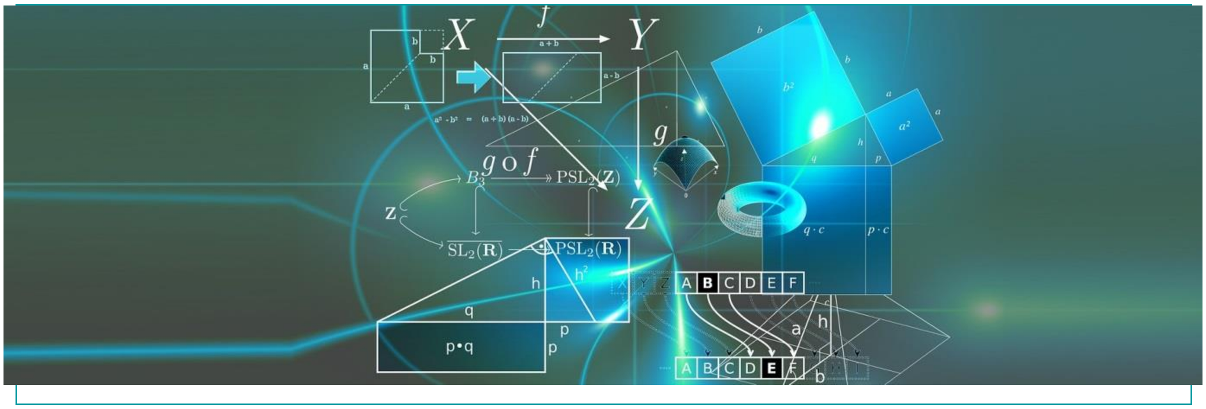
As Annex 3 explains, the Covenant of Mayors (see also 1.1.4) and the Paris Climate Change Conference of 2015 are creating momentum for the Energy Cluster to seize upon.

A second market failure the Flemish Energy Cluster will resolve, is the issue of co-ordination of the value chain. The Cluster wants to deal with co-ordination failures. It will do so, by bringing organizations from the complex new energy system together and by facilitating their collaboration. The Cluster takes up the task of facilitating this co-ordination process during the defining, the operational and the follow-up phase of the living labs. By doing so, any lack in expertise and/or market partners will be identified early in the process and interested parties will be contacted. The Cluster itself will not act as a commercial organization in such undertakings. The Cluster intends to bring competencies together from different sectors (electricity, heat and their intelligent combination) and add competencies of the construction, IT and finance. The presence and support of the different sector federations is essential for the success of the Cluster and should be seen as a key asset in the task to bring together consortia.

The third market failure the Flemish Energy Cluster will address, consists of capital market barriers. Technology innovation is typically a long-term investment fraught with risks to the investor. This is definitely the case for energy technology innovation (see Annex 3). Therefore, the Cluster will set up trajectories in which new business models are created by experts from the financial sector as well as companies active in the Cluster. Business schools like Vlerick are already assessing the potential of new business models in the field of battery storage in the project 'GREAT'. Accelerator programs such as the Knowledge and Innovation Center InnoEnergy are searching for partners in order to create effective teams to create new ventures. Rather then re-inventing the wheel, the Energy Cluster will support existing actions by making them known to relevant players. The Cluster will facilitate one-on-one support to organizations in general and SME's in particular. This is necessary when it comes to the creation of new business models or ways to attract capital.

All actions the Flemish Energy Cluster proposes to handle the market failures, are part of the Cluster's service offering. Chapter 5 presents the roles and service offering of the Cluster in detail. Annex 3 explicitly links each type of action to a certain 'service package' (talent, business and valorization) offered by the Cluster.

Chapter 2
Mission and vision of the Cluster



Summary:

The Flemish Energy Cluster wants to increase the competitiveness of the Flemish energy sector through (1) collaboration, (2) light-house projects and their (3) valorization and the (4) dissemination of success stories. The Cluster wants Flanders to internationally excel in selected segments in the new energy system and by doing so tap into worldwide growth markets. The Cluster proposes a timeline by which – 5 years from now - 90 partners will be working in innovator zones, 24 projects can show their first results and 50 million of direct investments will have been made (see chapter 7, workplan).

Vision

*In the energy system of the future, different energy flows will be **integrated**. Its **flexibility** will allow for a high degree of renewable energy production.*

*The solution will result from a **combination of integrated solutions** around energy efficiency and flexibility.*

*The energy system will consist out of **innovative** energy **components, services, systems and networks**, which all together form **new value chains** involving **new business models**.*

*Flanders wants to internationally **excel** in **selected segments** of these value chains in order to tap into **worldwide growth markets**.*

Mission

It is the Flemish Energy Clusters mission to realise a smart energy Flanders region by

• engaging the Flemish industry incl. SMEs,

• in order to generate economic and socially viable breakthroughs

• in the continued transition to a modern "sustainable" energy system

• by a unique positioning in the value of some key areas

in order to achieve economic growth for Flanders with innovations that can be applied both in Flanders and internationally.

The vision and mission of the Flemish Energy Cluster are in line with national and international reference documents such as:

• the Capgemini European Energy Markets Observatory Report 2015

• The revised European SET Plan 2015

• The report “Energy transition to sustainable NL”, January 2016

• VRWI visionary report “New energy demand and delivery in 2025”

The Vision and Mission were also verified with a representative sample of the industry in a brainstorming session around the definition of thematic focus points (innovator zones) which took place on January 19, 2016.

Chapter 3: Cluster Creation Process

Summary: In response to a 'call to action' from the industry, and in close collaboration with over 50 companies, nine organizations took up the glove and founded the Flemish Energy Cluster. Today, the Cluster has a vision and mission (chapter 2), 5 well-defined thematic priorities or innovator zones, with specific project proposals (chapter 4 and annex 4) and a work plan (chapter 7). What happened between October 2015 and September 2016 to achieve all this? In this chapter we take a look at 6 crucial moments in the creation process of the Cluster.

In October 2015 a broad range of stakeholders from the industry, research organisations, federations and governments embarked on the journey that has led to this proposal for a 'Flemish Energy Cluster'. Nine organizations – Agoria, Voka, Pixii, VCB, Living Tomorrow, EnergyVille, iMinds and UGent, under the lead of Smart Grids Flanders - agreed to work together to position Flanders internationally as a leading Smart Energy Region.

Today, it is clear to all those involved in the Flemish Energy Cluster, that it's essential to work over sectorial borders (Energy, ICT & Construction), with a triple helix structure (industry, research, policy makers), to form complete value chains and ecosystems of companies that share a thematic focus (5 innovator zones) in order to bring integrated, competitive solutions to three most promising market segments (energy-efficient industry; sustainable communities and cities; and smart homes). But how did we arrive at this consensus? In this chapter we look back on the different steps in the consolidation process of the Cluster.

During the process, 6 different phases have been undertaken, each with a specific deliverable:

- Consortium building (resulting in a 5 pager describing the general scope)
- Concept definition (resulting in a 10 page document focusing on the topical definition)
- First version of white paper (resulting in a 70 page white paper)
- Final version of the white paper
- Proposal writing (resulting in this document)
- Face-to-face fine-tuning with companies who have formally agreed to the highest level of engagement within the Flemish Energy Cluster (workshop September 12, 2016)

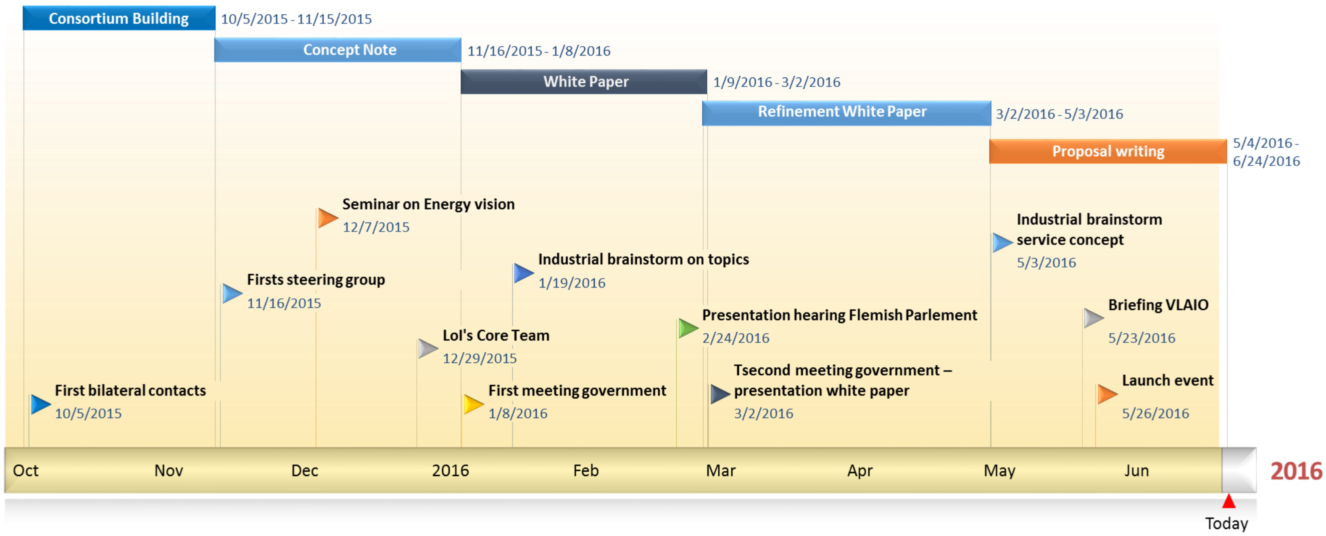


Figure 5: Cluster creation process

During the entire process the base document we started with, was continually expanded with new insights and information. The document has served (and is still serving) different purposes:

- Internal alignment amongst the organisations
- Engagement of and discussions with industrial partners
- Alignment with Flemish government (regarding cluster program management as well as energy policies)

In the near future, this document will also serve as the basis for putting the cluster into operation.

Six specific events deserve attention as they have formed the basis for the industry engagement within the cluster:

1. **Seminar on Energy Vision at the Antwerp Harbor**

   At this seminar, organised in close cooperation with Havenbedrijf Antwerpen and I-Cleantech and attended by 90 participants, the different innovator zones were launched and the necessity of broad collaboration within the energy system, including ICT and construction industry was confirmed by the audience. [16]

[16]] http://www.smartgridsflanders.be/en/nieuws/interactief-visie-seminarie-een-economische-en-duurzame-energievoorziening-2020

2. **Industrial brainstorm on the content specification** [17]

   On January 15, 2016 over 40 persons gathered to brainstorm on the opportunities, threats, potential scenarios in the different innovator zones. This formed the basis of the technical content of each zone, as well as for the supply chains connected to them.

3. **Industrial brainstorm on the service offering**

   Early May 2016, a presentation and consultation took place with a broad mix of leading innovative companies in the Flemish region. The segmented offering (see chapter 5) as well as a business oriented focus (business plan for each of the innovator zones) were agreed at this point.

4. **Member meetings/board of directors of the organisations initiating the energy cluster**

   Each of the supporting organisations presented the cluster initiative to the relevant bodies within his members/governance structure, the number of attendees ranging from 50 till 250. The feedback coming out of these meetings was used to enhance the white paper.

5. **Launch event** [18]

   On 26th of May, the energy cluster formally presented its intentions to an audience of 180 interested people. After keynotes given by Chris Peeters, CEO Elia (Belgian TSO) and Bart Boesmans (CFO Engie), there was a panel discussion with three Flemish companies (Siemens, Proximus, Actility) on the expectations of the energy cluster. The reactions after the event were very positive and even made some national newspapers. At the event, Frederik Loeckx, managing director of Smart Grids Flanders, was introduced as a driving force behind and also the future 'face' of the Flemish Energy Cluster.[19]

[17] http://www.smartgridsflanders.be/evenement/brainstormsessie-energieprioriteiten-van-het-bedrijfsleven
[18] Http://www.smartgridsflanders.be/nieuws/verslag-lancering-vlec-265
[19] http://www.smartgridsflanders.be/nieuws/interview-frederik-loeckx-nieuwe-algemeen-directeur-sgf

Impressions from the launch event

Soon after the Launch event, the first Letters of Intent, by which companies formally engage themselves within the Cluster, started to arrive, leading to over 50 engaged companies.

6. Face-to-face fine-tuning with companies who have formally agreed to the highest level of engagement within the Flemish Energy Cluster (workshop)

On September 12, 2016 a workshop was organized with companies – like ABB, Niko, Havenbedrijf Antwerpen, Proximus, Havenbedrijf Gent, Actility Benelux, Eandis, Condugo, Enervalis, Fifthplay, Ferranti Computer Systems, VOLTA and ESAS - who have engaged themselves in the Cluster at valorisation level. In the fall of 2016, parallel to the negotiation with the government, the Flemish Energy Cluster is fine-tuning its projects and business models, in order to be ready for an official kick-off, early 2017. Participants in the workshop agreed that the Cluster will focus on research that is close to the market (light-house projects) and that promises considerable return. They also stressed the willingness to seek synergy with IBN’s (innovatieve bedrijfsnetwerken).

During the efforts and exercises mentioned above, five core focus themes or ‘innovator zones’ were identified, each characteristic for a specific market breakthrough. The different zones however do not stand alone and have significant overlap. This means that a company active in one zone, can easily contribute to another zone, while targeting different markets with other products or services.

The selection of the five core themes was based on the following criteria :

- International market trends and market analysis for Energy
- Combined strength of the Flemish industry and knowledge institutions, with special attention to expertise with international accents.
- The need for a coherent value chain with very different companies

Ultimately the following core themes or ‘innovation zones’ were selected:

- Energy Harbors
- Micro-grids
- Integration of Energy flows on larger sites (communities and municipal industrial zones)
- Energy clouds and apps
- Smart renovation with building integrated energy production and storage

Chapter 4 takes a detailed look at each of these ‘innovator zones’. It is important to stress here, that the five zones are to be considered as ‘works-in-progress’. A continuous fine-tuning of each innovator zone is going on with regard to the companies involved and their roles, the focus within the zone, project descriptions, complementary initiatives, expected impact, business models etc.

Impressions from different stakeholder consultation events

Chapter 4
Innovator zones – thematic priorities

Summary:

This chapter is of special importance, since the concept of innovator zones is a key element in the Flemish Energy Cluster and lies at the core of the 'valorisation' package in the Cluster's services (chapter 5). In this chapter we take a detailed look at each of the five 'innovator zones' the Cluster focuses on.

After a definition and a brief recapitulation of essentials from the previous chapters, we take (in 4.1) a closer look at the context of each innovator zone. What are the market opportunities and challenges within each innovator zone? What are the specific strengths of Flanders in this respect – why does the Energy Cluster expect Flemish companies to achieve a breakthrough in each of these innovator zone? The value chain of companies required to achieve such a commercial breakthrough is identified and target companies of the Flemish Energy Cluster for this specific innovator zone are presented.

Then (in 4.2), we zoom in on the (sub)program of the Flemish Energy Cluster per innovator zone. What is the focus of the Cluster's program? What are the ambitions? At present, the five zones are to be considered as 'works-in-progress' and a continuous fine-tuning is going on. However, we are able to present for each innovator zone a key project that companies are working on at the moment. This chapter presents six project proposals in a nutshell. These projects lie at the core of the Flemish Energy Cluster. In annex 4 they are presented in more detail. We'd like to stress that annex 4 deserves special attention.

In the previous chapter we've explained how the five thematic priorities or 'innovator zones' of the Flemish Energy Cluster were selected. This chapter takes a closer look at each one of them: energy harbours, microgrids, multi-energy solutions at district level, energy cloud platforms and intelligent renovation.

But let's start with a definition. **What is an 'innovator zone'?**

The concept of innovator zones is a key element in the Energy Cluster and it lies at the core of the ‘valorisation’ package in the cluster services (chapter 5). **An ‘innovator zone’ is a clustered program of activities and projects leading to a specific innovation breakthrough in the market for the Flemish industry.**

An innovator zone typically consists of:

(1) A combination of **complementary projects with a common focus and** well-defined links and **interactions**. The Energy Cluster manages the interaction between these projects.

(2) **A combination of running and planned projects** by the partners. New projects will be initiated, as The Energy Cluster will point out – and help set up - the required “**missing-link” projects to achieve market impact**.

(3) A program of projects with **funding from different sources**: Flemish (regular and thematic), European (H2020, Interreg, Juncker, KIC EIT, EIB,…) and industrial. The Energy Cluster facilitates the acquisition of additional funding, optimises the amount of EU funding for Flanders and the optimal combination of different funding sources over the projects.

(4) In the Energy Cluster an innovator zone is typically clustered around **at least one or two major (geographically located) living lab projects** with international visibility and which are initiated by the cluster.

As explained in chapter 1 (1.1.5), the Flemish Energy Cluster helps companies focus on systemic innovations by mobilizing and integrating a whole chain of companies and other stakeholders from different sectors. The Cluster will operate in **three** - carefully selected and most promising - **market segments**: (1) energy-efficient industry, (2) sustainable communities and cities and (3) smart homes.

There is no 1-on-1 relation between companies and innovator zones. A company active in one zone, can easily contribute to another zone where it might be targeting different markets with other products or services. However, the **double axis innovator zone/market segment** does guarantee a clear focus of efforts. The Flemish Energy Cluster focuses on five thematic priorities (innovator zones) in order to bring integrated solutions to the three well-defined market segments mentioned above. Several of the innovator zones are linked to each other (e.g. energy cloud platforms are often used in microgrids), but are differentiated by their specific target market.

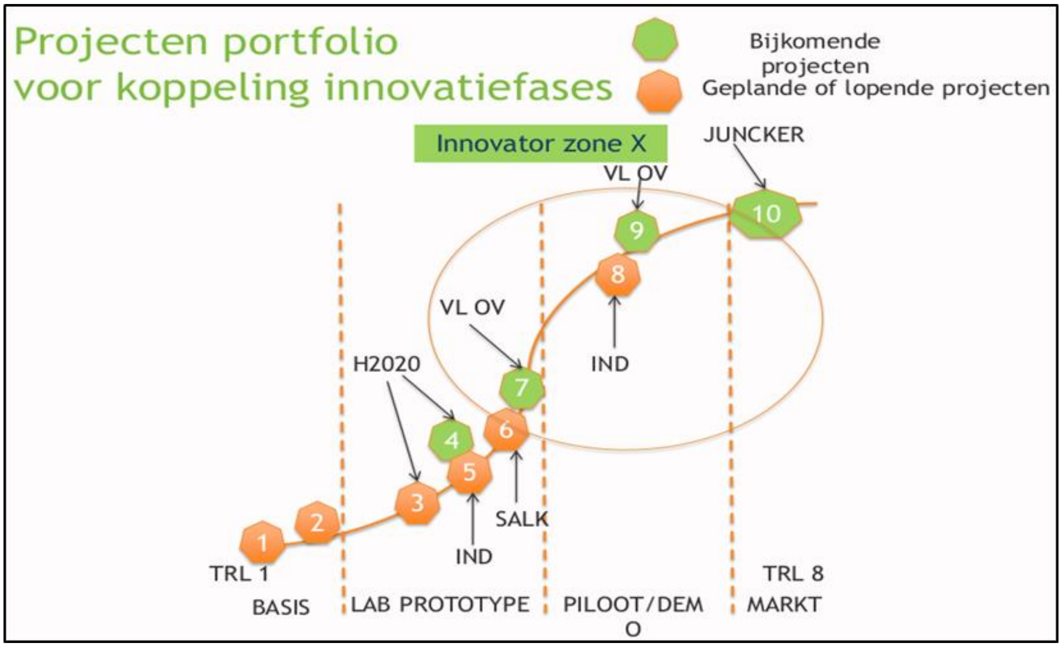


Figure 6: Concept of innovator zone

For each of the innovator zones a preliminary program has been defined resulting in a rough estimation of the global budget of about EUR 50-70 million for the first five years. As already mentioned this budget will be covered partially by Flemish, industrial and EU funding.

In this chapter, we will start with **(4.1) a closer look at the context of each innovator zone.** What are the market opportunities and challenges within each innovator zone? What are the specific strengths of Flanders in this respect – why does the Energy Cluster expects Flemish companies to achieve a breakthrough in each of these innovator zone? The value chain of companies required to achieve such a commercial breakthrough is identified and target companies of the Flemish Energy Cluster for this specific innovator zone are presented. By now, a number of them have already engaged themselves formally in the Cluster. Once the Cluster is operational, a continuous effort will be made to reach out to other relevant partners.

In the second part of this chapter **(4.2),** we **zoom in on the (sub)program of the Flemish Energy Cluster per innovator zone.** What is the focus of the Cluster's program? What are the ambitions? At present, the five zones are to be considered as 'works-in-progress' and a continuous fine-tuning of each innovator zone is going on with regard to the companies involved and their roles, the focus within the zone, project descriptions, complementary initiatives, business models etc… However, we do present for each innovator zone a key project that companies are working on at the moment and that gives a good example of (a) the type of solutions the Energy Cluster wants to help local companies bring to the international market, (b) the kind of collaboration required to reach such integrated solutions and (c) the impact (growth/jobs/patents…) they can have.

4.1. The 5 innovator zones in their context

Summary:

What are the market opportunities and challenges within each innovator zone? What are the specific strengths of Flanders in this respect? Which value chain of companies is required to achieve such a commercial breakthrough?

(4.1.1) ENERGY HARBORS

Harbor areas are destined to play a crucial role in the energy transition: they are at the crossroads of multiple energy vectors, they have a high energy intensity and they've put sustainability on top of their agendas.

Flanders has 4 harbors with direct access to the North Sea. Their economic importance can hardly be overestimated: In 2013 their total direct added value exceeded EUR 14,7 billion, the direct employment was 103.739 fulltime equivalents (FTE's) and EUR 3,0 billion was invested. With their strong ties to local knowledge centers and the Flemish chemical industry, our harbors offer a unique setting to launch integrated energy solutions into the market.

At present, a.o. Havenbedrijf Antwerpen, Havenbedrijf Gent, Actility Benelux, ABB, Ferranti and Eandis have engaged themselves at valorization level in the Flemish Energy Cluster. They are well-positioned to contribute to the innovator zone Energy Harbors.

(4.1.2) MICROGRIDS

Microgrids are groups of interconnected consumers, distributed renewable sources and energy storage solutions, within well-defined electric perimeters. Essentially, microgrids manage their own production, storage and demand facilities and are less depending on the distribution grid.

Microgrids are not new, but due to issues of (e.g.) grid stabilization and security of supply, they are growing rapidly worldwide, especially in the US. The potential in Africa and Asia is huge.

Flanders has a strong competence base, established international ties and an interesting energy landscape for test-driving new microgrid solutions.
At present, a.o. Eandis, ABB, Siemens, Triphase, Engie and Van Wingen have engaged themselves at valorization level in the Flemish Energy Cluster. They are well-positioned to contribute to the innovator zone Microgrids.

(4.1.3) MULTI-ENERGY SOLUTIONS FOR DISTRICTS

Energy solutions at district level offer scale benefits and allow for (1) an optimal integration of sustainable energy sources, (2) optimal energy storage, (3) a reduced energy demand and – when the site combines different functionalities – (4) great exchange opportunities between energy flows. Today, the market of district deployment and renewal, is at the beginning of a spectacular phase of growth – in Europe and worldwide. Flanders is an intensively urbanised area with over 150 cities engaged in the European Covenant of Mayors, and is therefore an ideal take-off market for multi-energy solutions on a district level. Trumps of the Flemish region include (a.o.) a growing number of SME's with energy integration as their core business and the strategic position of Flemish partners in the KIC InnoEnergy thematic area 'intelligent & efficient cities and buildings'.
The value chain of the multi-energy solutions innovator zone complements that of the innovator zone 'microgrids'. The multi-energy value chain adds companies in the field of heating and cooling, focuses on the integration of heat and electricity, on the demand side management and on project development aspects, with infrastructures as heating and cooling grids.

(4.1.4) ENERGY CLOUD PLATFORMS

A crucial question in today's energy landscape is how to provide (big) data towards third parties in a uniform, transparent, qualitative and legally correct format. To this end a multitude of (intelligent) energy apps and services are being developed and rolled out. With its focus on energy cloud platforms, the Flemish Energy Cluster is in line with the transition area 'Digital Society', put forward by the Flemish Government.
Flanders has strong ICT expertise in the domain of Internet technology, data security, interdisciplinary approach and digital real-life labs. Our digital start-up culture gets international recognition. The open data initiatives of the current Flemish government, as well as the research strategy of iMinds, create a positive context for the development of new, integrated applications.

The value chain in this innovator zones consists of energy providers & grid operators, Telco operators, IoT & data platform providers and automation providers.

(4.1.5) INTELLIGENT RENOVATION

In Europe almost 40% of the building stock predates 1960 and was not built according to any energy-efficiency plans. Therefore, an intelligent and ‘deep’ renovation of buildings (both of the envelope and its installations) makes considerable energy and emission reductions possible. The fragmented market and lack of ‘renovation packages’, however, make it a challenge to reach European and national goals. Flanders has a tradition of living labs where comfort issues in combination with energy measures or combined, an active participation in European research projects and an ‘early adopter’-mentality among home owners. This makes our region an ideal testing ground for solutions for intelligent renovation.

Companies like Think E, ABB, NIKO and Siemens have engaged themselves in the Flemish Energy Cluster and are well-positioned to contribute to the innovator zone ‘Intelligent Renovation – towards nearly energy neutral buildings with building integrated energy production and storage.’

4.1.1 Energy Harbors: context

4.1.1.1 Energy harbors: Market opportunities and challenges

Harbors as energy crossroads

Harbors, harbor cities and harbor areas have strong assets to play a crucial role in the energy transition (see e.g. publication of Flemish Port Commission, *Feiten, statistieken en indicatoren 2014*):

- They form the intersection of multiple energy vectors (electricity, heat, cooling, gas, hydrogen, bio fuels, …) and have potential to exchange waste heat;
- Several transport modes meet at harbors (water, rail and road);
- There is space available for large installations;
- The energy intensity is high due to a strong geographical concentration of large energy users and suppliers.

Energy integration as new flagship of the harbor strategies

Worldwide harbors are defining ‘energy’ as a priority in their strategy, both because of economic reasons as well as environmental concerns. Network projects such as “*E-harbors*”[20] and “*Duurzame Zeehavens*”[21] illustrate how Flemish harbors – together with other European harbors – are searching for business cases to increase the sustainability of the harbors’ energy systems.

Due to its unique harbor area, Flanders has a key position, both for the Flemish market and on an international level. Our harbors are very important for Flanders’ economic activities. In 2013 the total direct added value exceeded EUR 14,7 billion, the direct employment was 103.739 fulltime equivalents (FTE’s) and EUR 3,0 billion was invested[22].

This economic added value results in a significant energy use in these harbors. The Port of Antwerp, for instance, is home to the largest concentration of Belgian users (about 10% of the national electricity use and production)[23] and this on a relatively small area. The total energy use (electricity and gas) in the Port

[20] The E-harbors journey, point of arrival, smart energy networks in the North Sea Region, Interreg, 2014
[21] Duurzame zeehavens, Interreg, 2014
[22] De Vlaamse havens feiten, statistieken en indicatoren voor 2014, Vlaamse Havencommissie
[23] Duurzaamheidsverslag 2015, Port of Antwerp

of Antwerp in the period 2008-2013 was about 250 PJ per year. In the Port of Ghent the energy use was 54 PJ.

A growing part of this energy use is locally produced in a sustainable way, as illustrated in Figures 7 and 9. The share of renewable energy is increasing significantly. The Port of Ghent, for instance, has the ambition to win 30% of the energy mix from renewable sources in 2020[24]. This is increasingly realized in an innovative way, as illustrated by the project on smart control of Wind aan de Stroom in the Waasland Port[25] or by the exchange of energy flows as in the "*waste to energy*" project Ecluse[26,27].

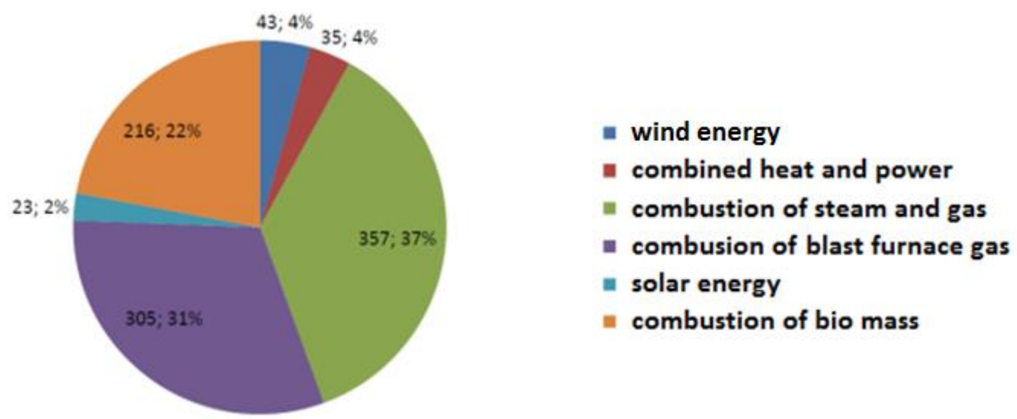


Figure 7: Installed electrical power in Port of Ghent in 2012 (in MW-%)

[24] Samen Groeien naar Duurzame Welvaart 2010-2020, Strategic Plan Havenbedrijf Gent, updated version December 2015
[25] http://www.smartgridsflanders.be/nieuws/slimme-aansturing-een-positief-verhaal
[26] http://www.ecluse.be/homepage/
[27] http://www.iminds.be/en/projects/2014/03/06/swift

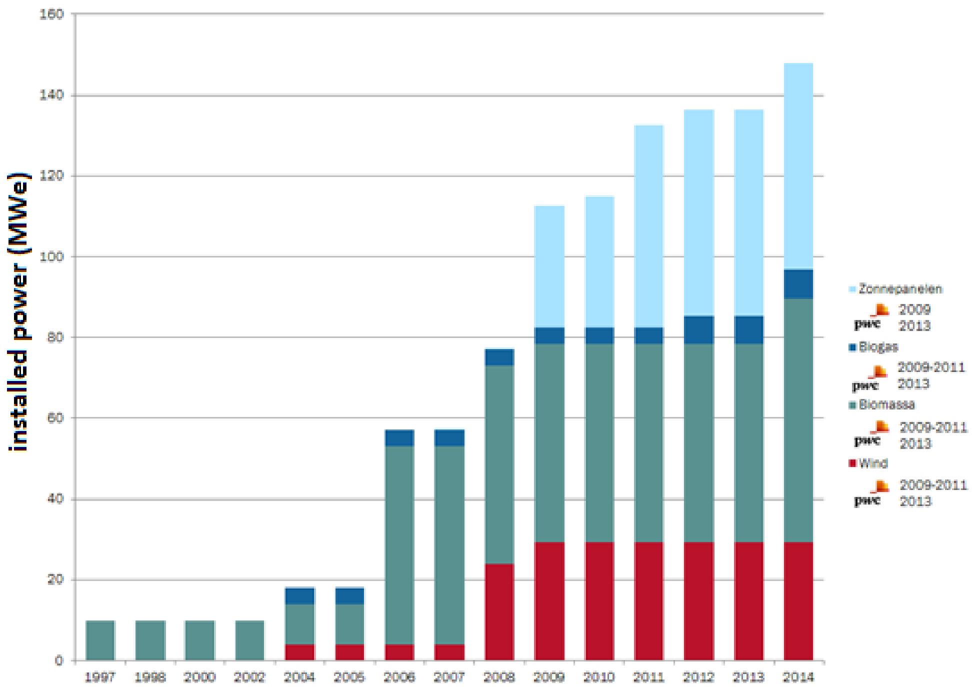


Figure 8: Installed power in renewable energy in Port of Antwerp

Equally important within the energy context, is the transport from and to harbors. Every year 70% of all cargo transport of the railway operator NMBS/SNCB is linked to harbor transport. On the water the challenge is coupled with the emissions of the commonly used heavy fuels. The introduction of the Environmental Shipping Index (ESI)[28] resulted in a greener fleet of ships which come to the Ports of Antwerp and Ghent. Also the introduction of ECA's (Nitrogen Oxide/Sulphur Emission Control Area) impose additional requirements which make the harbor transport greener.

Several roadmaps (e.g. OECD 2014)[29] and initiatives (e.g. EcoPorts)[30] confirm these market trends towards an integrated energy approach in harbors where port authorities have a leading role. Harbors are stimulated to subscribe to 'sustainability labels', such as the PERS[31] (Port Environmental Review System) or ESPO-ECOPORTS. In this context, the Flemish port authorities already have performed multiple studies on sustainability.

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28 http://www.environmentalshipindex.org/Public/Home
29 The competitveness of global port cities, OECD, December 2014
30 http://www.ecoports.com/map
31 http://www.havengent.be/product/311/milieurapport-2013

4.1.1.2 Energy harbors: Strengths of Flanders

- Unique location: Flanders has 4 ports which have direct access to the North Sea, all fairly close to each other and with a number of large industrial port companies. This offers a unique setting for a first launch of a new solution into the market.
- Collaboration between ports and knowledge centers: Explorative projects like E-harbors and '*Duurzame Zeehavens*' resulted in a basis for the first innovation opportunities and business priorities. Knowledge on harbors and energy systems have already been combined in several innovation projects (IWT Tetra-SBO, Interreg, ICON, MIP, etc.).
- Strong sectors: The link with a strong chemical sector offers specific opportunities for long-term energy storage as products. Companies like Atlas Copco, Daikin Europe, Solvay, BEP Europe and Hydrogenics aim at developing components for waste heat valorisation and the integration of the energy vectors. Furthermore, a large number of energy consultants are active in the Flemish harbor area. They can expand their businesses across the borders using new business models.
- Potential collaboration: A collaboration with the Dutch ports like Rotterdam and Zeeland Seaports can offer extra opportunities for high market impact.

4.1.1.3 Energy harbors: Value chain and target companies

For the port as energy system the value chain depicted in figure 9 is valid.
An overview of Flemish companies in this value chain is incorporated as an Annex. Target companies for the Flemish Energy Cluster in the innovator zone 'Energy Harbors' include port authorities and cities, technology companies (like Hydrogenics, Atlas Copco and PowerPulse), logistic companies (like Sea Invest), energy consumers, producers and 'prosumers' (Stora Enso, Eneco, Borealis…), consultants, aggregators and grid operators (Elia, Fluxys, Eandis)…

At present, a.o. Havenbedrijf Antwerpen, Havenbedrijf Gent, Actility Benelux, ABB and Eandis have engaged themselves at valorization level in the Flemish Energy Cluster. They are well-positioned to contribute to the innovator zone Energy Harbors.

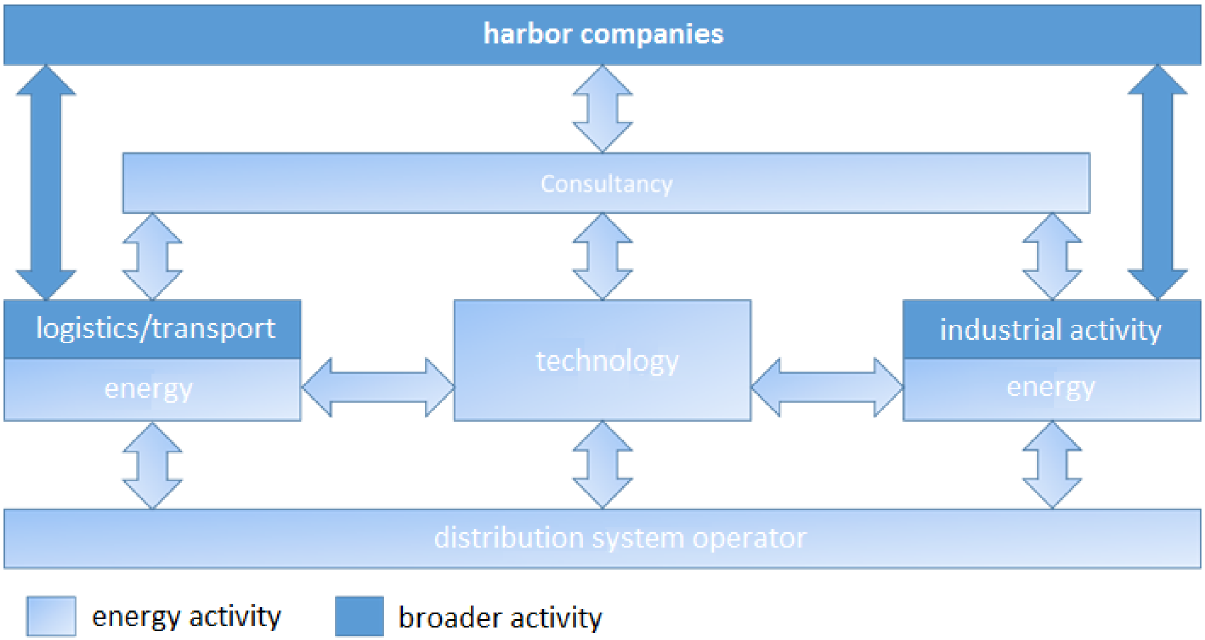

Figure 9: Global value chain of the 'energy harbor'

4.1.2 Microgrids: context

4.1.2.1 Microgrids: Market opportunities and challenges

Defining microgrids and nanogrids in an international context

A microgrid refers to a group of interconnected consumers, distributed renewable sources and (sometimes) solutions for energy storage, all within a well-defined electric perimeter (cf. Figure 10).

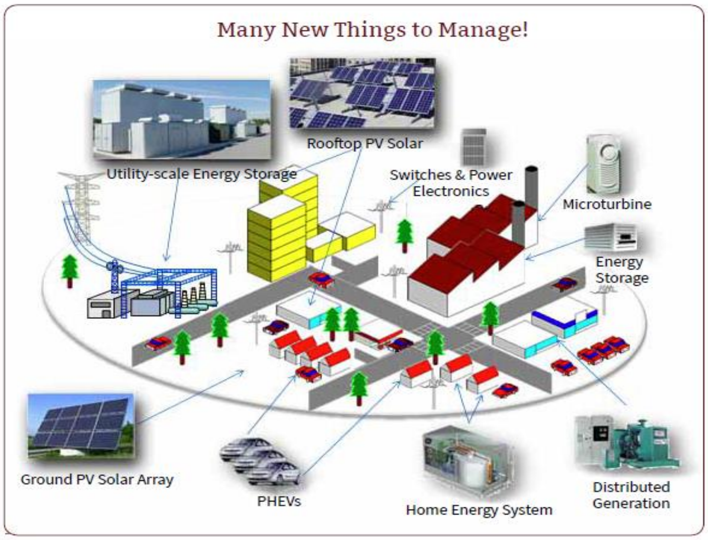

Figure 10 Microgrid systems layout

This system operates as a single, controlled entity within the overall distribution grid. A microgrid can be run in island mode (i.e. disconnected from the distribution grid) or in grid-connected mode. In our definition, we do not include a third group of systems, so-called remote microgrids that are not physically connected to the overall network.

Recent market trends

Microgrids as such are not new: they have existed ever since Edison's days and before the Second World War all electricity supply was essentially organised as primitive versions of microgrids. There are a number of recent trends, however, that foster a breakthrough.

- Security of supply: Cities and regions have come to consider microgrids as a lever for economic growth. Microgrids allow increased auto-consumption and energy independence, and are thus considered key assets for high-tech companies, data centres and other businesses requiring high standards of security of supply and reliability.
- Increasing cost efficiency: Microgrids have become extremely cost efficient as the prices for their main power sources – PV panels and natural gas – have crashed. The cost of storage is rapidly decreasing as well, increasing the attractiveness of microgrids built around solar energy (or other intermittent, renewable sources).

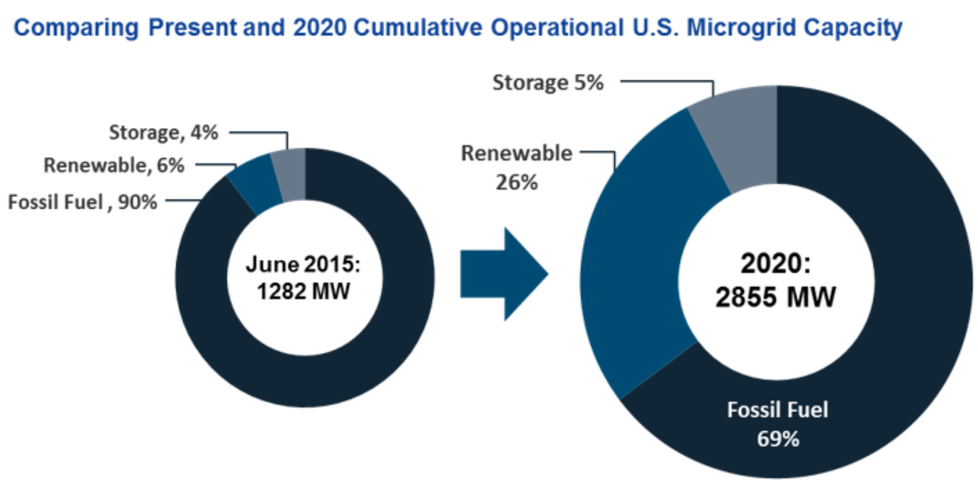

Figure 11: Microgrids US growth

- Integration of renewables: State-of-the-art control technologies and interfaces make integration of distributed (renewable) energy sources easier than ever.

- Increasing electrification: The number of people getting access to electricity is still increasing globally. For many regions and countries around the world – especially in Africa or Asia, where there is no pre-existing central grid infrastructure - microgrids are the only option to provide people and businesses with the energy supply they need for an improved quality of life and economic competitiveness. The growth potential in this area is almost unlimited.
- Stabilisation of grids: Even in regions with a well-developed energy infrastructure, microgrids can play a major role in further developing and controlling the distribution grid. The spectacular growth of distributed generation capacity has turned maintaining the balance between supply and demand into a major challenge. Microgrids offer better stability by thoughtfully combining technologies and components to minimise the load on the distribution grid feeders.

Microgrids are seen as a major element in the stability of the grid and security of supply in general. They can protect vital regions or companies from grid problems by providing a local and autonomous source of energy. Because of their superior handling of renewable energy sources, they additionally limit the fluctuation of energy prices and contribute to overall climate goals.

International market focus on Asia and Africa

By the end of 2015 the market for microgrid-related technologies grew to EUR 5,5 billion worldwide, representing some 685 MW of installed generation capacity. The undisputed leader is the US: the country has to invest heavily in microgrids, because the US is prone to blackouts as a result of frequent havoc-wreaking storms and tornadoes. Major growth, however, is expected from Asia and Africa. By 2020 the market will grow to EUR 22,7 billion, multiplying by six the installed capacity base (to more than 4000 MW) in less than five years' time. Other estimates think a Compound Annual Growth Rate (CAGR) of 17,36% for capacity and of a whopping 52% for turnover, is realistic. It goes without saying that microgrids are one of the hottest opportunities in the global energy landscape.

Flemish companies can capitalise on this trend by focusing on knowledge sharing and building integrated solutions that are competitive in those international markets.

4.1.2.2 Microgrids: Strengths of Flanders

- Strong competence base: Both R&D centres and companies have gathered the know-how and infrastructure needed for carrying out large-scale integration and demo projects. Several of them are already involved in microgrid projects. Company examples include manufacturers of CHP installations (VanWingen), medium-sized wind turbines (Xant), Gensets (Anglo-Belge) or PV (Perpetuum). On the R&D-side, several laboratories offer world-class facilities and have pooled their resources within the DER-lab consortium (e.g. EnergyVille, Ugent). This allows them to test the impact of microgrids on grid functioning (stabilisation, frequency control, peak shaving, autoconsumption, reseves) under real-life conditions.

- Pre-existing international links: The larger players (Engie, ABB, Siemens,...) in our region already serve the major growth markets described above. All of them are involved in the Energy Cluster, thus facilitating market access for the hybrid solutions to be developed.
- Liberalised and complex energy landscape: Belgium once was the first country to liberalise and is still ahead of the curve in terms of unbundling and energy market participation. In combination with the typically complex structure of the country, Belgium/Flanders is a rigorous context for test driving new propositions involving many stakeholders.
- Increasing strain on existing grids: Over the past decade, the growth of both PV and wind has put major pressure on existing grid infrastructure, which in turn has increased the awareness of – and willingness to adopt – alternative solutions for integrating renewables into the system.

4.1.2.3 Microgrids: Value chain and target companies

As indicated in the graph below, the core of the value chain consists of the suppliers of the main microgrid energy components (CHP, gensets, renewable generation, storage) on the one hand, and suppliers of the integrating technology on the other.

Also, especially in the context of hybrid microgrids, distribution system operators play a major role and contribute a major chunk of knowledge.

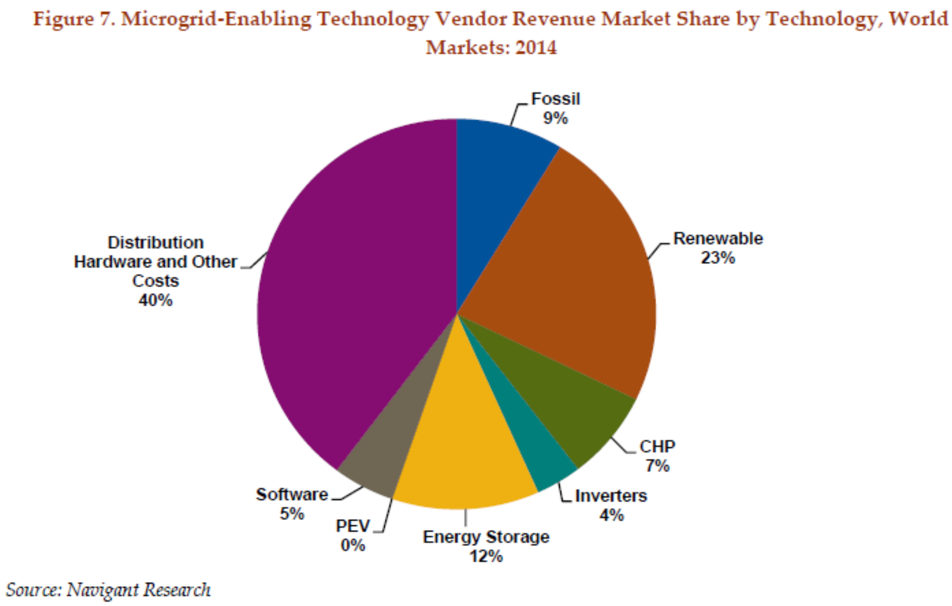

Figure 12: Micro-grid enabling technology vendors

An overview of Flemish companies in this value chain is incorporated as an Annex. Target companies for the Flemish Energy Cluster in the innovator zone 'Microgrids' include CHP's (like Continental, Van Wingen, Viesmann), GENSETS (like Europower, Bobindus, Hunter), Renewable generation (like Intellisol, Wase Wind, Colruyt, BASF), Storage (like Ysebaert, Bluegen…), integrated technology (like Siemens, Engie, Schneider Electric, CG Alstom) and study's (Encon, Tractebel…).

At present, a.o. Eandis, ABB, Siemens, Triphase and Van Wingen have engaged themselves at valorization level in the Flemish Energy Cluster. They are well-positioned to contribute to the innovator zone Microgrids.

4.1.3 Multi-energy solutions for districts: context

4.1.3.1 Multi-energy solutions for districts: Market opportunities and challenges

Energy solutions at district, area or site level

Energy solutions at district, area or site level offer advantages in an increasing number of market contexts, because of their scale benefits in comparison to an individual approach per building. Economic opportunities arise from the optimal use that energy solutions at district level make of sustainable energy sources, the storage of energy and the exchange of energy flows.

As early as in 2010[32], ECN develop a revised “trias energetica” for districts that consists of the following steps:

- The reduction of the energy demand
- The optimal integration of renewable energy
- The exchange of energy flows in an energy hub
- The storage of energy

Figure 13: Trias Energetica (ECN)

Sites that combine different functionalities (small industry, offices, hospitals… and residential buildings), offer excellent conditions to exchange and manage energy flows both on the level of electricity, heat and cold.

A European market driven by municipal engagements and a worldwide smart city context

Currently, the market of district deployment and renewal, is in a spectacular growth phase, both on a European and an international level. In Europe, over 6700 cities and communities have signed the Covenant of Mayors, supported by the European Commission.[33] By signing this covenant, the cities engage to go beyond the 20/20/20 energy and climate objectives of the European Commission. Each of these 6700 cities and communities has also agreed to map out an energy action plan.

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[32] Source: CHRI, ECN, 2010
[33] http://www.covenantofmayors.eu/index_en.html

The energy district approach is a key element in most of the current energy strategy documents, like the EU covenant, the priorities around smart cities of the SET[34] (Strategic Energy Technology) plan of the European Commission and the recent roadmaps[35] of the European building sector.

As a result, there is a boom in the number of large scale pilot projects and investments with energy approach at district level. This is also the case for the Flanders region (e.g. Thor site Genk, "Tweewaters" project in Leuven, "Nieuw Zuid" district in Antwerp, "Oude dokken" development in Ghent…).

Figure 14: Tweewaters (Leuven)

Assuming that each city or community in the Covenant of Mayors invests in at least 3 energy hubs, the European market potential alone amounts to over 20,000 investment projects at district level. This district approach also fits in other ambitious investment programs worldwide, e.g. the 100 smart cities challenge in India.[36]

The EU's new energy performance directives for the building environment will only strengthen these market trends. When it comes to multi-energy solutions for districts, we are only at the starting point, as is illustrated by the European analyses, like the Energy Hub[37] project. Most solutions and projects are still in a pilot phase, encountering both legal, organisational and technological challenges.

4.1.3.2 Multi-energy solutions for districts: Strengths of Flanders

Flanders is an intensively urbanised area with more than 150 cities engaged in the European Covenant of Mayors. Therefore, it is an ideal take-off market for multi-energy solutions at district level. The strengths of Flanders are:

- Major industrial players in heat conversion: companies like Daikin and Atlas Copco combine an important base in Flanders with an international position. They are ideally positioned to put Flemish innovations e.g. on ORC and intelligent heat pumps in the market.

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[34] http://ec.europa.eu/eip/smartcities/files/operational-implementation-plan-oip-v2_en.pdf
[35] http://www.ectp.org/cws/params/ectp/download_files/36D2981v1_Eeb_cPPP_Roadmap_under.pdf
[36] http://smartcities.gov.in/
[37] Energy-Hub for residential and commercial districts and transport, Description of market needs and business models in the area of district level energy services, December 2012, E-hub project FP7

• A growing number of SME's with energy integration as core business. Stimulated by the organization Smart Grid Flanders and with expert knowledge acquired through participation in major EU projects, a growing number of promising aggregators have surfaced in Flanders: Enervalis, Actility, Encon, Restore, Condugo… These companies are currently engaged in demand response matching from the industry, but they're keen to extend their markets to combined sites with residential functions.

• Flemish partners (EnergyVille, EANDIS, Enervalis,…) have acquired strategic positions within the thematic area "intelligent and efficient cities & buildings" of the European company KIC InnoEnergy. This collaboration initiative offers opportunities to facilitate European market access through a European network.

• EnergyVille is building a new state of the art living lab, which will be fully operational by 2018. Its aim is to optimise functionality and interoperability of energy components and systems at district level and to gain international visibility. A preparatory research program has been initiated and can function as the crucial basis for knowledge building.

• 150 Flemish cities and communities, engaged in the Covenant of Majors, are ready to be the first pilot market for investment projects with energy hubs at district or site level. In this context Flanders can take a leap in the application of heating and cooling grids, with a complete focus on new grids.

• Unique geological conditions allow Flanders to play a front-runner role in specific energy hubs based on geothermal energy. The geothermal potential of Flanders has been proven a.o. by VITO[38].

4.1.3.3 Multi-energy solutions for districts: Value chain and target companies

Parts of the value chain of the innovator zone 'Multi-energy solutions for districts' complement the chain of 'microgrids', with the market application as main differentiator. In the 'multi-energy' innovator zone

[38] https://vito.be/en/news-events/press-messages/next-step-in-deep-geothermal-energy-project-balmatt-site

we also find specific sectors related to the development of building districts and the building environment, such as project developers, suppliers of HVAC components and ESCOs.
Specifically, for the part of heating grids the value chain of companies is represented in Warmtenetwerk Vlaanderen (under ODE).
In case geothermal solutions are – at a certain point in time - considered to be integrated in solutions, then additional industries like drilling companies have to be taken into account.
Several major component developers like Daikin and Atlas Copco have a strong basis in the Flanders region. However, it is not unlikely that for some components e.g. heat exchangers a cooperation with Scandinavian countries or with the Netherlands could be beneficial to complete the value chain.
With respect to ESCOs we believe that Flanders has several candidates, now active as energy aggregator, that are ready and willing to take a new step.

An overview of Flemish companies in this value chain is incorporated as an Annex. Target companies for the Flemish Energy Cluster in the innovator zone 'Multi-energy solutions at district level' include technology companies (Fifthplay, Ferranti, ESAS, 3E…), system integrators (Siemens, Cofely Fabricom, DEME…), energy providers (EDF Luminus, Engie, Lampiris…), project developers (Matexi, Grontmij, studiebureau Boydens…), ESCO's and aggregators, grid operators and city governments.

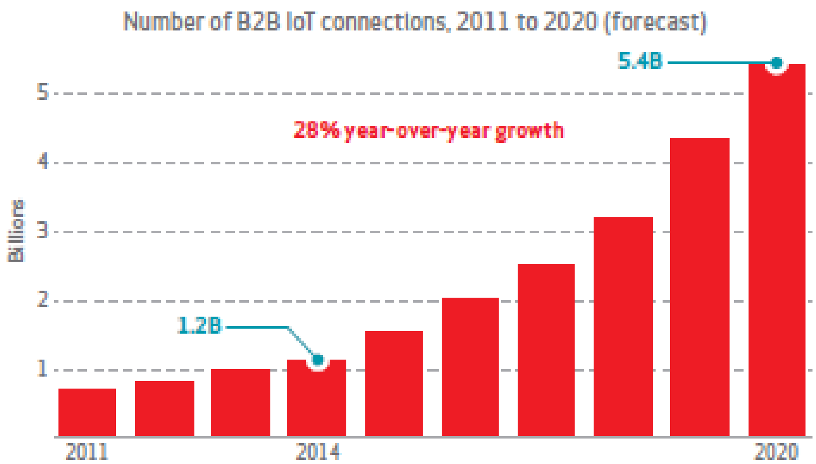
At present, a.o. Engie, Lampiris, Actility Benelux, Condugo, Enervalis, Siemens, ABB, Eandis and Infrax have engaged themselves in the Flemish Energy Cluster (full list in Annex). They are well-positioned to contribute to the innovator zone Multi-Energy Solutions.

4.1.4 Energy Cloud Platforms: context

4.1.4.1 Energy Cloud Platforms: Market opportunities and challenges

A 'green button' for Flanders?

Internet of Things (IoT) and Cloud Platforms are rapidly changing markets in many domains (**Error! eference source not found.**4), including the energy and building sector. Many new players enter the market and large ICT oriented players disrupt the landscape (e.g. Google NEST smart thermostats). The digitization trend redefines roles in the value chain, threatening current market players but also creating opportunities for Flemish companies to create value in new markets and realise innovation-driven growth.



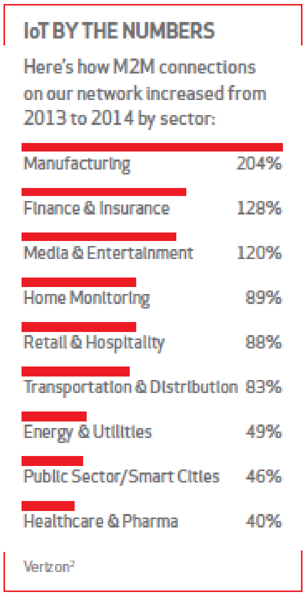


Figure 15. Number of B2B IoT Connections - Source: "State of the Market. The Internet of Things 2015. Discover how IoT is transforming business results"

A lot of research and development efforts are currently devoted to energy data platforms, smart and easy deployable monitoring sensors, self-learning building systems, etc. However, several steps still need to be taken to realise breakthroughs at a large scale. The crucial question is how to provide (big) data towards third parties in a uniform, transparent, qualitative and legally correct format. To this end a multitude of (intelligent) energy apps and services are being developed and rolled out.

International initiatives, such as the Green Button initiative in the US (http://energy.gov/data/green-button), were a source of inspiration for the Flemish Energy Cluster in our decision to focus on energy cloud platforms as a thematic priority. The Green Button initiative allows customers to securely download their detailed energy usage with a simple click. Subsequently, they can use the data to take advantage of a growing number of smart energy services to increase energy efficiency and save money.

The Flemish Energy Cluster sets high ambitions for digital Flanders and aims to facilitate individuals and companies in the development of services (with market value) that combine and enrich energy data with building, context and other available open data. The goal is to accelerate IoT based energy applications and services in buildings, energy grids and industry.

The Energy Cloud Platform innovator zone is clearly in line with the vision of the Flemish government towards 2025 with respect to science, technology and innovation. The government puts forward 7 transition areas and the Flemish Energy Cluster with its focus on central data platforms for apps and services, clearly responds to the transition area ‘Digital Society’ as presented by VRWI in 2014 (Figure 16).

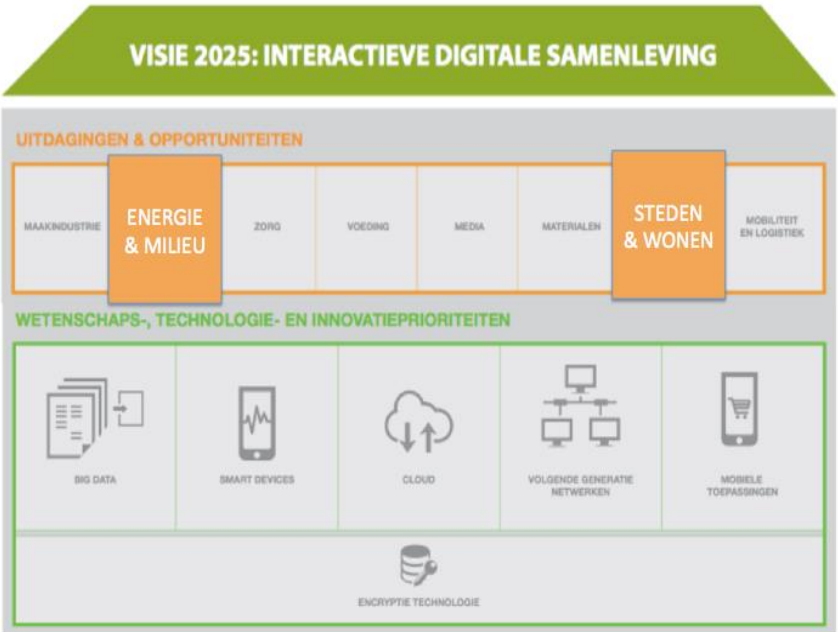


Figure 16. Transition area for the digital society

(Source: VRWI - http://www.vrwi.be/pdf/Uittreksel%20TV2025%20Digital%20Society.pdf).

4.1.4.2 Energy Cloud Platforms: Strengths of Flanders

- Flanders has strong ICT expertise in the domain of Internet technology, data security, interdisciplinary approach and digital real-life labs. Also, our digital start-up culture gets worldwide recognition. Flanders is an active member of Enoll (European Network of Living Labs) where it carries out different living labs. Our region has important lab infrastructures, like the iMinds IoT HomeLab, Office Lab, CloudNetLab and City of Things, and it has unique demonstration sites like Living Tomorrow.

- iMinds has a specific IoT program that can serve as a basis for follow-up projects applied to the energy domain, complemented with specific projects on smart cities like EPIC (http://www.epic-cities.eu/). Furthermore, iMinds' research strategy focuses on three domains which are all highly relevant for a smart, connected energy system: Internet of Things (*Everything Connected*), Big Data (*Data Science*) and Cyber Security (*Digital Trust*).
- Projects like LINEAR (coordinated by EnergyVille) have already demonstrated that it is possible to realise a connected home where power flexibility is exploited for various business cases.[39]
- The open data initiatives outlined in the coalition agreement of the Flemish government create a positive context for the development of new, integrated applications.

4.1.4.3 Energy Cloud Platforms: Value chain and target companies

An overview of Flemish companies in this value chain is incorporated as an Annex and figure 17 (below) summarizes the core. Target companies for the Flemish Energy Cluster in the innovator zone 'Energy Cloud Platforms' include

- Energy providers & grid operators (like ENI, Eneco, Aspiravi…)
- Telco operators (Telenet, Belgacom…)
- IoT & data platform providers (Codit, AllThingsTalk, iXorTalk…)
- Automation providers (like NIKO, DUCO…)
- Security and privacy (Totion, LSEC…)

Three different sectors are targeted: buildings, energy grids and industry, with a special initial focus on building automation solutions (domotics) that integrate additional context data and are interoperable with other (eco)systems. Opportunities for new start-ups that can launch a new app with a limited investment will be stimulated. These opportunities will arise from the standardised interfaces of the targeted energy cloud.

[39] http://www.smartgridsflanders.be/nieuws/conclusies-linear-zes-tariefblokken-dag-te-veel

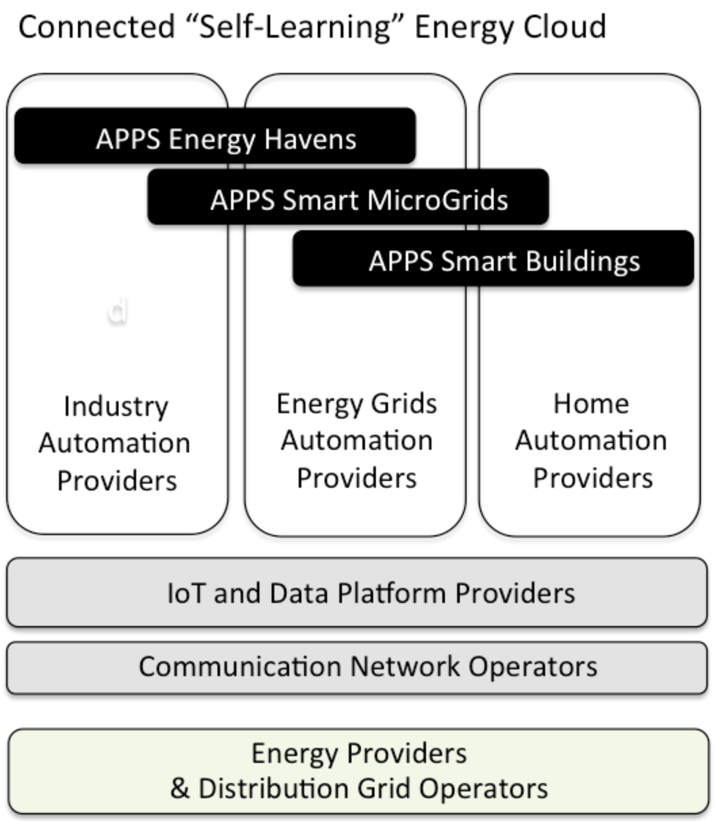


Figure 17. Schematic value chain for the energy cloud

Atrias, the platform that aims to realize a central clearing house for the Belgian energy market, is a crucial player in this domain.

At present, a.o. Proximus, Fifthplay, Condugo, NIKO, Eandis, Infrax have engaged themselves in the Flemish Energy Cluster (full list in Annex). They are well-positioned to contribute to the innovator zone Cloud Energy Platforms.

4.1.5 Intelligent Renovation towards Energy Neutral Buildings with Building Integrated energy production and storage: context

4.1.5.1 Intelligent Renovation: Market opportunities and challenges

Growing renovation market provides an opportunity

Did you know that the heat and electricity used by buildings makes up one third of the total energy use?

Or that fossil fuels account for the greater part of it – directly and indirectly? (figure 18).

Therefore, considerable energy and emission reductions are possible, when the best available technologies and new techniques are combined in the 'intelligent' renovation of buildings, both in the building envelope as in its components, in heating and cooling systems.

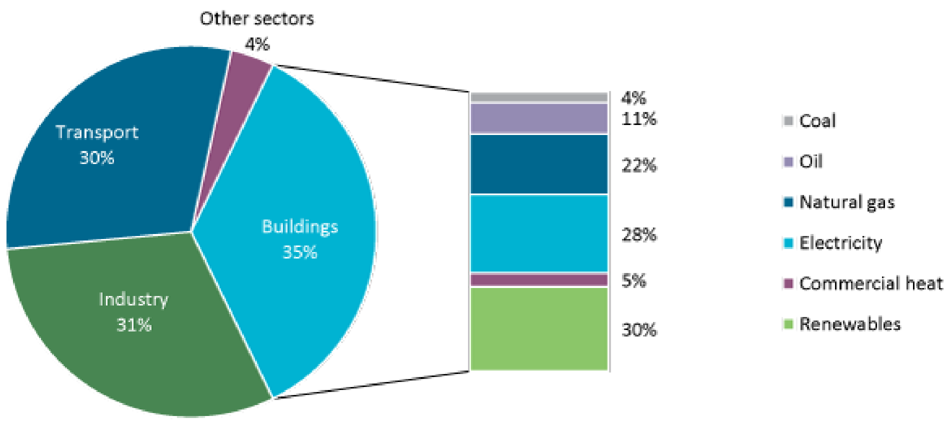


Figure 18: final consumption of enery sources, per sector (source : energy Technology Perspectives 2013)[40]

In Europe almost 40% of residential buildings predate 1960, while only 15 to 20% were built after 1990. Research has shown that the present renovation rate of our building stock is too low to achieve the energy efficiency goals of 2050. In order to achieve these goals the renovation rate has to increase by a factor 2.5 at least.

It's important to note that the building stock has 3 to 4 times the life expectancy of the technical installations used in it, such as HVAC or solar panels (figure 19). Buildings outlast installations.

The existing building stock has a huge long term potential for energy savings. Since the building stock is outdated and predates for a major part any energy-efficiency regulation, 'intelligent' renovation will increase energy-efficiency dramatically.

[40] http://www.iea.org/publications/freepublications/publication/Building2013_free.pdf

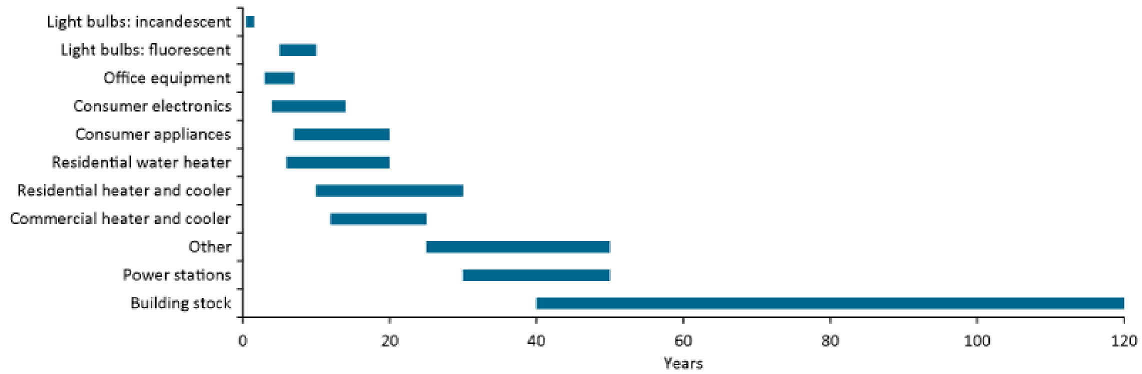


Figure 19: Economic Life spans of energy consuming equipment and infrastructure (source : energy Technology Perspectives 2013) .

"Deep" renovation packages needed

Increasing the renovation rate is one thing. Equally important is the concept of 'deep' renovation or intelligent renovation towards (nearly) energy neutral buildings with building integrated energy production and storage.

Deep renovation comes with quite a few challenges. They are identified in a local study by Pixii/Passiefhuis-Platform for the Flemish Energy Agency (VEA). Building owners in Flanders and the Walloon Region, choosing to renovate their home to an ambitious energetic level are both financially and technically challenged. The renovation market is a very traditional and fragmented one with a lot of small contractors[41] and a lack of 'total renovation'-packages. This means that new technologies and building techniques, making energy efficiency more accessible for the housing market, are hard to find. The available technologies and techniques are also very expensive. The residential home owner usually renovates his house by employing small contractors, who often lack an oversight on total renovation and who have difficulties in finding access to new techniques, innovative components and smart systems for balancing energy supply and demand.

Driven by European directives and mechanisms and national and regional regulations

In its revised SET (Strategic Energy Technology) plan the European Commission urges cities and regions to take ambitious and pioneering measures to achieve by 2020 a 40% reduction of greenhouse gas emissions. A key element in these measures is often a sustainable use and production of energy. This requires a systemic approach and an organizational innovation,

[41]http://www.provincieantwerpen.be/content/dam/provant/dwep/economie/studie-speerpuntsectoren/Eindrapport_provincie_Antwerpen_2014_bijlage_sectorprofielen_tg.pdf

encompassing energy efficiency, low carbon technologies and the smart management of supply and demand. To this purpose the EU supports different strategies for the refurbishment of existing buildings.

On a national level it is crucial to increase the renovation rate and the performance of deep renovations. This holds true in the framework of the European building directive (EPBD)[42] and the energy efficiency directive[43], but also in order to achieve other European climate and energy goals, especially the reduction of greenhouse gas emissions for non-ETS (Emission Trading Schemes) sectors and the renewable energy goals.

To sum up, the building renovation sector faces a few challenges but has a lot of opportunities for creating market space and economic value. Long term goals on energy efficiency and greenhouse gas emissions will only be achieved when innovative systems and components are combined with new policies by local and national governments.
Policy makers will have to map out new roads in spatial planning and urban design, and with regard to energy efficiency measures.

4.1.5.2 Intelligent Renovation: Strengths of Flanders

- <u>Industry:</u> A recent publication[44] on strategic planning from the Flemish Building Confederation (VCB, Vlaamse Confederatie Bouw) shows that the building industry is aware of its crucial role in energy-innovation activities. The building sector is increasingly involved in initiatives that unite energy and innovation in a strong learning context, like - for example - Energy Saving Pioneers (ESP), activities from organizations in the civil society as well as policy consultants from local governments such as cities, small communities and provincial support centers.
- <u>Research and development</u>: several Flemish knowledge centers have been involved in European research projects to strengthen their knowledge of and expertise in building renovation. Through

[42] https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings
[43] https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficiency-directive
[44] Visiedocument 2015, DOORBRAKEN, Scenario's voor de technologische revolutie, VCB

projects like Episcope[45], Cohereno[46], Rennovates[47], they gained a solid reputation within the European research sphere (IEE-FP5-H2020-…) and in Flemish initiatives such as Renofase[48], STAR[49]… . Institutes as BBRI (Belgian Building Research Institute) also add an essential competence linking comfort with energy. This strong portfolio of project and results forms a solid base for creating market breakthroughs.

- Thanks to the unique Belgian climate with very rapidly alternating weather conditions our country/region is the ideal testing ground to thoroughly investigate and test applications that are influenced by weather conditions. For example, to increase the temperature dependent efficiency of heat pumps, one needs insight in how heat pumps function in different climatic zones or how they interact with sudden temperature drops. With this insight, the application can be optimized and made accessible for the international market.
- <u>Flemish living labs on home renovation (Vlaamse Proeftuinen Woningrenovatie)</u>: Several demonstration projects on home renovation are already running under the supervision of a coordination platform (Kennisplatform woningrenovatie)[50]. These living labs form an ideal platform for further innovation. This overall coordination platform, that also acts as a knowledge dissemination centre, unites most of the important Flemish and national stakeholders and knowledge centres of the building sector: Pixii/Passiefhuis-Platform, Vlaamse Confederatie Bouw, Bouwunie and the Nationale Architecten Vereniging. Also involved are the Confederatie van Immobiliënberoepen Vlaanderen vzw, de Organisatie van Raadgevende Ingenieurs, Engineering- en consultancybureaus vzw and the Verenigde Eigenaars vzw, EnergyVille (KULeuven, VITO en IMEC) as well as UGent research group building physics, construction and climate control.
- A study by Pixii/Passiefhuis-Platform for the Flemish Energy Agency (VEA) made clear that the Flemish home owner shows a strong 'early adopter mentality' making it relatively easy to set up demonstration projects for deep renovation with ambitious energy efficiency level. Because Flemish building companies are already active on the international market, our region has a window for creating breakthroughs here.

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[45] http://episcope.eu/
[46] http://www.cohereno.eu/
[47] http://rennovates.eu/
[48] http://www.renofase.be/
[49] http://www.passiefhuisplatform.be/onderzoek/star
[50] http://www.iwt.be/subsidies/proeftuinbouw

4.1.5.3 *Intelligent Renovation: Value chain and target companies*

There are various types of professionals and companies in the building sector: producers and suppliers of building materials and systems - from big companies to small enterprises and one man businesses -, building promotors and developers, contractors of structural work or installations, architects, engineers and consultants or IT-experts. Figure 20 visualizes the complexity of the sector.

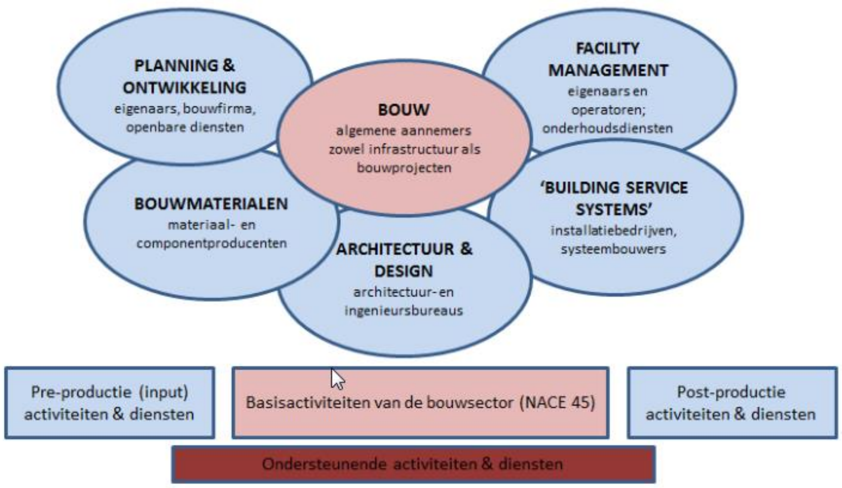


Figure 20: Demarcation of the building sector (source: Asikainen & Squicciarini, 2009)

From a segmented value chain (Figure 21) a broader playground is deduced. Knowledge institutes (EnergyVille with VITO, KU Leuven and IMEC, Ghent University, BBRI) and knowledge based organizations (Pixii/ Passiefhuis-Platform, Vlaamse Confederatie Bouw, Agoria, Voka, Cogen, ODE) strive to help the building industry to fully tackle innovation, so they can upscale from a niche market to wide market.

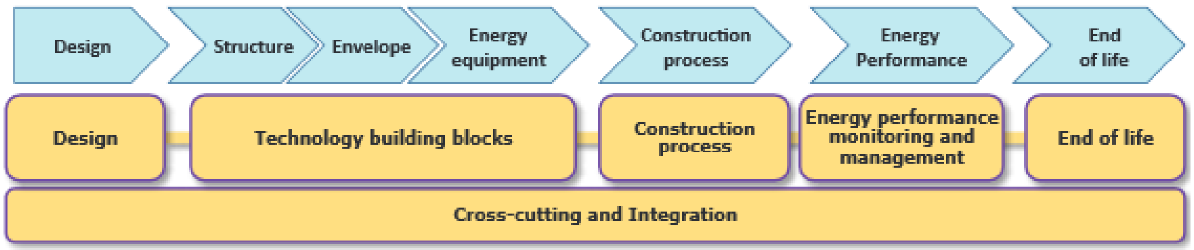


Figure 21: Representation of the segmentation of the Value chain

An overview of Flemish companies in this value chain is incorporated as an Annex. Target companies for the Flemish Energy Cluster in the innovator zone 'Intelligent Renovation' include architects and engineering (like Boydens, Poelmans, Think E...), consultants (like Ingenium, Arcadis...), project developers (Bostoen, Matexi…), the technology industry (integrators like Alelek or Smart Buildings Control as well as solar power companies like Intellisol; home battery suppliers like Daimler, Hoppecke, ABB, Enersys; thermal companies like Viesmann or Daikin and home automation systems like NIKO, Siemens, Domintell…), renovation contractors (Durabrik, Eribo…), prosumers, grid operators and local and regional policy makers like VREG.

At present, a.o. Think E, ABB, NIKO, Siemens, Eandis and Infrax have engaged themselves in the Flemish Energy Cluster. They are well-positioned to contribute to the innovator zone ‘Intelligent Renovation – towards nearly energy neutral buildings with building integrated energy production and storage’.

4.2. The program of the Flemish Energy Cluster per innovator zone

SUMMARY:

Now that we've put each innovator zone in its context (4.1), it's time to zoom in on the (sub)program of the Flemish Energy Cluster per innovator zone. What is the focus of the Cluster's program? What are the ambitions? What will be the added value? Is there a need for areas with alternative regulatory conditions? And which concrete projects are being worked out in the zones?

4.2.1 Energy harbors

4.2.1.1: Energy harbors: Focus of the Cluster

The Flemish Energy Cluster made an initial selection of priorities for the innovator zone 'Energy Harbors' based on current market trends, the strategic plans of the harbors and exploratory projects, such as the E-harbors and Sustainable Seaports. These focal points were discussed with a large industrial audience during the *'Interactive seminar on vision: An economic and sustainable energy supply in 2020'* in collaboration with Port of Antwerp on 7 December 2015.

Initially, the innovator zone 'Energy harbors' will focus on the following break-throughs:

- Flexible thermal power stations and heat networks using waste heat streams towards a functioning thermal market that can guarantee affordable and sustainable heat;
- Demand side management for cooling installations to integrate renewable energy (wind, PV…) with energy storage to effectively use the financial mechanisms of the energy market and to optimise investments in the power grid;
- Bi-directional shore power using renewable energy as an economically profitable solution for sustainable shipping;
- Storage of energy by power-to-products in interaction with the chemical and fuel industry;
- More sustainable harbor infrastructure by renewable energy supply and electrical storage;
- The harbor area as a power station.

Flexible thermal power stations and heat networks using waste heat streams

The potential of waste heat in most harbors is immense: the petrochemical industry in Antwerp alone has a 1000MW of waste heat at 80°C[51]. A diverse number of players in the harbor areas have waste heat available, while others require sources of heat.

A connection (e.g. from the harbor to the city as in the heat network Stad Gent) seems obvious. However, this kind of thermal connection consists of more than just connecting both processes/systems. It is evident that it needs to be linked to the Flemish heat company.

Time and distance are the main limitations of an efficient heat network. Produced (green) industrial heat has to be transported at the right temperature and pressure, more often than not in an already densely built-up area. Therefore, buffering is very often a necessity. Successful projects at an industrial scale in harbor areas are being rolled out, e.g. the heat networks of StoraEnso in Ghent or Indaver in Antwerp. Opportunities to the respective city centres are great but their realisation progresses slowly. The Flemish Energy Cluster will try to speed up the market entry by researching new concepts for storage and transport.

Break-throughs on different aspects are required for a potential market realisation:

- Efficient solutions for upgrading low temperature waste heat;
- Management of networks with different (heat) sources;
- Thermal storage in e.g. mobile units (e.g. using phase change materials or as chemical products);
- Flexible thermal power stations to either produce electricity or process heat.

Demand side management for refrigeration systems coupled to renewable energy, with integrated energy storage

Refrigeration systems (including refrigerated containers) cover a large share of the energy use in food preservation and logistics. Their huge thermal capacity provides opportunities to implement demand side management and for integration with local energy production from renewable sources (frequently PV panels on storage facilities and wind turbines in business parks). Companies that provide flexibility can be compensated through current and future price mechanisms on the energy market. The storage

[51] http://www.mipvlaanderen.be/nl-be/webpage/107/restwarmtevalorisatie.aspx

conditions of course take priority and dictate the boundaries on the amount of flexibility. Therefore, the cost effectiveness of this strategy needs to be compared to other alternatives like thermal and/or electrical storage. Exploratory initiatives with Flemish participating partners are described in e.g. the previously mentioned E-harbors project (Interreg North-Sea-Region). But a large scale market penetration requires more pilots with improved control algorithms and solutions to both contractual and business model issues. The innovator zone 'Energy Harbors' will tackle this ambition, preferably in interaction with the Dutch harbor market.

Bi-directional ship connections with renewable energy

Moored boats typically have a need for electricity/energy to provide some common household commodities (heating, lighting, etc.). Today this is realised by operating the ship engines at part-load. Not only do these engines run inefficiently, they also show larger diesel consumption compared to the required power, resulting in higher local emission of CO_2, sulphur and nitrogen. This is especially polluting when the engines work with heavy fuel. In the air quality plan, as approved by the Flemish government (VR 30 March 2012), the foundation of a shore supply platform was already anticipated. As a possible solution, an electrical grid is proposed where ships are connected bi-directionally with each other and with a local power plant running on renewable energy sources. The local power plant features a local energy storage system but also provides the opportunity to activate gen-sets on the ships that are the most environmentally friendly. This leads to an optimal configuration between the ship, the energy storage system, the local consumers and the grid.

The focal point 'bi-directional ship connections with renewable energy' can be linked to ongoing initiatives. Within the EU LIFE program there is a project proposal filed concerning clean inland shipping whereby around 20 barges are converted to clean fuels, including an intensive monitoring. Within the innovator zone ‘Energy Harbors’ a test pilot to prove the feasibility of the system could be run, by using one or more of these converted ships. For this, an ICT infrastructure is needed (for example a platform with a central booking system and with intelligent control). Also required to develop the system is a secure grid coupling at the level of the ship infrastructure (to provide a safe coupling of the gen-set to the grid) as well as an area with less stringent regulations.

Energy storage through power-to-products

Harbors are the ideal location to invest in large scale industrial installations. This holds equally true for installations with large, long-term energy storage. A specialized way of energy storage is to use the surplus electrical energy for the production of primary chemical substances through a power-to-products process (e.g. methanol or ethanol production). This can also be coupled to the possibility of storing CO_2. The resulting products can be utilized as a primary source for the chemical sector or they can be used as ‘electro fuels’. In this manner, locally sustainable transport can be realized. An example is the initiative International Carbon Recycling in Iceland where an installation was built for the production of methanol from electricity and CO_2. The Flemish harbors are currently exploring the opportunities for these systems. Within the context of the Energy Cluster a demonstration unit can be built, which on short-term will use the state-of-the-art techniques and on a longer term will implement more innovative techniques. These innovative techniques can result from projects of (or together with) the Cluster Sustainable Chemistry and/or with IBN power-to-gas, although the IBN focuses on gas while the focus of the Energy Cluster is on products. Either way, collaboration will be fruitful.

Enhancing sustainability of harbor infrastructure by using renewable energy and electrical energy storage

Locks are an important part of the harbor infrastructure and Flemish harbors have several ideas for energy neutral locks. This would mean linking the locks to local renewable energy sources (wind/solar, but also energy extraction from water flows) and equipping the locks with electrical energy storage (batteries). The relatively large power needed to open and close the gates of the lock is one of the challenges for implementing the technology. The advantage of this system is that a major part of the decision power lies with the harbor companies, although timing is crucial because such systems have an expected life time of 40 years. However, within the time frame of the Cluster several opportunities are possible. Another promising route takes harbor cranes as a starting point. Harbor cranes can offer energy flexibility for example by reducing peak loads with short-term energy buffering using ultra-caps.

The harbor area as power plant

Large scale renewable energy production (wind such as *Wind aan de Stroom* and large solar parks such as *Terra-Nova solar*) can be located in the harbor area (for example Linkeroever). These production sites should be linked in a smart and future-oriented manner to the existing electrical infrastructure, in order to lead to a more sustainable energy production in Belgium. Given the limitations of the existing electrical infrastructure, additional techniques have to be implemented to avoid network congestion.

Remark: Next to specific focal points as summarized above, the harbors can also play an important role in other areas related to the energy transition:

- *Efficiency increase in the processing industry. It should be noted that this is the core business of the processing industry and that the cluster does not wish to take a frontrunner role in this field.*
- *The integration of off-shore wind farms and their impact on the harbor areas. It might be feasible for the Energy Cluster to support certain integration and interconnection aspects of these wind farms in collaboration with other initiatives with a focus on the infrastructural development of off-shore wind.*

The table below summarizes the Cluster's preliminary ambition, which will be further refined in the course of 2016 together with the companies that engage themselves in the innovator zone 'Energy Harbors'.

Period	Ambition
< 5 year	First improved components for waste heat utilization are made ready for the market. One to two projects are selected for further development. Each of these projects have a budget of +/- EUR 1.000.000.
	A cost effective monitoring/control system for demand side management of cooling systems is applied in the main Flemish ports by a representative number of companies. If relevant, a new compact thermal storage solution will be made economically viable. We aim for three relevant projects with a project budget only used for cost efficient monitoring. A systematic approach will be developed. Each of these projects has a budget of +/- EUR 500.000. One project, with a budget of EUR 1.5

	million aims at a more active intervention in the capacity of the thermal storage.
	A pilot project 'Integrated shore power' will be unrolled in a Flemish port. Through links with other projects the financing needs can be limited to the intelligence and the necessary hardware for the bi-directionality. This project's budget is estimated to be EUR 750.000.
	In the context of energy storage in harbors a specific site and consortium is selected for power-to-products business cases/models and a scale model is set up. Despite its small size and – in an early phase - the use of available technology, this project has a price tag of around EUR 3 million specific project financing (in addition to extra investment costs).
	The concept of sustainable port infrastructure becomes concrete: choice of infrastructure, feasibility, business model, authorization dossier in preparation. At this stage this is related to a feasibility analysis, estimated at EUR 500.000.
	Further development of ports as power stations with smart grid coupling techniques: new production units are smartly coupled and these techniques facilitate the decision making for various stakeholders. In this project existing knowledge will be used, without investment costs. Specific project funding amounts to something in the order of EUR 500.000.
5-10 years	A global system approach for flexible waste heat is put on the international market by Flemish companies.
	Through practical experiences within the Flemish innovator zone, the Flemish technology providers and aggregators are active in several foreign ports with innovative business models for demand side response.
	Further commercialization of the integrated shore power concept is being developed together with the shore power platform.
	A full scale demo of power-to-products implementation is active in the Flemish port region.

Table 1: Ambitions Energy Harbors innovator zone

The additional project funding for this innovator hub for the first 5 years amounts to +/-EUR 10 million. This is project funding without extra investment budget.

The aimed KPIs can be summarized as:

KPIs in 1 year	Consortium assembled	3
	# of companies in the consortium	9
	Projects applied	1
	Feasibility studies	6
	Update program	At the end of the year
KPIs in 3 years	Finished demonstrator projects	2
	# of ports included	2
	# of companies in the projects/studies	10
	Assigned project means	EUR 3 million (excl. investment)
	Feasibility studies	15
	Update program	At the end of the 3-year period
KPIs in 5 years	Finished projects	5
	# of companies in the projects/studies	20
	Project means	EUR 10 million (excl. investment)
	Update program	At the end of 5-year period

Table 2: KPI's energy harbors innovator zone

4.2.1.3: Energy harbors: Added value

In 2013 the total direct added value of the ports exceeded EUR 14.7 billion, the direct employment was 103.739 fulltime equivalents (FTE's) and EUR 3,0 billion was invested. The estimated indirect added value and indirect employment for the four Flemish ports together in 2013 respectively amounted to more than EUR 12,8 billion and 129.261 FTE. This last group includes a lot of technology suppliers active in the innovation zone.

As indicated, the additional project financing for the innovation zone is estimated to be around EUR 10 million, on top of the extra investment costs.

Important to note is that the intended breakthroughs in the innovation zone 'Energy Harbors' will be spread over the ports, with a focus on Ghent and Antwerp. In this way there is a maximum use of the available infrastructure as well as both ports' identities and activities. Furthermore, it adds an extra dimension to the Flanders Port Area initiative.

4.2.1.4: Energy harbors: Areas with alternative regulatory conditions

As mentioned above, the concept of bi-directional shore supply requires a technology-backed zone with less strict regulations, to allow connection of non-approved generators to a part of the electrical grid. Furthermore, a fast implementation of large-scale generation of renewable energy depends on the willingness of different players (permits, grid operators…).

4.2.1.5: Energy harbors: Presentation of project

In Annex 4 a complete file can be found on the project '**Demonstration of different storage solutions in a future electricity system'**, initiated by Port of Antwerp and The Port of Ghent. This is a good example of the type of projects that can be carried out in the innovator zone 'Energy Harbors'.

The idea behind the 'Storage Solutions' project proposal is that the massive introduction of renewable energy sources (wind, sun,…) makes (additional) electricity storage possibilities a necessity for the future electricity system. Storage act on a short time basis (batteries, power-to-power), but excess electricity production can also be used to create other useful energy vectors (power-to-heat, power to hydrogen, power to methanol…). Harbor areas are complex nodes of energy systems with different energy vectors geographically very close to each other. Therefore, the port of Antwerp and the port of Ghent are ideally fit to demonstrate different kind of electricity storage solutions as part of a future energy system.

This demonstration project actually concerns 2 pilots:

The Port of Antwerp will focus on the conversion of wind energy and industrial CO_2 into methanol. The produced methanol can be used as a transport fuel for the road sector (blending with gasoline) or as a marine fuel. Alternatively, the produced methanol can be used as a chemical building block in different chemical processes within the port of Antwerp.

The Port of Ghent will focus on the storage of solar energy in batteries and the conversion into hydrogen. As the port of Ghent is an industrial port, the local demand of electricity and industrial gasses like for example hydrogen is high. Antwerp and Ghent are multi-modal hotspots in Flanders so the fuel demand is potentially high. The transition from fossil based fuels to alternative/low carbon transport fuels starts here. There is a strong link with IBN project 'Power-To-Gas' in which TerraNova Solar nv is partner (for further details, see the complete project proposal in Annex 4).

The **business case** of both pilots is **based on grid stability on one hand and the conversion into transport fuels on the other hand.** The demonstration of viable business cases for the above mentioned pilots leads to know-how that can be valorized throughout harbor areas in Europe (and the rest of the world), as all harbors face the challenges of massive introduction of renewables and the need for storage.

Annex 4 provides amongst other things a list of companies and organizations that can realize the pilots; a list of technological/economical/regulatory advancements needed in order to realize this lighthouse project; schematic overviews of the Power-to-battery-to-hydrogen project of the Port of Ghent and the Power-to-Methanol project of the Port of Antwerp and company profiles of Port of Antwerp and Port of Ghent in relation to the Flemish Energy Cluster.

4.2.2 Microgrids

4.2.2.1: Microgrids: Focus of the Cluster

Within the innovator zone 'Microgrids' the Energy Cluster will focus on scalable hybrid microgrids for a wide range of residential and industrial settings. As the large multinational technology providers are often not well-placed to offer competitive solutions for those smaller types of microgrids, there is an entire market segment open for local companies to grab. Within this segment grids range from a couple of tens kW up to a few MW.

It is quite a challenge to integrate generation, storage and control technologies in settings with lots of renewables and complex consumption patterns. It will be necessary to develop integrated concepts that can handle this type of complexity and provide the flexibility to be deployed internationally. Combining different technologies is paramount and aligning them with appropriate control systems is crucial in this respect. The need for scalability, flexibility and absorbing complexity translates into a focus on ***hybrid*** microgrids. Those grids can operate both in islanding and grid-connected mode and can flexibly switch between both as needed. In order to do so, they have to be able to reconfigure internally – which will eventually include expanding or contracting their perimeter.

The Flemish Energy Cluster clearly aims at a step-up from the current breed of trepid microgrid developments which, especially in Europe, focus on either island-settings (without a main grid to connect to) or limited demonstrators in controlled settings (http://microgridprojects.com/). Therefore, the innovator zone 'Microgrids' will build on recent advancements in energy market functioning, technology and regulation. Because of the early liberalisation of the energy markets and the complex institutional landscape, Belgium is an attractive staging ground for propositions in this area. At the same time, we will have to work within the boundaries set by standards, such as IEEE p.2030.7 and IEEE p.2030.8 on the modularity of and test protocols for microgrids.

All this runs in parallel to the ambitions of the grid operators, together with the storage industry, to work on new market designs that will fully incorporate islanding, flexibility management, aggregation and demand response (http://www.gridplusstorage.eu/deliverables; integrated implementation plan on R&I activities)

The integrated solution for hybrid microgrids will take shape in the Cluster through three core pilot projects. Each of them is to be implemented on a different site and has a unique focus that covers a specific aspect of hybrid microgrids. Each of the projects will have a viable business case in and by itself – or will evolve towards one.

Together they offer the pieces of the more complex economic, regulatory and technological model that will underpin the integrated offering after five years (cf. infra, ambitions).

Project	**Description**
Increased integration of renewables by intelligent local integration of production, consumption and storage	A microgrid aimed at maximising the integration of renewables by fully exploiting the potential of both flexible demand and storage. Technical integration and improved return to microgrid participants are key.
Microgrids for local grid support	Microgrids exhibit great potential for alleviating local bottlenecks on energy/electricity grids, as they can be controlled to absorb/conserve considerable amounts of energy when needed. This pilot project puts emphasis on the interaction with DSOs and the options of opening up current grid management models to third parties.
Local markets	For hybrid microgrids to fully come to fruition, energy market transactions will have to be possible – between microgrid participants on the one hand and between microgrid operators and DSOs at local hubs/bottlenecks on the other. This

demonstrator sets up and runs such market places at limited scale.

Table 3: focus micro grids innovator zone

4.2.2.2: Microgrids: Ambitions of the Cluster

The overall ambition of the innovator zone 'Microgrids' is to turn Flanders as a region and its companies into the worldwide reference for integrated solutions for hybrid microgrids.

This long term ambition translates into the intermediate ambitions spelled out in the table below. After the preparatory work in the first year, the innovator zone will work towards both project-specific milestones and commercial ones. Three years into the project, the first pilot site will be online, incorporating (at least) 250kW in installed power. At the same time, the partners will have developed a viable model for building and operating hybrid microgrids of this size. After five years two more pilot sites will have been developed, both of which will represent a major step-up in terms of capacity as well as in complexity of the microgrid configuration. Those pilots will integrate a larger variety of (renewable) sources and integrate with overall grid operation. At the same time, integrated solutions will be offered on a commercial basis, both in Belgium and abroad. After ten years the continued development and expansion of the microgrid offering will have earned Flanders the status of reference in this field.

Time horizon	Ambition
1 year	3 pilot projects/business cases for flexible hybrid microgrids defined and consortia identified
3 years	. First pilot site online. 250 kW connected . Viable model (economic; regulatory; technical) for hybrid microgrids developed
5 years	. Second and third, more complex, pilot sites online: > 1MW connected, managed and integrated with overall grid operation. . Flexible hybrid microgrids solution offered on international markets.
10 years	Flanders recognized as the worldwide reference on hybrid microgrids

Table 4: Ambitions microgrids innovator zone

Carrying out the projects mentioned above, will require the resources set out below during the first three years of operation. The numbers and relative weights are based on the eegi/Grid+Storage implementation plan 2016-2018, which spells out grid development at the European level.

Year	y1	y2	y3	Share eegi
Project				
Increase renewables	50k	500k	750k	50%
Local grid support	50k	125k	500k	30%
Local markets	50k	125k	250k	20%

Table 5: resources needed for the micro grid innovator zone

This budget estimate

a) Uses the first year for fully scoping each of the projects and identifying participants

b) Gives priority from year 2 onwards to the project on increasing renewables. The local grid demonstrator is ramped up a year later, whereas the local markets pilot will only be fully deployed after the initial three-year period.

c) Respects the relative weights implied by the eegi implementation plan and puts 50% of the funds with increasing renewables; 30% on local grid support and 20% on creating local markets.

KPIs to track progress will be further developed together with the companies taking part in the Innovator Zone.

Time horizon	KPIs	Value
1 year	# of pilots/business cases # partners involved in consortia	3 5
3 years	# kW in pilot site Viable (commercial) model developed	250 Yes
5 years	#MW in pilot sites # Renewable generation technologies in pilot sites EUR Turnover international sales of hybrid microgrid solutions	> 1 3 EUR 5 million
10 years	# Participations in international trade shows by Flemish companies	150

Table 6: KPI's microgrids innovator zone

4.2.2.3: Microgrids: Added value

Economic activity under NACE 31.1; 31.2;31.4;31.62; 40.1 is directly affected by the opportunities created in this innovator zone.

Apart from opening up further avenues for growth and international expansion, the appearance of Flanders as the leading provider on hybrid microgrids will further strengthen the role of the Belgian competence centers within the multinational technology providers mentioned above.

4.2.2.4: Microgrids: Areas with alternative regulatory conditions

Microgrids are currently held back by two pieces of regulation. It is part and parcel of the Cluster's work to study, adjust and implement them in ways that combine the interests of all stakeholders. The power of the hybrid microgrid concept is that it can achieve exactly this.

On the one hand, the ban on direct exchange of energy over private networks makes it difficult to achieve the kind of local optimisation that is core to microgrids' functioning. A less stringent approach that considers microgrids to be a tool within overall grid management will help.

On the other hand, the rules and fee structure governing grid access for storage units need to be considered. When such units engender fees twice (once for 'consuming' electricity and once for putting it back on the grid), the case for installing them becomes less obvious – even though they are essential in delivering the kind of grid-supporting services that are sorely needed.

4.2.2.5: Microgrids: Presentation of project

In Annex 4 a complete file can be found on the project '**Microgrids as a local grid with a minimum dependency on fossil sources and the distribution grid by surveillance of maximizing the local energetic balance immediately'**. The companies currently involved are: **Eandis, ABB, Triphase, Enervalis, Van Wingen, Vyncke, Engielab and storage companies** (tbc). Since the city of Kortrijk is offering a site for real life demonstration, the test platform can be build and programd as a copy of the real testing ground. This is a good example of the type of projects that can be carried out in the innovator zone 'Microgrids'.

The project aims to **build an open system for micro grids via a building block concept**. A building block could be (non-exhaustive list) a CHP, Gen set, PV technologies, on shore wind turbines, storage units (batteries, flywheels, hydro, super caps…), grid-active and grid-interactive inverter systems, distribution related components and so on. These must be **completed with all types of functional block control systems**. The **interconnecting technology** may be single- or three-phase AC, low-voltage DC or a hybrid.

Since a smart micro grid must be able to combine those functional blocks on both predictable and heuristic base, there is the need of **a multi-agent structure** with the aim to keep energetic balance all over the network on quasi instantaneous base. A software system based on machine learning algorithms can integrate any building block by any player in the field fitting connectivity standards, achieving **true interoperability**. As a novel approach, the software will optimize the system during a learning phase, during which multiple objectives are put forward, all to find a balance between efficiency, sustainability and asset lifetime.

The implementation in a real testing ground is not feasible yet. Therefore, the project takes an oriented approach, where all new concepts will be developed in a 'technology independent' way and build up on a free programmable and free configurable test platform under real load conditions. The approach contains three stages: control layers development, lab testing and a living lab validation with actionable customers on an external site, implementing circular economy principles (see Annex 4 for a schematic overview). Due to this general approach, **new technological solutions or building blocks will be non-limitative.** To conserve and to distribute the knowledge in Flanders an **expert group** will be formed out of these three steps.

Annex 4 provides additional information on this project, e.g. alternative approaches and actions required to come to a full business plan.

4.2.3 Multi-energy solutions at district level

4.2.3.1: Multi-energy solutions: Focus of the Cluster

Within the innovator zone 'Multi-energy solutions at district level', the Flemish Energy Cluster will focus of solutions for the integration and flexibility of heat, cold, electricity and other energy carriers on district level. This is a multi-energy carriers approach, with the interaction between electricity and e.g. heat being part of the solution.

Figure 22 (below) shows schematically how this multi-energy carrier approach can be translated into an energy hub solution.

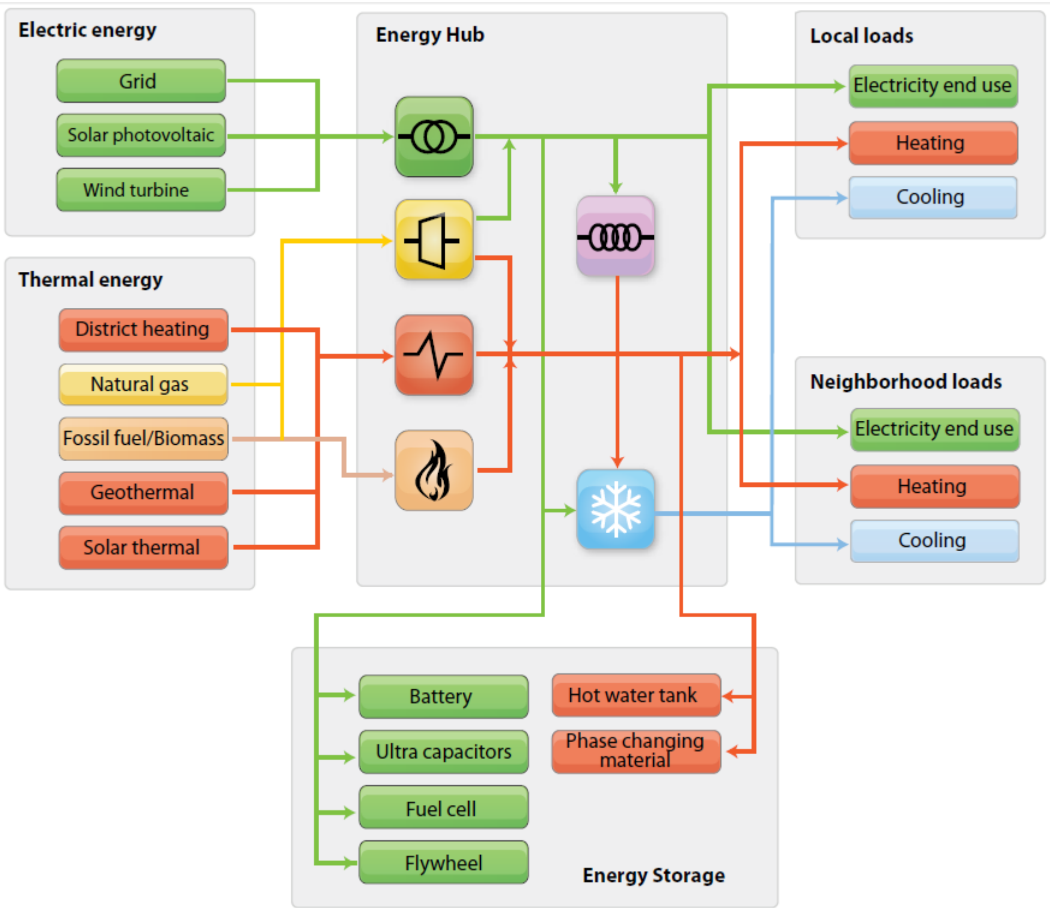


Figure 22: Schematic representation of an energy hub (Source: EPIC-HUB project)

In this context the Flemish industry will focus on three goals:

• ***the enhanced interoperability of the energy components*** for local energy networks. As such, Flemish products (e.g. smart meters, heat pumps, ORCs, cogens, batteries, hot water boilers, HVAC components…) will be able to communicate and function optimally in a wide range of working environments. Starting from unique knowledge on communication protocols, the integration of both electric and thermal components can be considerably improved.

• ***the initiation of a new type of ESCOs*** (energy service companies) able to offer a portfolio of energy services (comfort) instead of (energy) commodity (kWh). By doing so, they will optimally use the future mechanisms of the energy market. New business models will be put into practice (e.g. new forms of PPPs or public private partnerships). To have a unique selling proposition the innovative proposition needs to combine different services and innovative energy technologies. Classic heating grid solutions for instance are an established market, whereas heating grids combining different energy sources and temperature levels, and able to take interactions with the electricity grid into account are a new market.

• ***Specific energy hubs, e.g. based on geothermal energy*** are an opportunity to consider once they've become economically viable through risk reduction and new technologies. In the context of dedicated energy hubs Flanders can also play a frontrunner role in 4^{th} generation energy grids combining different energy sources and user types.

4.2.3.2: Multi-energy solutions: Ambitions of the Cluster

The table below summarises the preliminary ambitions of the Flemish energy cluster. These ambitions will be specified and translated into an operational planning during 2016 by the engaged partners.

Timing	Ambition
< 5 year	**First Flemish energy components with enhanced interoperability are introduced into the market.** To this end, a specific project will be initiated to optimise specific energy components of Flemish industrial partners in real life conditions. The available living lab infrastructures in Flanders (e.g. resulting from the SALK project) are a strong asset for this project. Existing components like electric boilers, heat pumps, batteries, PV panels, smart meters… are improved with control and communication intelligence as to participate in an exchange of energy flows at district level. Experience from previous projects with international recognition and industrial participation (such as LINEAR, Meta-PV…) serve as a starting basis. Project budget: about EUR 4 million (depending on the number of products to be optimised) Project duration: 3 years Industrial partners are expected to bring in their own equipment.
	First new 'energy hub' ESCOs launched with application in Flanders Flanders (EnergyVille) is currently preparing and investigating new business models for the exchange of energy flows at district level. Also, some zones where regulatory alternatives can be tried out, are being considered. Assuming these preparatory activities are concluded within 3 years, their results will be translated into a package of energy services offered by specific companies (ESCOs). The Energy Cluster will build on the experiences obtained with the business models and regulatory conditions, in order to create a viable energy hub structure and service package to be transferred to a new type of ESCO companies. The project includes first

	demo's in Flanders. Project budget: about EUR 3 million Project duration: 1,5-2 years (starting from 2018)
➢ 5 years	**A second, truly innovative 4th generation grid active in Flanders** For the moment heating & cooling grids are not widely applied in Flanders, but interest in them is strong. This is especially the case, since a lot of the residential areas are close to industrial areas with a lot of waste heat. The Energy Cluster has the ambition to establish a 4th generation grid in a specific location in Flanders. The Nieuwe Dokken in Ghent have such grid, but the Cluster aims for a truly innovative one, where industrial partners can develop new control intelligence and flexible components in the heating grids of the future, and where the operation of heating and electricity grids are integrated. Where relevant the links with geothermal energy should be made to strengthen the Flemish added values. Running EU projects as STORM can be linked to current project plans of new heating and cooling grids, e.g. Antwerp, Ghent, Roeselare, Genk as well as to research from e.g. GeoWatt in SALK. All this input can be used to design an effective concept for a large scale demo. Project budget: about EUR 6 million Project duration: 5 years (starting 2017) Infrastructure investment is not yet taken into account in the budget.
	International applications for the energy hub ESCOs with results in priority target markets, budget to be defined
	International visibility of a Flemish energy hub demonstrator with Flemish "interoperable components" and a resulting contract with foreign investors, budget to be defined

Table 7: Ambitions multi-energy districts innovator zone

Global budget of the main additional cluster projects: about EUR 13 million in 5 years.

The KPI ambitions are summarised in the table below.

Timing	KPI	
After 1 year	Consortia formed	2
	Number of companies in the consortia	10
	Project proposals submitted	2

	Feasibility studies	4
	Program update	1
After 3 years	Demos performed	1
	Technologies enhanced	5
	Number of cities involved	4
	Number of companies involved	15
	Multiplication factor project financing	3 (incl. investments)
	Program update	Complete update also long term
After 5 years	Demos performed	4
	Number of cities involved	8
	Number of companies involved	20
	Multiplication factor project financing	5
	Number of export activities running	3

Table 8: KPI's multi-energy districts innovator zone

4.2.3.3: Multi-energy solutions: Added value

Multi-energy solutions at district level have the following added value for Flemish employment:

- A growing ESCO-market. At present, the well-established players in Flanders are active in the public building sector (see e.g. link to Vlaams Energiebedrijf). Belgian ESCO's are currently united in BELESCO. However, the new energy service providers that are profiling themselves with expertise on energy districts are in most cases SME's; there is also a potential to start new companies combining competences (heat, electricity…) and electricity aggregators are a growing share of service providers. The district development sector widens the market potential of these companies to a European scale.
- European examples have shown that large scale energy district projects create significant employment, e.g. 1370 FTE's in Oslo and 100.000 jobs in Helsinki (Kalasatama project, see 1.1.4).
- Major companies focussing on innovative components for heating grids and heat conversion, e.g. Daikin and Atlas Copco, employ several thousands of people.

4.2.3.4: Multi-energy solutions: Areas with alternative regulatory conditions

Discussions on a dedicated zone with new regulatory conditions in a pilot site in e.g. Waterschei have been initiated. During a major research project (started in 2015), the requirements of this 'new regulation' zone are being developed. One thing to address is the regulation on the exchange of surplus heat and electricity between buildings on the same site. The remuneration of storage solutions through new market mechanisms is another specific issue.

4.2.3.5: Multi-energy solutions: Additionality with respect to running initiatives

The projects of the Energy Cluster in the innovator zone 'Multi-energy solutions at district level' build on following initiatives:

- New living labs built on the exchange of energy flows in districts: e.g. the SmarThor lab in Genk (SALK project). Here different buildings on a combined site are connected with an integrated IT infrastructure and opportunities to connect new energy components. This infrastructure can be used to improve and demonstrate the interoperability of new energy components.
- Investment projects on district developments and heating grids: e.g. Luchtbal Antwerp, Oude Dokken Gent, MIROM Roeselare… are a basis for innovative demonstrators.
- Through interaction with Warmtenetwerk Flanders the Energy Cluster will promote the results to a broad industrial network. Warmtenetwerk Flanders also serves as a link to the Dutch Warmtenetwerk and EU frontrunner initiatives like Celsius (H2020).
- Since legislative aspects remain essential to achieve economical breakthroughs, discussions with VREG, CREG and EU legislative bodies will give the necessary feedback on regulatory innovation, based on experience in areas with alternative regulatory conditions.

4.2.3.6: Multi-energy solutions: Presentation of projects

In Annex 4 a complete file can be found on two projects. The first one is the project **'The Thor-site: enhancing multi-energy technology'**, with a potential of 14 Flemish companies to be involved equally distributed over 3 parts of the value chain (components, IT, energy services), with about half of them SME's. The second one is **'A business case for a local smart grid – De Nieuwe Dokken, Ghent'**, initiated by DuCoop. Both are prime examples of the type of projects that can be carried out in the innovator zone 'Multi-energy solutions'.

The project proposal **'Enhancing multi-energy technology at the Thor-site'** is **linked to the completed infrastructure on the Thor-site, the EnergyVille Labs** and to planned infrastructure investments. The main objective of this project is to **reduce CO_2 emissions while guaranteeing security of supply** and offering energy services at competitive prices by **developing market models and ESCO services for on-site exchange of energy flows in a district with mixed functionalities** (small industry, education, hospitals, sport facilities, residential…). It focuses on the improved system flexibility by combining complementary conversion and storage technologies bringing energy vectors as heat, cold and electricity in one common market platform.
Appliances like HVAC, heat pumps, cogeneration, advanced thermal energy storage are interconnected and equipped with improved flexibility features and enabled to high interoperability. On the Thor-site the Flemish industry can tackle this challenge in a real **district development with international visibility**. Annex 4 provides more details on the project, e.g. a list of the 14 companies to be involved; the important role of Flemish aggregators already active in the new energy system and necessary advancements in the fields of standardization and regulation.

In the other project, **'A business case for a local smart grid at De Nieuwe Dokken, Ghent'** issues of **grid balance** (demand side management, grid level storage and a local grid for communal energy needs…), **energy management for EV-charging** (with smart charging points connected to the local smart grid and later maybe the use of car batteries to balance the grid) and **energy management for smart home appliances** are addressed in a concrete project at De Nieuwe Dokken. Other districts where renewable energy is implemented and EV-charging rolled out may encounter similar problems, so solutions that are implemented (open source) at Nieuwe Dokken can later be applied in other projects elsewhere in Europe. Annex 4 provides additional information on this project, e.g. the software developments needed to steer the smart applications, regulatory issues and a company presentation of DuCoop.

4.2.4 Energy cloud platforms

4.2.4.1: Energy cloud platforms: Focus of the Cluster

The challenges facing the Flemish Energy Cluster in the innovator zone 'Energy Cloud Platforms' are manifold: (1) to digitise in a cost efficient way, (2) make current building systems, appliances, energy assets, industrial processes, etc. connected via standardised interfaces; to (3) improve efficiency, reliability and interoperability of current communication systems, and (4) add real-time data processing and self-learning capabilities. By tackling these challenges, we can realise a Flemish energy cloud that creates a lot of added value for all stakeholders involved.

The innovator zone 'Energy Cloud Platforms' will focus especially on the following breakthroughs:

- Realising an energy cloud with open interfaces for stimulating the creation of new intelligent apps and services
- Improving robustness, scalability and self-configurability of wireless communication networks to connect buildings, industrial plants and grid assets in a reliable way.
- Making building systems and appliances connected, smart and self-learning, by adding cheap sensors and machine-learning capabilities.
- Guaranteeing the reliability of our energy system and protecting privacy sensitive data by adding capabilities to the energy cloud that can realise cyber security and trust.

Open Energy Cloud

As indicated above, a Flemish energy cloud inspired by e.g. the Green Button initiative will combine energy data (real-time measurements and predictions of generation, consumption, power flexibility, etc.) with context data (e.g. temperature, air quality in buildings, industrial process parameters, etc.) and other data sources (e.g. weather predictions, data from energy markets) which can be accessed via standardised interfaces.

This will allow service and application providers to develop new services and (mobile) apps to improve energy efficiency, a better matching of (variable) generation and consumption patterns and an improvement of the grid capacity.

An important challenge to be addressed is the identification of the stakeholders that can support and maintain this open energy cloud, e.g. the DSOs, VREG, …

Also, following technical and business breakthroughs are necessary to come to a system with clear added value:

- Standardised, interoperable, self-describing interfaces to easily connect the cloud with a multitude of existing and future (eco)systems.
- Efficient data processing capabilities to provide real-time control applications with the data they need
- Design of new business models for sharing data via the energy cloud

Intelligent, highly-configurable communication networks

To realise an interconnected and smart energy cloud, we need to make our buildings, power grids and industrial processes connected. This requires the deployment of cheap and reliable sensors and actuators, and installation of communication equipment for transmitting monitoring and control information.

As the energy domain, but also our building stock and industrial plants are characterised by many legacy assets with long lifetimes, very often wireless solutions will be needed to unlock flexibility and realise smart control.

Recently deployed and upcoming standards like LoRa, Sigfox, WiFi HaLow, new LTE standards and the upcoming 5G communication specifications offer interesting opportunities to make current systems, buildings, etc. connected in a cost efficient way as they consume very little energy but are still capable of transmitting information over long distances.

However, as many protocols use the same spectrum and due to the long ranges, interference will increase. To reduce congestion and keep these technologies reliable, highly configurable networking components need to be designed that can sense their environment and reconfigure their radio transmitting parameters in real-time. Furthermore, research and development is needed to realise a reliable wireless communication with low latencies in the often harsh environments of industry and grid substations.

Smart, self-learning appliances & systems

To increase energy efficiency of buildings and better match local consumption with local generation, building systems (e.g. HVAC, ventilation, lights, …) should become aware of the environmental context, the current needs and wishes of users in the building, the status of surrounding systems and appliances and they should be able to learn from user configurations and overrides. The goal of all this is to maximise the user's comfort with a minimum of (externally produced) energy.

This can be realised by integrating cheap sensors in these systems and appliances and by providing interconnections so the systems can interact with each other.

For an effective roll-out, a plug & play installation and configuration is key. New appliances and systems should be automatically discovered and included in the local network.

By adding machine-learning capabilities, these systems will become self-learning and predictive maintenance services will become possible. Also, available power consumption flexibility can be consulted and accurately predicted, and feedback on the building performance can be provided to facility management and building designers.

Trust & Cyber Security

Security is a concern to many energy actors. They fear that, when our energy systems become truly connected, this might create opportunities for hackers to tamper with business critical applications. Reliability is key within energy systems as a malfunctioning of the system has a large impact on society and economy.

Energy data are often very privacy sensitive, so it’s of the highest importance to realise trust and cybersecurity in a digitised energy system.

4.2.4.2: Energy cloud platforms: Ambitions of the Cluster

The table below summarises a preliminary ambition, which will be further refined in the course of 2016 with the engaged companies.

Period	Ambition
< 5 year	Aim is to bring together IoT companies and energy companies and demonstrate a first multi-actor energy cloud where new smart & connect energy services can be integrated. Focus is on services with a good valorisation case and exportable to international markets.
	Realising prototypes of highly configurable networking components to optimise an ecosystem of co-existing wireless communication protocols.
	First smart & self-learning building systems that can interact with each other.
	Investigation of potential security issues and development of associated solutions for guaranteeing a secure operation of the multi-actor energy cloud.

5 years	Realisation of a Flemish energy cloud combining real-time production, consumption, flexibility, environmental and other data, to further stimulate the development of new apps and services
	Full demonstration of the energy cloud communicating in a secure way with different appliances, sensors and systems in diverse environments using the flexible networking components.
	Application of self-learning algorithms to the domain of energy grid automation and industry automation
10 years	Realisation of a complete connected energy platform, a scalable, reliable and secure ecosystem where buildings, energy providers, grid operators, industrial actors, etc. interact with each other and where smart energy and comfort services are offered.
	Self-learning algorithms are capable of learning user preferences and habits, optimise set points in building systems, industrial processes, and grid assets to realise optimal user comfort and cost savings for all actors involved.

Table 9: Ambitions cloud platforms innovator zone

The additional project funding for this innovator zone in the first 5 years is estimated at ± EUR 10 million. This is pure project funding without extra investment means. To obtain this amount of funding we will look for synergies with existing funding channels like iMinds' ICON program, "O&O" program from VLAIO, etc.

The aimed KPIs can be summarized as:

KPIs in 1 year	Consortiums assembled	3
	# of companies in the consortium	9
	Projects applied	2
	Feasibility studies	4
	Update program	At the end of the year
KPIs in 3 years	Finished demonstrator projects	2
	# of companies in the projects/studies	12
	Assigned project means	EUR 3 million (excl. Investment)
	Projects applied	8
	Feasibility studies	10
	Update program	At the end of the 3-year period
KPIs in 5 years	Finished projects	6

	# of companies in the projects/studies Assigned project means Update program	20 EUR 10 million (excl. Investment) At the end of the 5-year period

Table 10: KPI's innovator zone Cloud Platforms

4.2.4.3: Energy cloud platforms: Added value

The open data culture and standardised interfaces will allow new players to come up with innovative apps that can be tested, demonstrated and valorised within the Flemish Energy Cluster. Subsequently, they are scaled up and valorised internationally.

Also the innovative technological building blocks which will be developed to realise the energy cloud (reliable and flexible wireless communication, data processing, self-learning capabilities, digital trust solutions, etc.) will be valorised in other markets both nationally and internationally.

4.2.4.4: Energy cloud platforms: Areas with alternative regulatory conditions

To explore the possibilities of combining energy data with additional data sources, specific policies might be needed to include – for example - DSO smart metering data, which is protected by privacy legislation.

4.2.4.5: Energy cloud platforms: Presentation of project

In Annex 4 a complete file can be found on the project **'The IoT Energy Cloud Accelerator'**, a proposal **supported by Condugo, Eandis, ESAS, IncubaThor, Niko and Proximus** (all in the current line-up of the Flemish Energy Cluster). It is a prime example of the type of projects that can be carried out in the innovator zone 'Energy Cloud Platforms'.

The IoT Energy Cloud Accelerator is to become a fixture of the new energy landscape of Flanders. It will be **a true accelerator environment, allowing faster introduction of advanced and innovative products and services on Digital Energy.** The infrastructure (hardware, software, communication), data usage rights and organizational setup all need to single-mindedly support the mission of being an accelerator with (commercial) value added in the market place.

Realizing this ambition requires **building a unified/standardized IoT (Energy) Cloud that**

- **centralizes, captures and processes data fully automatically at an industrial scale** (i.e. billions of data points per day). Data will come directly from connected devices or through open, standardized and well-documented APIs that enable the exchange of data and information with vendor-specific clouds.
  All demonstrators in the innovator zones of the Flemish Energy Cluster will incorporate such devices and use the APIs from the onset to turn the energy cloud into the central hub it needs to be.
  Specific attention will go to APIs/continued compatibility with new and existing DSO-systems such as smart meters.
- integrates with systems for the efficient, large-scale rollout, monitoring and servicing of connected devices (i.e. thousands of interventions per day).
- supports scenarios (=use cases, developed by third parties) for creating and using clusters of smart homes, buildings and industrial installations for value-added applications.
- fully guarantees privacy (of individual data), data security and transparency.

Annex 4 provides additional information on the 'IoT Energy Cloud Accelerator' project, e.g. four specific project goals and tasks; an estimate of the general market potential and a view on user groups.

4.2.5 Intelligent Renovation towards Energy Neutral Buildings with building integrated energy production and storage

4.2.5.1: Intelligent Renovation: Focus of the Cluster

In the innovator zone 'Intelligent Renovation – towards Energy Neutral Buildings with building integrated energy production and storage', the Flemish Energy Cluster will focus on techniques that are both feasible within the Flemish building context and scalable to an international level. The main focus lies on deep renovation with integrated energy systems.

Figure 23: Deep renovation example (source: BAM de Stroomversnelling)

A central position in renovation market opportunities is held by new business models that aim to increase living comfort with integrated renewable energy systems (e.g. Building Integrated PV) and new means of storage, distribution and use. It's essential to develop cost efficient 'deep renovation packages' in order to refurbish and upgrade old buildings to new, 'energy active' buildings. Of course, different types of buildings require a different approach and trias energetica principles have to be respected. The challenge is to efficiently integrate innovative systems that can spread the load on the electricity grid by effectively matching electricity supply and demand.

Key performance indicators are:

- Energy and CO_2 impact
- Cost-efficiency
- Simplicity of technique
- Comfort

A deep renovation package is based on an overall design and consists of several individually optimized technologies, in tune with each other. The further development of the following components are important:

Building envelope: smart sun blinds, glass in windows with low-emission coatings for cooling purposes, optimized building design, insulation components of the building envelope for optimal heating.

Efficient heating and cooling technology applicable in renovation: integrated and hybrid systems in combination with existing components and subsystems.

Energy generation: building integrated systems, such as building integrated PV, can be used either in roof constructions or in facades.

Energy storage: electrical (e.g. batteries) as well as thermal long term and short term storage of energy on building level and direct use, in-house distribution with Direct Current (DC) grids.

Intelligent control systems: integrated control systems allow a building to self-diagnose and facilitate the integration of e.g. hybrid heating systems, with customized IT offering a combination of services in safety, health, comfort and energy-efficiency.

Nevertheless, it remains important to focus on affordable housing and work on the breakthrough of new developments in a wide market. Therefore, we need to upscale the production and work on cost-efficient production processes. Both new technologies and the effectiveness of their production processes are important.

4.2.5.2: Intelligent Renovation: Ambitions of the Cluster

In the table below, preliminary ambitions are summarized. They will be fine-tuned in the course of the first year of the Energy Cluster in close cooperation with the companies that engage themselves.

Period	Ambition
< 5 yr	• A Flemish roadmap towards intelligent renovation is issued. The Flemish Region has a clear vision and a long term policy on deep renovations. • Professionals unite in a consortium that works on solid business propositions and collaboration models for deep renovation. A new but important player here is the IT sector bringing in cloud solutions, monitoring systems and energy steering systems. • A new group of professionals enters the market with a clear vision on and a solid knowledge of deep renovation and energy efficiency. This implies reforming educational programs. Such reformation can take up to 2 years depending on the educational system. • At least 10 exemplary residential building sites are initiated (preferably geographically well positioned, e.g. 2 per province) as well as 5 deep renovation projects of collective buildings (apartment blocks). These building sites are focused primarily on deep renovation and on a holistic implementation of the following building components: new products and building techniques; new production and building processes; IT solutions for monitoring and steering; energy production and storage techniques; cloud systems and grid connections. All the construction sites will function as living labs and learning facilities. Deep renovation projects traditionally take 2 to 4 yrs from start to finish (from designing to recommissioning). • At least two players active in the market of smart control systems have products for buildings on residential level.

5-10 yr	<u>5 yr</u> • Renovation rate has increased by 2,5% per yr, and at least half of the renovations fulfill the requirements of the Flemish program for 'deep' renovations. • There is a clear turn in the market towards the use of new technologies in renovations where contractors work together in deep renovation. • The Flemish industry specializes in the technological improvement of the Belgian renovation market and in the development of new systems.
	<u>10 yr:</u> • The Flemish building sector is a modern sector where an integral approach with modern techniques and building components are common practice. • Belgian companies have found a window towards the international market with regard to building components and modern materials and systems. The Belgian building sector has gained specialized expertise in different climate zones and in a variety of building styles and types, and is able to operate globally.

Table 11: Ambitions Intelligent renovation innovator zone

The aimed KPI's can be summarized as follows:

KPIs in 1 year	Consortia assembled	3
	# of companies in the consortium	5-10
	Building sites initiated – residential	3
	Building sites initiated – collective	2
	Infrastructure investment	EUR 4 million
	Additional project means	EUR 1 million
	Number of companies involved in the building projects	20
KPIs in 3 years	Consortia assembled	5
	# of companies in the consortium	5-10
	Finished demonstrator projects	2
	Additional building sites initiated – residential	7
	Additional building sites initiated – collective	3
	Infrastructure investment	EUR 5 **million**
	Additional project means	EUR 2 **million**
	Number of companies involved in the building projects	60
	Number of companies reached through dissemination	300
KPIs in 5 years	Finished projects	6

	# of companies involved in the building projects	20
	Number of companies reached through dessimation projects	600
	Assigned project means	EUR 10 **million**
	Update program	

Table 12: KPI's Intelligent renovation innovator zone

The indicated budgets are tentative; they need to be revised once the size of the pilot projects is more clear.

4.2.5.3: Intelligent Renovation: Need for incentives

Companies engaged in the innovator zone 'Intelligent Renovation' of the Flemish Energy Cluster will move from niche markets to wider market opportunities. Entrepreneurship in the Belgian building sector is very diverse and fragmented. The innovator zone 'Intelligent Renovation' will open up a traditionally 'closed' sector to new technologies. Proper incentives can help to upscale niche products for a global market.

With regard to regulations, some relaxation on the topic of building permits might be needed in order to realize Building Integrated PV demonstrators.

4.2.5.4: Intelligent Renovation: Presentation of project

In Annex 4, there is a complete project proposal **'The power backbone for IoT devices – Intelligent low voltage direct current distribution network within a building with broadband data communication capabilities',** initiated by Matthys&Partners (MaPa), Triphase, Enervalis and EnergyVille. This is typically a project where a part of the renovation (electrical) is tackled, in the program these innovations can further be integrated into a more holistic renovation model.

Next to that there is a very relevant project proposal coming forth of the results from the kennisplatform Woningrenovatie (see further in Annex 4).

Today, an increasing number of buildings are equipped with rooftop solar panels, which natively generate DC that must be converted to AC to tie into **the building's electric system**, only later to be reconverted to DC for many end uses. All these **DC-AC-DC conversions result in substantial energy losses** because of inefficient rectifiers and adapters. Obviously, there is **a need for new enabling technologies for emerging energy structures** (like the IoT ready micro-grids) **to modernize the home**

power grid in line with the evolution of the digital world to ensure affordable energy and a secure local data communications network that may serve as the power backbone for all kind of IoT devices and applications.

Matthys&Partners (MaPa)* has worked out such a solution with the *iDC concept, an intelligent safe-to-touch DC nanogrid for new and renovated buildings, which integrates power and broadband data communication on a building scale, simplifies cabling and gathers power usage data for local energy management applications outperforming AC energy management tools.
The *iDC concept* is not only a power distribution network but also a broadband local data communication network, much like a regular LAN-network. Each wall socket is interactive instead of passive as in traditional AC power installations.

In the project 'The power backbone for IoT devices', that is being initiated by MaPa, Triphase, Enervalis and Vito-Energyville, the initiators strive along with SME-partners, to jointly design, develop, demonstrate the iDC solution in an operational building and /or a neighbourhood of 20 houses. This includes a full scale (with local energy production and storage) demonstration and deployment of the iDC concept in a real-life environment. The outcome of the life-demonstration is the validation and exhibition the iDC technology and its performance.
The next step is to make the iDC products 'manufacturability' ready for manufacturing locally.

Annex 4 provides additional information on the project 'The power backbone for IoT devices', for example an overview of the specific problems the solution addresses; the intended performance of the iDC concept and a provisional overview of the supporting companies.

Chapter 5:
Roles and service offering of the Cluster

SUMMARY:

Companies that engage themselves in the Flemish Energy Cluster, can do so at three levels of engagement: talent, business and valorisation. Naturally, a higher level of member engagement corresponds to a higher level of service by the Cluster. In this chapter we take a detailed look at the roles and service offering of the Cluster. Also, the governance structure of the Cluster is presented.

The Cluster aims to fulfil four roles for its member: (a) be a central actor in the energy playing field, (b) create sector collaboration (both roles are offered to members in all packages), (c) facilitate internationalisation (in business and valorisation package), (d) manage cluster specific resources (in valorisation package only).

There are eight 'building blocks' of service offered by the Cluster. The first three – (1) education, (2) dissemination, (3) networking – are common to all packages, including the entry level or talent package. In the business package three more 'blocks' are added: (4) SME support, (5) business model innovation and (6) internationalisation. At valorisation level the final two come in: (7) active participation in the innovator zones and (8) access to the Cluster's resources.

At talent level, the members of the Flemish Energy Cluster get a service offering of (1) education, (2) dissemination and (3) networking. The Cluster aims to create complete value chains of companies working together at specific market breakthroughs in innovator zones. Therefore, the target companies of each innovator zone should be informed (education/dissemination) and brought into contact with companies already engaged in the Cluster (networking).

On top of this, members of the Flemish Energy Cluster at business level receive (4) support for SMEs, start-ups and spin-outs, (5) help in creating innovative business models and (6) support for internationalisation. The Flemish Energy Cluster wants to create complete ecosystems of companies working together on integrated, internationally competitive solutions, able to realise economic growth. Hence the triple focus at business level to support SME's (complete ecosystem), create business models (realise growth) and support internationalisation.

Moreover, members of the Flemish Energy Cluster at valorisation level are entitled to (7) active participation in the innovator zones and (8) access to the Cluster's resources. These members form the core of the Flemish Energy Cluster and will bring new, integrated energy solutions to the three promising international market segments (a) energy efficient industry, (b) sustainable cities and communities and (c) smart homes.

The governance structure of the Flemish Energy Cluster is presented as an annex to this chapter. The annex provides information on the roles, responsibilities, composition and meeting frequency of the Cluster's General Assembly, Board of Directors, Management Team and Steering Committee. In this chapter we also briefly present the three individuals who will ensure the continuity between Smart Grids Flanders (the membership organisation where the 'germs' for the Cluster were sown) and the Flemish Energy Cluster we are forming today.

In accordance with the general Flemish cluster policy, the Flemish Energy Cluster will focus on three particular roles:

- Be a central actor in the Energy playing field
- Create and increase collaboration within the sector
- Manage cluster specific resources

Additionally, the Energy cluster will take up a fourth role:

- Facilitate the internationalisation of the Cluster and its members

To achieve all this, the Energy Cluster presents to its members a differentiated service offering. Members can opt for **a talent, a business and a valorisation package (see below)**. In all packages the Cluster will be a central actor in the energy field and create collaboration. Internationalisation is a specific vertical pillar within the business package, while the management of the cluster specific resources mainly occurs in the valorisation package. So, a higher level of member engagement corresponds to a more customized and intensive level of service from the Cluster.

A specific view on the management of cluster specific resources and project selection, based on existing best practices, can be found in annex 1. This procedure will be further refined in view of the cluster pact negotiations.

The Energy Cluster modelled its service offering on the Flemish TI2 (talent, innovation, internationalization) concept: attention is given not only to innovation but also to education, internationalization and business models with the aim to transform technology into an internationally attractive product offering.

Now let's take a more detailed look at the three levels of member engagement/three packages of service offering.

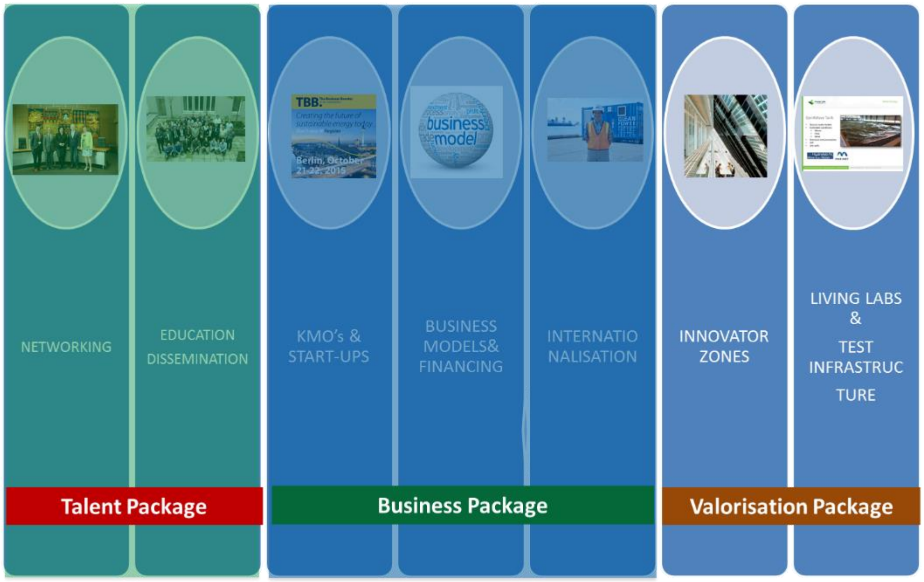


Figure 24: Service offering Energy cluster

5.1 Talent package

The **talent** package is the entry level of the Energy Cluster and its service offering is similar to the services offered by Smart Grids Flanders – the membership organisation that forms the starting point of the Flemish Energy Cluster and that will be 'absorbed' by the Cluster.[52] The ambition is to organize cross-sectoral participation in which the members are brought into contact with each other through joint activities. The Energy Cluster thus offers a unique range compared to other organizations that target specific sub-sectors. The membership fees for this package are the ones currently used by Smart Grids Flanders. They are kept deliberately low to promote accessibility. **At talent level, the members of the Flemish Energy Cluster get a service offering of (1) education, (2) dissemination and (3) networking. The Cluster aims to create complete value chains of companies working together at**

[52] http://www.smartgridsflanders.be/nieuws/interview-frederik-loeckx-nieuwe-algemeen-directeur-sgf

specific market breakthroughs in innovator zones. Therefore, the target companies of each innovator zone should be informed (education/dissemination) and brought into contact with companies already engaged in the Cluster (networking).

Educate

- **Access to three-day intensive Smart Grid School, other seminars and knowledge-sharing opportunities**
- **Creation of a global training strategy**

Within companies there exists an important need to continuously educate their employees on the new trends in the energy world. From the beginning of Smart Grids Flanders, a yearly Smart Grid School was organised as an ideal platform for introducing new employees in a fast way to the theme of smart grids and energy in general. Also for companies outside the energy sector, these programs form an ideal way to gain insight into the energy world. With the broadened focus of the Energy Cluster, these sessions will be extended through the contribution of the various organizations that support the cluster. As a result, more parallel sessions will be offered each in line with the innovator zones. On top of that, together with existing initiatives at Syntra and in close collaboration with the different sector federations, a global training strategy will be created that streamlines the training in technical, industrial and higher education systems developed by the Energy Cluster.

Collaborate & Network

- **Active participation and collaboration in 4 yearly information sharing sessions per innovator zone (20 in total)**

The energy landscape consists of many actors and bringing them together in specific sessions is a basic activity for the Energy Cluster. The cluster will (similar to the thematic groups within Smart Grids Flanders) conduct dissemination actions on the five thematic areas, directly linking the content to the innovator zones. These sessions will form a bridge between the different actors in the cluster. In addition to information sharing, these sessions should provide the companies in the talent package the opportunity to act as a first reflection board for each of the innovator zones. The content definition of these activities will be done in close collaboration with the research centres, while overall coordination is provided by one of the companies that are part of the innovator zone. The cluster provides the general organizational framework and coordinates the activities among the various innovator zones. The primary audience of these activities are the cluster members themselves. Each year features four sessions for each of the innovator zones, resulting in 20 events in total, only open to the cluster members. These might involve concepts such as webinars and living labs tours.

Disseminate & Network

- **Yearly international seminar (at Cluster level) or large event (per innovator zone) to reach out to - and network with – target companies, all stakeholders and international companies**

An internal brainstorming showed that there is a need for a platform where the merits and capabilities of the technology will be widely disseminated. This dissemination can take different forms, ranging from information sessions to broad marketing campaigns. The focus will be on the potential of the technology in real-life systems. The target audience is broader than the cluster members and also involves potential customers, policy makers, and other stakeholders. One such wider event is organised per innovator zone. They might be combined into one large international seminar.

5.2 Business package

The services inside the business package deal specifically with the commercialization of technological innovations in the energy landscape with an offering on an organisational level. The business package is tailored towards SMEs and start-ups that can use help in finding their way in the energy landscape and markets. **In addition to (1) education, (2) dissemination and (3) networking, members of the Flemish Energy Cluster at business level receive (4) support for SMEs, start-ups and spin-outs, (5) help in creating innovative business models and (6) support for internationalisation. The Flemish Energy Cluster wants to create complete ecosystems of companies working together on integrated, internationally competitive solutions, able to realise economic growth. Hence the triple focus to support SME's (complete ecosystem), create business models (realise growth) and support internationalisation.** The role of the Energy Cluster in these areas will mainly consist of matchmaking and creating a one-stop shop for companies.

SMEs and start-ups

- **Facilitate connections between SMEs or start-ups and large companies**
- **Strategic support through involvement in advisory boards or board of directors**
- **Yearly event tailored towards SMEs**

SMEs, spin-offs and spin-outs form an essential part of our Flemish economy. For many SMEs, becoming part of the eco-system of larger companies is a necessary yet difficult strategy. The Energy Cluster wants to play a role in guiding these SMEs and take up a referral function to the many existing players in this area. The Cluster will help SMEs benefit from services offered by such players as Innovation Centres (AIO), Bryo (Voka), KIC InnoEnergy (EnergyVille), Innotek, iMinds start-up counselling, etc.

A second advantage of this package is that (members of) the Cluster will show involvement in the advisory board or board of directors of SME's in order to provide them with the necessary experience and background to take strategic decisions. Finally, an annual event will be organized specifically aimed at SMEs in the energy sector with the aim to create a general awareness around the potential of innovation and internationalization in their specific sectors. This will be done in collaboration with the above partners.

Business models

In each of the different innovator zones, possible business models and their relevance in different possible scenarios will be investigated. Links with the Vlerick Business School will be established. In collaboration with Living Tomorrow, specific vision groups will be initiated, which play an important role in defining possible future market models and keeping the roadmap of the energy sector up to date.

Internationalization

- **Close cooperation with FIT on export and with NCP to attract European co-funding**
- **Promotion of Flemish infrastructure and solutions through liaison with neighbouring clusters and GSGF**

In the field of internationalization, several players are already active in the Flemish landscape. The role of the Energy Cluster is therefore to act as a facilitator and matchmaker with a specific focus on the energy sector. The cluster will specifically operate on three different fronts: export, international project facilitation and internationalization of the Cluster itself.

Concerning export, extensive cooperation with FIT (Flanders Investment and Trade) is aimed at, in which both organizations mobilise their members to participate in sectoral booths, as well as to conduct sector missions around specific energy topics. Yearly, an export guide will be created, cataloguing the capabilities of the Flemish members of the cluster.

Project facilitation at international level occurs in close cooperation with the NCP (National Contact Point) specialised in Energy. The ambition is also to attract European co-funding for each of the innovator zones.

The international link is established through liaison with neighbouring clusters (Netherlands, UK, France and Germany), as well as through active participation in the GSGF (Global Smart Grid Federation) in which Flemish companies are linked to large-scale activities financed by these organisations and vice versa promote the Flemish infrastructure to other international clusters.

5.3 Valorisation package

At valorisation level, members of the Flemish Energy Cluster receive – on top of the 6 offerings in the business package - (7) active participation in the innovator zones and (8) access to the Cluster's resources, like living labs and test infrastructure.

The Flemish Energy Clusters will develop and manage a balanced project portfolio in five areas (or 'innovator zones', see chapter 4) with an alternative regulatory framework. In these five areas a mix of research and demonstration projects will be implemented by a wide range of companies and research institutions. The Energy Cluster facilitates and supports this process and manages the access to the necessary infrastructure. Eventually, in each innovator zone around 10 companies will operate in different projects, making for a total group of 50 example organizations.

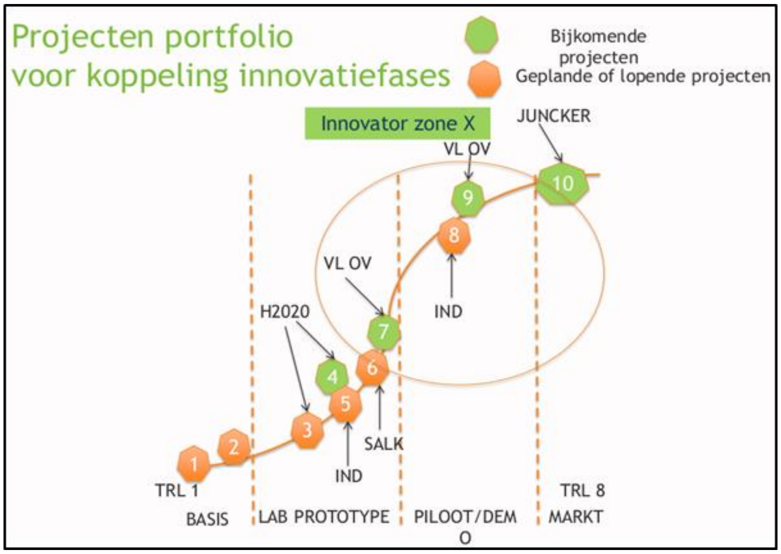


Figure 25: Innovator zone project portfolio

Innovation

In each innovator zone, a project portfolio will be managed, ranging from basic research down to pilots close to the end user. This portfolio is managed in cooperation with the relevant research institutions to ensure optimal use of resources (financial + people).

The Energy Cluster will focus specifically on facilitating projects that are close to the market (trial projects with a high TRL level). The Cluster will help to initiate partnerships for these projects and will provide assistance in defining the topical challenges and work program as well as in writing applications for any project grants. An intensive follow-up during the course of the project is guaranteed.

The Energy Cluster also presents the thematic project portfolio's to the Flemish government as a basis for the program's funding. The Energy Cluster provides one (full-time) coordinator per innovator zone while the actual project management rests with the project leader of the consortium of companies. This project manager is not a staff member of the Cluster. The project management is not seen as a root cluster activity.

The activities below are seen as the prime tasks of the cluster (see also Annex 1 and 2 on project selection and IP models):

Selection

- Stimulate and evaluate a limited number of new topical themes over the next 10 years
- Annual evaluation of relevance of the themes chosen for the Energy Cluster

Realisation

- Formation of consortia
- Guidance to the vision, strategy formation process, work programs
- Guidance in applying for project grants, with a particular focus on European co-funding
- Comparing and selecting locations for test beds, living labs
- Defining policy sheltered conditions and interact with the Flemish government
- Interaction with ongoing and planned initiatives outside the Cluster

Follow-up

- Monitor KPIs on innovator zone level including efficient use of resources
- Address issues relating to open innovation, model IP's
- Facilitate collaboration between partners

- Interact with new initiatives
- Valorisation
- Explore priority customer segments and foreign markets
- Support business models and financing

It is envisaged that – once the Flemish Energy Cluster is fully operative - in each innovator zone several trial projects will be performed simultaneously.

Access to living labs, test infrastructure

Some of the innovator zones will be located within zones with alternative regulatory conditions (see for example section 4.2.4.4 on 'microgrids'). These zones are formed after the Dutch example, in which one can experiment with different exemptions of existing laws and regulations. The idea behind zones with alternative regulatory conditions is that such zones facilitate valorisation by measuring the effect of regulation on economic growth of the (regional) economy and by testing modifications to existing legislation.

These regulatory-relaxed areas could coincide with or make use of existing research infrastructure of the Cluster's partners and members. This will allow them to strengthen their international position, eg. EnergyVille and Ghent University Lemcko in DER-Lab (European Distributed Energy Resources Lab). This infrastructure will be supplemented by additional energy systems which lie closer to commercialization, within the requirements of the innovator zone. Determining these needs, as well as the management of the resulting infrastructure, in consultation with all stakeholders, is an essential part of the Energy Cluster.

5.4 Governance

The governance structure of the Flemish Energy Cluster is presented as an annex to this chapter. The annex provides information on the roles, responsibilities, composition and meeting frequency of the Cluster's General Assembly (representing the different stakeholders of the Cluster), Board of Directors (ensuring a coherent strategy and governance for the Cluster), Management Team (ensuring an effective and efficient execution of the Cluster's operational activities) and Steering Committee (ensuring consistent operations across all innovator zones and between innovator zones and stakeholders).

Here we also want to present the three individuals who will ensure the continuity between Smart Grids Flanders (the membership organisation where the 'germs' for the Cluster were sown) and the Flemish

Energy Cluster. The Cluster will build upon the experience of Smart Grids Flanders and will attract experts with additional competencies, once the Cluster comes into operation. Several people have, in fact, already expressed their interest in working for the Cluster, but these contacts will only be pursued once there is certainty about the funding for the Cluster. The envisioned growth will be co-ordinated by the following people, all with a proven track record and a strong network within Smart Grids Flanders:

Frederik Loeckx

- **Current general director of Smart Grids Flanders & one of SGF's founding fathers in 2011**
- **One of the driving forces behind the Energy Cluster proposal, from the very beginning (May 2015)**

After working six years as project leader and country leader in a security software company, Frederik held a position as innovation advisor at the Flemish government for four years. He specifically helped SME's in realising innovation projects by improving their processes, in teaming up with other organisations with relevant expertise and in attracting funds.

In 2006, Frederik became one of the founders of Triphase, a spin-off producing research equipment for the niche of energy systems research (battery coupled systems, electric vehicles, power hardware in the loop simulators, …). Through organic growth, Triphase grew to 17 people with a customer base worldwide from Chile to Japan, Singapore… As CEO of Triphase, Frederik was one of the founders of the Smart Grids Flanders in 2011 and he is still representing Triphase in the Board of Directors of Smart Grids Flanders today. As such, Frederik was one of the driving forces behind the Cluster proposal, from the very beginning.

On June 1st, 2016 Frederik was appointed General Director of Smart Grids Flanders. At the launch event of the Cluster (May 2016) at Living Tomorrow, Frederik Loeckx was presented as 'the face' of the Flemish Energy Cluster.

Heidi Lenaerts

- **General Director of Smart Grids Flanders (2011-2015), still active in its operations**
- **Will lead one of the Cluster's innovator zones**

After being responsible at the university of Leuven for one of the first pilot projects on smart meters in Flanders, Heidi Lenaerts joined Smart Grids Flanders in 2011 and built up a considerable network in the Flemish energy sector. She gained profound expertise in organising events and schools as well as in facilitating brainstorm events in the area of innovation. Inside the cluster Heidi will continue these tasks, leading one of the Cluster's innovator zones.

Natacha De Brouwer

- **Responsible for the back-office and administration of Smart Grids Flanders since 2011**
- **Will continue to do so also for the Cluster**

Chapter 6:
Additionality and collaboration

6.1 Additionality

This cluster application shows additionality to existing initiatives on different fronts

- Additionality to existing platforms in the energy field
- Additionality to existing other thematic clusters in Flanders

Additionality to existing initiatives in the energy system

In general, one can state that most of the existing platforms within the energy sector, focus on lobbying and networking activities, while the focus of the Energy Cluster is on the creation and maintenance of a coherent program management with large scale collaboration and (international) valorisation. A second distinctive feature is the integrating focus of the Cluster. Other initiatives focus on one specific subsection of the value chain and/or have a dedicated technological focus.

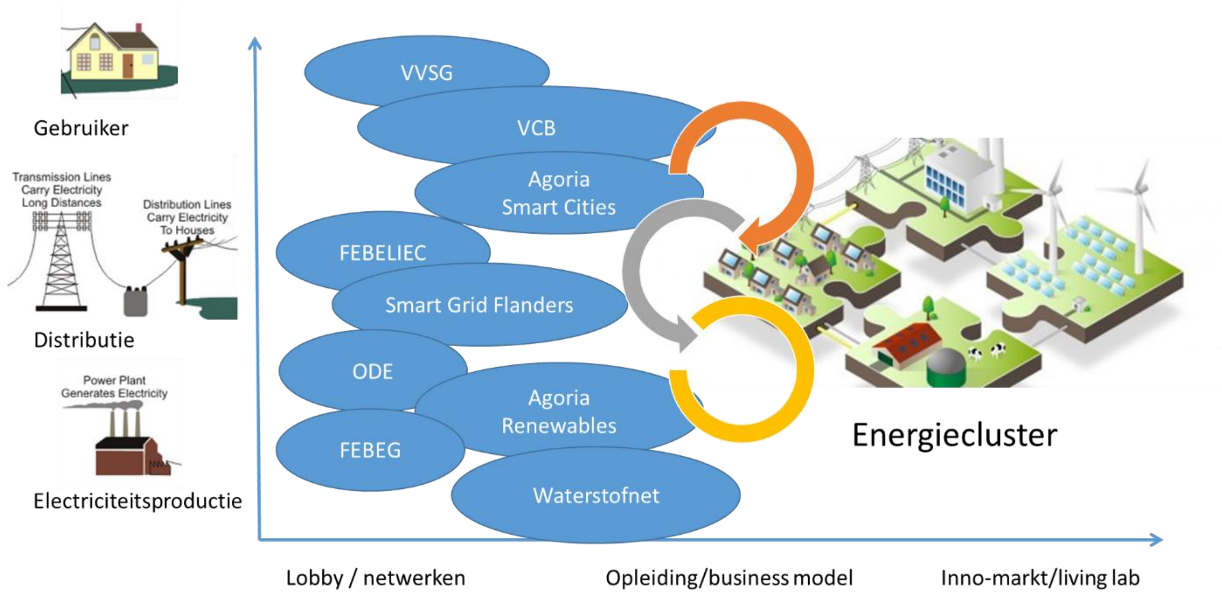


Figure 26: Role of the Energy cluster in the energy eco-system

The picture above shows how the Energy Cluster provides two essential functions in the Flemish industrial scene, that were missing up to now:

1. The continuation of existing initiatives with a focus on demonstration or valorisation. Follow-up responsibilities have not yet been embedded in any of the existing organisations.
2. The integration of the parts of the value chain in one global system

It is also the intention to bring the existing organisations closer together and stimulate collaboration within Cluster and between the Cluster and partners on the outside.

Additionality in the closing of the TRL cycle

Within the Energy Cluster, the objective is to build the eco-system based on the valorisation potential, bridging TRL 5-8, with a strong focus on innovative pilot project and living labs. This additionality is illustrated in the figure below, also illustrating the facilitation of interaction between research and industry. In this context knowledge institutes form an integral part as partners in the Energy cluster and contribute, where relevant, to the innovator zone activities.

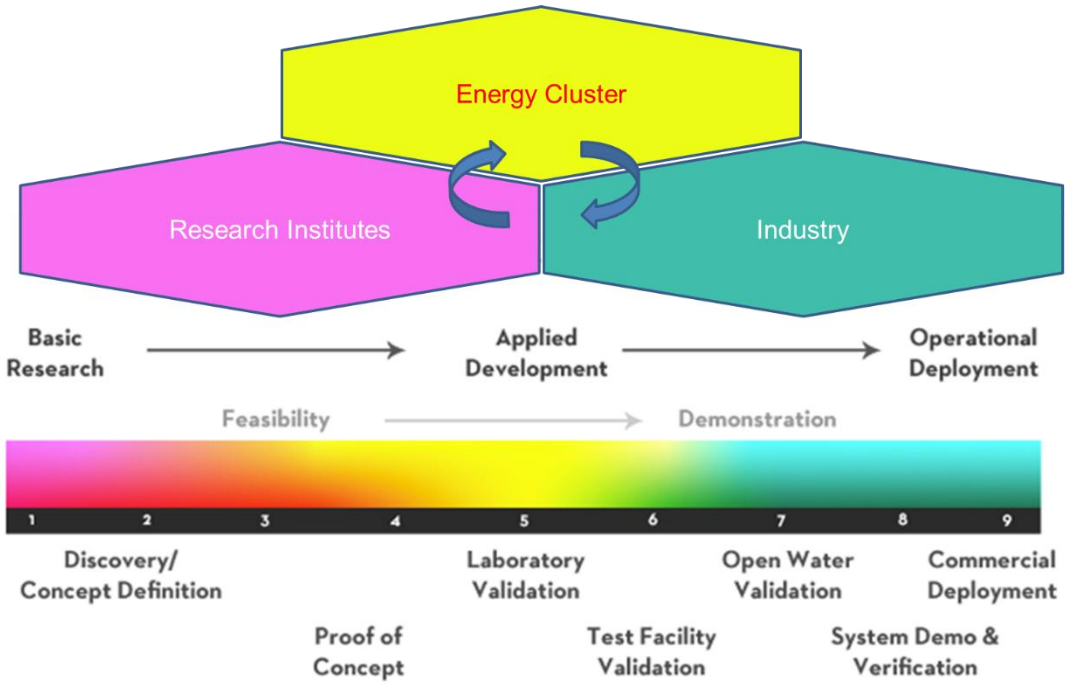


Figure 27: Technology Readiness Level positioning of Energy Cluster

6.2 Collaboration

Collaboration is key, both amongst the partners in the Cluster as between the Cluster and other initiatives. The Cluster wants to pursue an open dialogue with other, existing or future initiatives. It is therefore the ambition to pursue cooperation agreements with complementary initiatives, such as:

Other Flemish clusters active in the field of energy

Small as well as large clusters with a specific energy focus will be contacted in order to ensure complementarity and collaboration. The topic of long-term energy storage based on power-to-gas or power-to-products for example, can provide added value to the innovator zone 'Energy Harbors' and vice versa.

The interfaces of the Energy Cluster with the other selected large clusters or existing Strategic Research Centres will be concretized. Interaction with the following domains (non-exhaustive list) can be sought:

- Advanced new or reused materials / components for energy storage in relation to the materials sector
- Power / CO_2 to chemicals in relation to the chemicals sector
- Integration of mobility as a function of the energy system in relation to the transport sector
- Energy efficiency in production or processing systems

Moreover, the Energy Cluster is open to set up a regular dialogue between the coordinators of all the selected clusters to share best practices around cluster organizations, enhance impact, exchange international positioning, organise joint training and build a joint 'cluster-branding'.

Large-scale research initiatives

The five innovator zones of the Energy Cluster will build on recently completed, ongoing and/or approved large-scale initiatives by the Flemish research such as he LINEAR project where Energyville and I-Minds, together with industry put together a budget of EUR 40 million. The coordinating partners of the above project are also partners of the Energy Cluster.

For further dissemination, collaboration will also be started with some other platforms such as ODE (Organisation for Sustainable Energy), FEBEG, DSP-Vallei, Green-light, BERA (Belgian Energy Research Alliance), the Flemish Energy, FEDELEC (union electricians) WaterstofNet, Benelux Energy Expertise Network, I-Cleantech , VVSG (Association of Flemish Cities and Municipalities). Several of these organisations have already contacted the Energy Cluster Initiative to discuss the nature of such collaboration. The discussions have been put on hold until the approval of the Energy Cluster.

Policy Initiatives

The 5 selected innovator zones also connect the Energy Cluster to the following Flemish political priorities (energy policy from 2014 to 2019):

- The promotion of green heat, waste heat, geothermal energy
- The Renovation Pact, energy renovation program in 2020, almost energy-neutral buildings
- Improving the investment climate for heat grids, renewable energy, CHP
- Realization of the renewable energy target
- Make considerable progress in digitizing energy
- Initiatives related to "energy pact"
- Visie2050 of the Flemish government, view smart grids and smart cities

Discussions with VEA and VREG (policy platform grids) and the policy makers on Energy have already been conducted in order to align the strategies. These actions will be continued in order to assure an optimal alignment. As such, most of the initiators of this proposal also engaged in working on the Flemish Energy Vision and Flemish Energy Pact.

Figure 28: Engagement within the Flemish Energy Pact

The five innovator zones are also in line with the relevant EU Directives and the Fourth European Energy Pact, as well as with the priorities of the SET Plan (Strategic Energy Technology Plan). These documents were used as the basis of the underlying roadmaps of the innovator zones. This alignment is a sine qua non to connect with the international agenda.

Chapter 7: Work Plan

Considering the ambitions of the cluster and its provided size and financial needs, careful consideration was taken to draw the organizational chart. Key work packages were identified, broken down in achievable tasks and subtasks. Staff capacity was allocated and scheduled over the next three years. Accomplishments through expected results and deliverables were identified as well as KPI's as a means to measure and control the process and advancements.

Six work packages are described below.

Unit number:	-1	**month started:**	-4	**duration: (month)**	6	**total number of person months:**	5
Title:	Business plan innovator zones						
Partner:	**Y1**	**Y2**	**Y3**				
Person months:	0	0	0				
Subcontractor(s): None							
Objectives and criteria The goal of this work package is to detail the innovator zones based on the input from the companies engaged at the highest level. At the end of this work package each of the innovator zones is worked out into a business plan agreed between the companies. Empty spots in the supply chains as well as in the expertise level are defined in order to be remediated as soon as the cluster starts. This work package is scheduled to start and end before the actual start of the cluster. It is performed by the initiating organisations at their own expenses (in kind).							
Tasks: description of methods, techniques, etc. The work package will run bases on three different techniques. The procedure will be similar for all five innovator zones. First a general brainstorm session will be held in order to find the most promising product suites for the companies involved at the highest level. For these product suites, a scenario planning session is performed as well as a business model canvas. This business model canvas will be the guideline for the innovator zone over the lifetime of the cluster. In the last stage of this workpackage, the business model canvas is further detailed in a business plan, concretising amongst other the expected outcome, specific KPI's as well as financing needs.							
Task -1.1:	Agreement on the procedure: 09/2016 Starting beginning of September, a first meeting over all innovator zones was organized in order to provide a rough insight into the innovator zones and to agree on the procedure.						
Task -1.2:	Two Pager: 09-10/2016 In two sessions, the interesting product suites and the involvement of all companies will be defined. For these product suites, a two pager will be created indicating the goals of the project, the involved partners, missing expertise. First actions in this task have been started.						
Task -1.3:	Business Model Canvas 10/2016 – 12/2016 Each of the product suites will be worked out in a business model canvas. Special attention will be put on the external requirements of the canvas, such as • Missing partners • Missing knowledge • Missing infrastructure • Regulatory needs • Investment needs • Operational needs • …. This activity will be continued during the operational phase of the cluster						

Task -1.4:	Consolidation of the input 12/2016 – 01/2017 The input of each of the innovator zones will be consolidated in order to get a view on the general needs of the cluster. These needs will serve as a basis for further input to all relevant stakeholders. Special care will be taken in order to find general needs between all innovator zones and to create horizontal work packages where possible.
Expected results and deliverables D1.1 Business model canvas for each of the innovator zones Q4 2016 D1.2 Scenario for each of the innovator zones Q1 2017 D1.3 Specific KPI set for each of the innovator zones Q1 2017	

KPI's	**Target value**
Number of business model canvases and KPI sets	5

Unit number:	**0**	**month started:**	0	**duration: (month)**	36	**total number of person months:**	41,5
Title:	Platform management / KPI Assessment						
Partner:	**Y1**	**Y2**	**Y3**				
Person months:	17,5	13,5	11,5				
Subcontractor(s): Recruitment company (To be defined) **Legal Advice (To be defined)**							
Objectives and criteria This work package concerns the general administration as well as governance of the cluster.							
Tasks: description of methods, techniques, etc.							

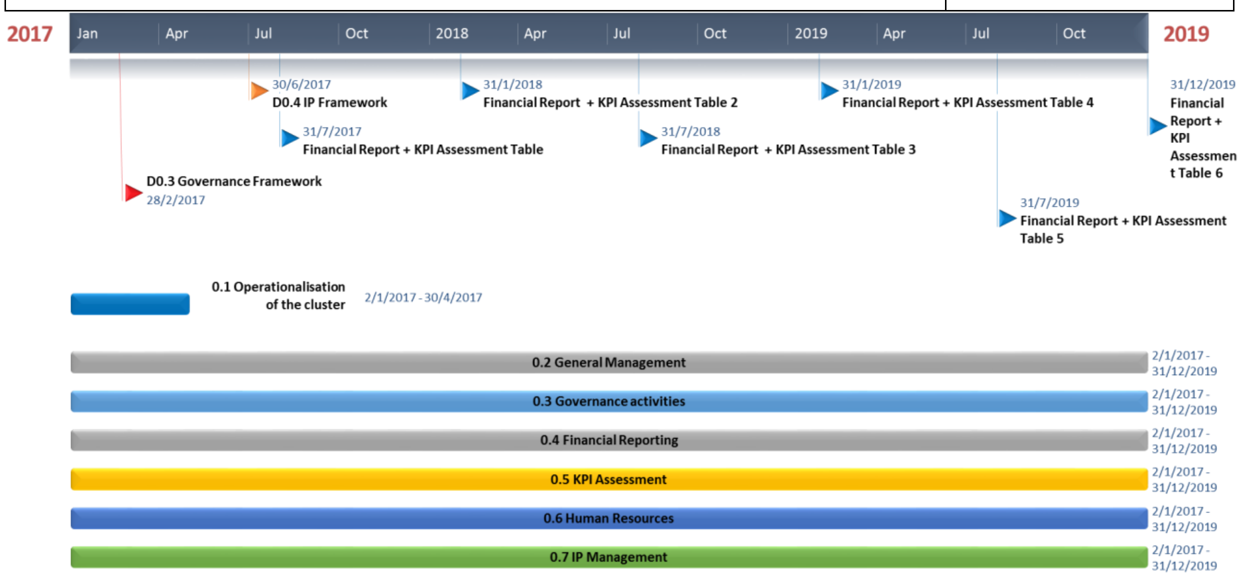
Task 0.1:	Start-up of the cluster (4 mm) M1 – M4 Although the cluster will be founded by nine long standing organisations, effort will need to be performed to adapt one of these organisations (Smart Grid Flanders) into the cluster. This will involve the implementation of a new governance structure, hiring of new employees as well as adapting the administrative processes to a bigger organisation.
Task 0.2:	General Management (15 mm) M1 – M36 This task relates to the general co-ordination activities within the cluster as well as to the daily administrative follow up of the cluster. It also involves regular contacts with the different stakeholders as well as
Task 0.3:	Governance activities (3 mm) M1 - M36 A new governance structure including an academic advisory board will be implemented. A board of directors will be convened at least every three months. At least once a year, a general assembly is convened.
Task 0.4:	Financial reporting (4,5 mm) M1 – M36 Financial control will be performed on a quarterly basis and a general progress report will be created every six months. Of course, yearly accounts will be produced in the official format. This task also involves the daily accounting tasks according to Belgian law. The book-keeping itself will be outsourced to an external accountant. Entry and payment of the invoices is handle from within the cluster.
Task 0.5:	KPI assessment (3 mm) M1 – M36 For each KPI, a target and a measurement interval is defined. At regular moments in time, the KPI's will be presented to both the internal management as the board of directors and remediation measures will be defined where appropriate. The KPI system will essentially

	measure input, output and outcome indicators. Impact measurements are deemed to be a task of the cluster program management. KPI's will also be governed by the ambition to reach ECEI gold status after a timeframe of five years.
Task 0.6:	Human Resources (5 mm) M1 – M36 Human resources will play an important role throughout the success of the cluster. The biggest asset of the cluster are indeed his employees. In this task, care will be taken that the group will grow over the years. Care will be taken to agree on a personal development plan for each of the employees and to put into place a life-long learning plan. Next to its technical expertise, each of the employees will also develop a specific cross-functional specialisation (e.g. IT, process engineering, juridical, state aid, …)
Task 0.7	IP Management (7 mm) M1 – M36 Within the innovator zones, organisations will collaborate intensively in order to integrate different technologies into market breakthroughs. In order to foster collaboration between the different companies, a IP management strategy based on open innovation principles will be put in place. Within this management model, special attention will be put to enable access to existing innovator zones, involving potentially entry fees. The IP model is expected to be available the first half of year 1.

Expected results and deliverables

D 0.1 Financial Report M7, M13, M19, M25, M31, M37
D 0.2 KPI assessment table M7, M13, M19, M25, M31, M37
D 0.3 Governance Framework M2
D 0.4 IP Framework M6

KPI	**Target value**
Co-financing value of the memberships	Y1: **EUR** 500 000
Self-sustaining nature of the cluster	> 60% after 5 years
Budget horizon	3 months
Income	See budget
Employee Retention	100%



Unit number:	1	**month started:**	0	**duration: (month)**	36	**total number of person months:**	90

Title:	Operational management of the innovator zones				
Partner:	**Y1**	**Y2**	**Y3**		
Person months:	29	31,5	29,5		
Subcontractor(s):					

Objectives and criteria

This task is the key emphasis of the cluster. The excellence of the cluster will largely depend on the outcome of this work package. Its tasks are targeted to the members operating at the highest engagement level, including knowledge centres where relevant: the valorisation package. The objective is to create a performant supply chain in each of the different innovator zones, taking into account the specific market and innovation dynamics in each of these zones. In the end, the aim is

- to create product suites that are demonstrated in a realistic close to the market environment
- to provide insights to all stakeholders on research, financial and regulatory needs

The budget of this workpackage is based on ½ FTE (6 person months) for each of the innovator zones

Tasks: description of methods, techniques, etc.

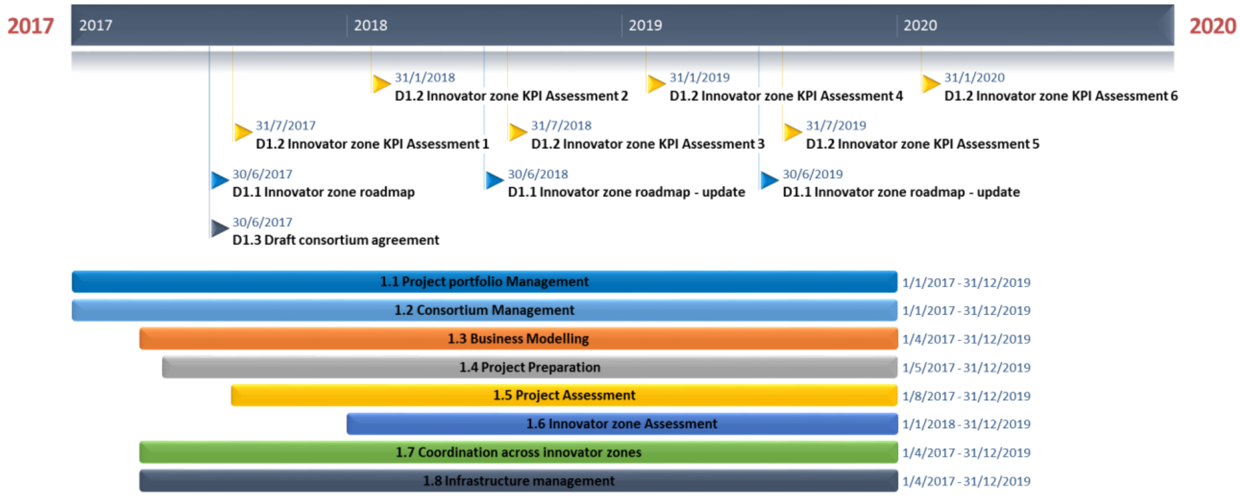
Task 1.1:	Roadmap, project portfolio management and business plan (15 mm) M1 - M36 Based on the overall business plan created in WP-1 , a roadmap for each of the innovator zones will be created and yearly reviewed by the organisations with engagement at valorisation level within the cluster. This exercise will be conducted in close cooperation with the relevant research and knowledge organisations in order to align the research roadmaps and fill gaps where necessary. For each of the projects inside the project portfolio, the business plan will be revised based on the new insights and the KPI's are adapted accordingly. This task is repeated at the end of each year for each of the five innovator zones and is expected to take a yearly effort of 1 mm in each of the innovator zones.
Task 1.2:	Consortium management (18 mm) M1 - M36 Each of the consortia in the innovator zones will be governed by a consortium agreement. In this task the consortium agreement is drafted and agreement is sought across all innovator zones. This also implies agreeing on policies for organisations entering or leaving the consortium. The generation of this consortium agreement template is expected to take 3 months with a deliverable after 6 months. This task also involves the creation of new balanced consortia when the need arises for new projects within the project portfolio or when new organisations propose projects to the cluster. This consortium building, being a core function within the cluster, is done through extensive communication and brainstorm sessions with the cluster members as well with external companies and universities (effort is 1 mm per innovator zone per year leading to on average two proposals a year). The outcome of this task is a two pager that can be evaluated in order to receive funding facilitating task 1.3 and 1.4
Task 1.3:	Business modelling (7.5 mm) M4 - M36 The cluster will assist each of the project proposals successful after task 1.2 with business modelling expertise in order to ensure proper valorisation potential of the projects. The business model will be created synchronous with project preparation task. The model will be based on the business model canvas methodology. Brainstorming meetings are foreseen which are facilitated by the cluster. On average, one such effort is foreseen yearly per innovator zone (10 md per project).
Task 1.4:	Project preparation (19.5 mm) M5 - M36 The cluster will assess the best financing options based on the needs of the innovator zone. These might include but are not limited to the cluster-specific resources, conventional VLAIO subsidy schemes, Interreg, Horizon 2020, cluster funding. Care will be taken to have a balanced funding portfolio, including international resources. The cluster will facilitate the proposal preparation as well as the link towards the funding and government authorities. The project preparation step will also involve an analysis on the needs for infrastructure

	and for regulatory frameworks. The necessary links will be made to the appropriate government instances in order to make them aware of these needs. On average, one such effort is foreseen yearly per innovator zone (26 md per project)
Task 1.5:	Project assessment (12 mm) M8 - M36 While the cluster will not be involved in the daily management of the projects, it will play an in important role in the assessment of the projects, both during selection as during operational phase. To such extent, the cluster will always be part of a user board in each of the projects. The cluster management will also agree on KPI's with each of the projects in order to provide global reporting. The task is budgeted to take 1.5 mm each year for the preparation and follow-up of the selection process as well as 0.5 mm per year per innovator zone in order to attend the user boards of the various projects.
Task 1.6:	Innovator zone assessment (3 mm) M13 - M36 All projects in an innovator zone will be consolidated into a general set of Key Performance Indicators. Yearly, an assessment in each of the innovator zones is conducted in order to ensure business potential within the innovator zone. Based on this assessment, innovator zones might be changed or stopped throughout the operational lifetime of the cluster. This task is performed at the end of each year.
Task 1.7:	Coordination across innovator zones (9 mm) M4 – M36 It is anticipated that general needs across all innovator zones might occur (e.g. data needs). In order to ensure efficiency, these needs will be coordinated across all projects. A bi-weekly meeting between all responsible for an innovator zone is set up in order to ensure this.
Task 1.8:	Management of access to cluster-specific resources and infrastructure (6 mm) M4 - M36 The cluster will be the unique portal to the cluster specific resources as well as to regions with less regulatory restrictions. The exact nature of this portal will be agreed with the governmental bodies responsible for these fields.

Expected results and deliverables

D1.1 Innovator zone roadmap	M6, M18, M30
D1.2 Innovator zone valorisation KPI assessment	M13, M19, M25, M31, M37
D1.3 Draft consortium agreement	M6

KPI	**Target value**
Project Generation Efficiency	4 months to grant
Manageability (consortium size)	5 consortium members on average
Two innovator zone specific KPI's	See innovator zone
Success rate proposals	80%
Consolidated planning	80% of milestones reached
Global investments in each innovator zone projects	EUR 10 million



Unit number:	2	month started:	0	duration: (month)	36	total number of person months:	91
Title:	Dissemination on the innovator zones						
Partner:	**Y1**	**Y2**	**Y3**				
Person months:	29	31	31				
Subcontractor(s):							

Objectives and criteria

This task is one of the key tasks in the cluster. Its tasks are targeted to all the members of the cluster as well as the broader audience of stakeholders. The objective is to create a performant dissemination platform, taking into account the specific market and innovation dynamics in each of these zones. In the end, the aim is

- to widely disseminate the outcome of the innovator zones
- to educate the workforce on the tendencies in the energy sector
- to organise one broad conference each year

The budget of this work package is based on ½ FTE (6 person months) for each of the innovator zones

Tasks: description of methods, techniques, etc.

Task 2.1:

Dissemination activities (37 mm) M3 – M36

For each of the innovator zones, a yearly dissemination plan will be created and integrated in the global communication plan of the cluster. Yearly, 4-6 sessions per innovator zone are envisaged, leading to an activity each two weeks. These sessions can consist of

- thematic sessions
- guided visits
- end user demonstrations
- international exchanges
- …

On average, two weeks of effort is planned for each of the dissemination activities, leading to 37 mm of effort in total.

Task 2.2:

Educational activities (12 mm) M6 – M36

Based on the existing concept of the Smart Grid Schools, two yearly education schools are planned targeted at company level. One session will be planned as an introductory course people new to the specific sector. The second session will be dedicated to a deepening of the understanding of experienced employees and will involve exchanges with international speakers.

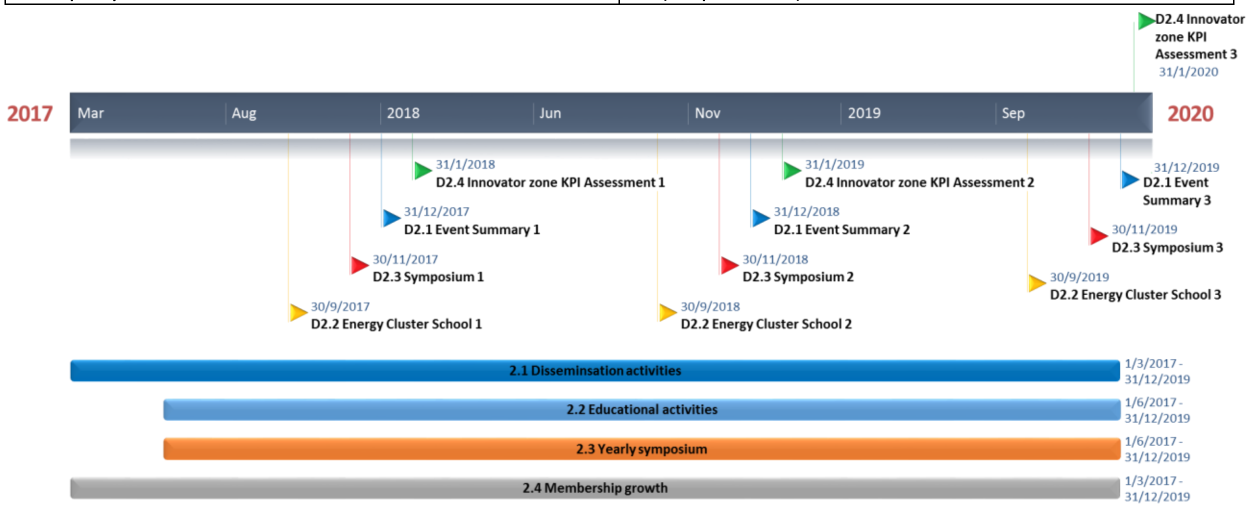
Based on experience with these kind of activities, two months of preparation is needed per school, leading to 12 mm of effort in total.

Task 2.3:	Yearly symposium (21 mm) M6 – M36 At the end of the year, a big international symposium will be organised bringing together business, research as well as managerial tracks over all the innovator zones. This event will mobilise the marketing department of all participating federations and research centres in order to attract a broad audience. In order to achieve an excellent international program, realise a close collaboration with all federations, research centres and universities, 7 mm of effort is scheduled for each symposium.
Task 2.4:	Membership growth (21 mm) M3 – M36 An important part of dissemination is handled by one to one company visits both at member and non-member companies. A target of 5 monthly company visits will be set to organisations not yet part of the cluster, as well as 5 companies already member of the cluster. Each member will be visited at least once each two years. Next to retention and growth of the cluster, a second aim to get feedback on the cluster performance and getting ideas for further enhancement of the services provided by the cluster. Based on historical data, 1,15 day per visit is counted for preparation, visit and after care, leading to 414 mandays or 24 man months.

Expected results and deliverables

D2.1: Event summary	M12, M24, M36
D2.2: Energy Cluster Schools	M9, M21, M33
D2.3: Symposium	M11, M23, M35
D2.4: Innovator zone dissemination KPI assessment	M13, M25, M37

KPI	**Target value**
Member Retention	100%
Member growth	See business plan
Customer satisfaction	9 (on a scale out of 10)
Company visits	60 (12 per zone)



Unit number:	**3**	**month started:**	1	**duration: (month)**	36	**total number of person months:**	90

Title:	Business creation				
Partner:	**Y1**	**Y2**	**Y3**		
Person months:	4	41,5	44,5		
Subcontractor(s):					

Objectives and criteria

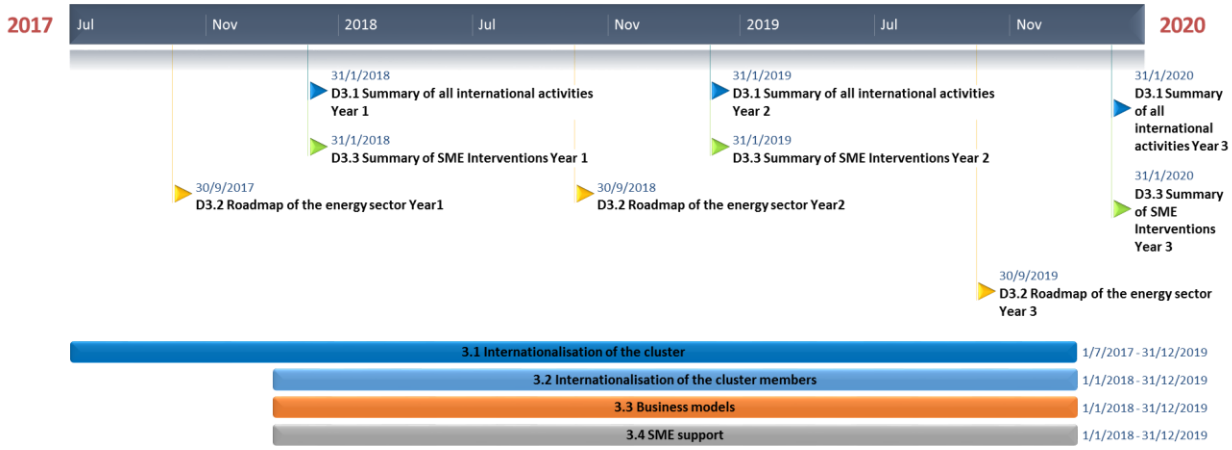
This task is one of the key tasks in the cluster. Its tasks are targeted towards specific sets of companies within

the clusters that are willing to engage up to the business service level. The objective is to enhance the internal valorisation potential within each of the companies taking part. Focus is on the output as well as ensuring appropriate processes are put into place into the organisations in order to ensure of the learnings during the support provided by the cluster are embedded into the organisation's behaviour. Where possible, links will be created to specialised accelerator or consulting initiatives already present. Care will also be taken to involve the financial and VC world into this work package. In the first year, the task on internationalisation of the cluster is expected to start as well as preparations on management level to start with tasks 2, 3 and 4. These two tasks are expected to become operational beginning of year 2 and from that moment each of the tasks will involve 1 FTE.	
Tasks: description of methods, techniques, etc.	
Task 3.1:	Internationalisation of the cluster: (18 mm) M7 – M36 Starting from year 1, care will be taken to embed the cluster in an international context. This task can result in several outcomes: • Partnerships with existing foreign clusters • Mutual engagement in funding proposals • Shared infrastructure programs • Engaging in the European smart specialisation program • Setting up branches abroad This task is scheduled to be involve 1/2 FTE starting the second half of the first operational year of the cluster.
Task 3.2:	Internationalisation of the cluster members: (24 mm) M13 – M36 Next to the internationalisation of the cluster itself, the internationalisation of the companies of the cluster is of prime importance. Internationalisation plays in two different fields • Internationalisation of the research In this task, the cluster will engage in steering the international programs towards the Flemish competences, together with the Flemish administration. The cluster will also represent the Flemish competences at different matchmaking events. A collaboration will also be set up with the National Contact Point Energy, where the cluster is open to host the National Contact Point. The intensity of this collaboration is subject to the negotiations of the Flemish Cluster Pact. • Internationalisation of the valorisation In close collaboration with FIT (Flanders Investment and Trade), a yearly overview of the competences of the members will be created and distributed internationally. The cluster will be part of international missions of the government and will support group booths at international fairs and exhibitions. The cluster will also act as a knowledge platform on the competences of the Flemish Energy industry for the Flemish administration services related to internationalisation both in Flanders as abroad. The intensity of the collaboration with FIT is subject to the negotiations of the Flemish Cluster Pact. This task is scheduled to be performed by 1 FTE starting the second operational year of the cluster.
Task 3.3:	Business models: (24 mm) M13 – M36 Disruptive innovation involves a dramatic change in business models, often thinking out of the box. The objective of this work package is to assist companies creating innovative business models in the energy sector. Collaboration will be started with business schools such as Vlerick Business School who already have a lasting experience in this area (e.g. the European project STORY, the Interreg project GREAT, …). This task will also run in cooperation with Living Tomorrow, one of the organisations

<table>
<tr><td></td><td>behind the cluster. Living Tomorrow has built up considerable experience with this topic. They develop new ideas for the future together with partners in so-called visionary groups. Existing groups are:
• Health & Care
• Smart Cities
• Sport
• Retail
• Agriculture and food
• Internet of Things

This task is scheduled to be performed by 1 FTE starting the second operational year of the cluster.</td></tr>
<tr><td>Task 3.4:</td><td><u>SME support: (24 mm) M13 – M36</u>
Special care will be taken on the integration of SME’s into the innovation and valorisation chain of the cluster. In each of the innovator zones, a SME dedicated event will be launched in order to enhance the innovation readiness of SME’s. The exact nature of each event will depend on the specifics of the innovator zone.
A lot of (public as well as private) accelerators and investors already exist in Flanders, often with a broad sectoral scope. Often they lack the expertise on the specifics in the Energy platform. The cluster will seek active collaboration with these actors and present themselves as the expert when it comes to energy related matters and business models. An attempt will be made to bring all stakeholders together in a larger fair (e.g. at the yearly symposium of task 2.3). This activity is scheduled to involve 1/2 FTE starting the second operational year of the cluster.
As a last step, each SME will be entitled to 5 days of free consultancy in one of the innovation or valorisation processes of the company, with an emphasis on Business Process Engineering rather than on the factual outcome. Of course the activities need to be in line with the core ambition of the Innovator Zones. It is the goal to assist each year 10 SME’s with this support. In total an effort of 10 days per company is calculated for these activities (1/2 FTE)</td></tr>
<tr><td colspan="2">Expected results and deliverables
D3.1 Summary of all international activities M13, M25, M37
D3.2 Strategic business roadmap for the energy sector M21, M33
D3.3 Summary of SME interventions M25, M37</td></tr>
</table>

KPI	**Target value**
Projects with international partners	5
Number of participants in a visionary group on energy	40
Number of dedicated projects with SME's	12
Partnerships with international clusters	5



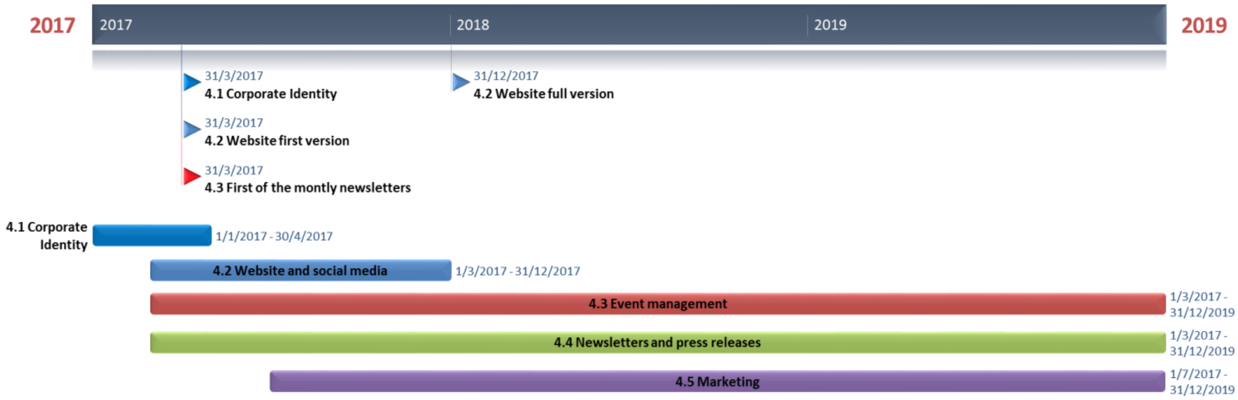
Unit number:	4	**month started:**	1	**duration: (month)**	36	**total number of person months:**	47,5
Title:	Event management, marketing and member management						
Partner:	**Y1**	**Y2**	**Y3**				
Person months:	16,5	15,5	15,5				
Subcontractor(s): Copywriting (to be defined)							
Objectives and criteria The objective of this work package to create brand name around the energy cluster. This brand name is necessary to ensure member growth as well as international recognition. A second objective of this work package is to handle all event management from an organisational point of view.							
Tasks: description of methods, techniques, etc.							
Task 4.1:	<u>Corporate Identity (4 mm) M1 – M4</u> Since the cluster is a new organisation, a logo, letterhead, wallpaper, banner … needs to be created. The results will be consolidated in a handbook specifying the use of the marketing material. This task is scheduled to take 4 months at the start of the cluster.						
Task 4.2:	<u>Website and social media (6 mm) M3 – M12</u> The corporate identity will be carried through in the website of the cluster. Weekly, updates will be made to the website indicating new events, news, … In order to reach a broad audience, use will also be made of linked in, twitter, whatsapp for communicating events. The website will also play an important role in the internal processes of the cluster. A private section will be established with a customer relationship management tool as well as a project collaboration tool to be used in each of the innovator zones. This task is scheduled to take 6 months during the first year of the cluster						
Task 4.3:	<u>Event Management (18 mm) M3 – M36</u> This task will deal with all the organisational matters of events such as invitations, registrations, room booking, catering, … The content of the events (programs, speakers, …) is dealt with in other tasks. Performant processes will be put in place in order to handle these activities as efficient as possible. The logistics of the symposium is however left out of this task and is a part of task 2.3. In total 27 events are scheduled each year (25 topical events + 2 schools) with on average a week of preparation/follow-up, …, leading to ½ FTE for three years						
Task 4.4:	<u>Newsletters and press releases (6 mm) M3 – M36</u> Communication towards the members will also be done through monthly newsletters, providing details on success cases, upcoming events, member stories, … Historically, an effort of 1/2 week is spent for the management of each newsletter (layout/ sending /						

	maintaining distribution list, …) (4,5 mm over the three years). When applicable, press releases will be sent out in order to seek for media coverage for the cluster as well as for the energy sector (1,5 mm). In order to ensure a high quality of these newsletters and press releases, collaboration will be sought with a professional copywriter specialised in the energy scene.
Task 4.5:	<u>Marketing (13,5 mm) M7 – M36</u> In order to get internationally recognised, the marketing of the cluster brand is an important aspect. Care will be taken in order to brand the cluster national as well as internationally as a vital and central point. Marketing efforts are continuously undertaken staring the moment the corporate identity is fixed and 1/3 FTE per year is foreseen for these activities.

Expected results and deliverables

D4.1 Corporate identity	M3
D4.2 Website	M3, M12
D4.3 Newsletters	M3 – M36 Monthly

KPI	**Target value**
Number of newsletters	12
Updates to the website	At least weekly



Staff Planning

		Y1						Y2						Y3						Y1+Y2+Y3
		Director	Innovator zone leader	Facilitator	Event Manager	Assistant	Total	Director	Innovator zone leader	Facilitator	Event Manager	Assistant	Total	Director	Innovator zone leader	Facilitator	Event Manager	Assistant	Total	Total
0.1	Start-up of the cluster	2.0				2.0	4.0						0.0						0.0	4
0.2	General Management	4.0				1.0	5.0	4.0				1.0	5.0	4.0				1.0	5.0	15
0.3	Governance activities	1.0					1.0	1.0					1.0	1.0					1.0	3
0.4	Financial reporting	1.0				0.5	1.5	1.0				0.5	1.5	1.0				0.5	1.5	4.5
0.5	KPI assessment	1.0					1.0	1.0					1.0	1.0					1.0	3
0.6	Human Resources	1.0				1.0	2.0	1.0				1.0	2.0	0.0				1.0	1.0	5
0.7	IP Management	2.0	1.0				3.0	1.0	1.0				2.0	1.0	1.0				2.0	7
1.1	Roadmap, project portfolio management and business plan		5.0				5.0		5.0				5.0		5.0				5.0	15
1.2	Consortium management		8.0				8.0		6.0				6.0		4.0				4.0	18
1.3	Business modelling		2.5				2.5		2.5				2.5		2.5				2.5	7.5
1.4	Project preparation		4.5				4.5		7.5				7.5		7.5				7.5	19.5
1.5	Project assessment		3.0				3.0		4.5				4.5		4.5				4.5	12
1.6	Innovator zone assessment		1.0				1.0		1.0				1.0		1.0				1.0	3
1.7	Coordination across innovator zones		3.0				3.0		3.0				3.0		3.0				3.0	9
1.8	Management of access to cluster-specific resources and infrastructure		2.0				2.0		2.0				2.0		2.0				2.0	6
2.1	Dissemination of activities		11.0			1.0	12.0		11.0			1.5	12.5		11.0			1.5	12.5	37
2.2	Educational activities		3.0			1.0	4.0		3.0			1.0	4.0		3.0			1.0	4.0	12
2.3	Yearly symposiun		5.0			1.0	6.0		5.0		1.0	1.5	7.5		5.0		1.0	1.5	7.5	21
2.4	Membership growth		6.0			1.0	7.0		6.0			1.0	7.0		6.0			1.0	7.0	21
3.1	Internationalisation of the cluster		4.0				4.0	3.0	2.5				5.5	4.0	4.5				8.5	18
3.2	Internationalisation of the cluster members						0.0			12.0			12.0			12.0			12.0	24
3.3	Business models						0.0			12.0			12.0			12.0			12.0	24
3.4	SME's						0.0			12.0			12.0			12.0			12.0	24
4.1	Corporate Identity				3.0	1.0	4.0						0.0						0.0	4
4.2	Website and social media				5.0	1.0	6.0						0.0						0.0	6
4.3	Event management				3.0		3.0				5.5	2.0	7.5				5.5	2.0	7.5	18
4.4	Newsletter and press releases		1.0			1.0	2.0				1.0	1.0	2.0				1.0	1.0	2.0	6
4.5	Marketing				1.0	0.5	1.5				4.5	1.5	6.0				4.5	1.5	6.0	13.5
	Total	12.0	60.0	0.0	12.0	12.0	96.0	12.0	60.0	36.0	12.0	12.0	132.0	12.0	60.0	36.0	12.0	12.0	132.0	360

Table 13 Staff Planning table

month	deliverable	description
M2	D0.3	Governance framework
M3	D4.1	Corporate Identity
M4	D4.2	Website
M4	D4.3	First Newsletter
M6	D0.4	IP Framework
	D1.1	Innovator zone roadmap 1
	D1.3	Draft consortium agreement
M7	D0.1	Financial Report 1
	D0.2	KPI Assessment table 1
M9	D2.2	Energy Cluster Schools 1
M11	D2.3	Symposium 1
M12	D2.1	Event Summary 1
	D4.2	Website
M13	D0.1	Financial Report 2
	D0.2	KPI Assessment table 2
	D1.2	Innovator zone valorisation KPI assessment 1
	D2.4	Dissemination KPI Assessment 1
	D3.1	Summary of all international activities 1
M18	D1.1	Innovator zone roadmap 2
M19	D0.1	Financial Report 3
	D0.2	KPI Assessment table 3
M21	D2.2	Energy Cluster Schools 2
	D3.2	Roadmap of Energy sector 1
M23	D2.3	Symposium 2
M24	D2.1	Event Summary 2
M25	D0.1	Financial Report 4
	D0.2	KPI Assessment table 4
	D1.2	Innovator zone valorisation KPI assessment 2
	D2.4	Dissemination KPI Assessment 2
	D3.1	Summary of all international activities 2
	D3.3	Summary of SME interventions 1
M30	D1.1	Innovator zone roadmap 3
M31	D0.1	Financial Report 5
	D0.2	KPI Assessment table 5
	D1.2	Innovator zone valorisation KPI assessment 3
M33	D2.2	Energy Cluster Schools 3
	D3.2	Roadmap of Energy sector 2
M35	D2.3	Symposium 3
M36	D2.1	Event Summary 3
M37	D0.1	Financial Report 6
	D0.2	KPI Assessment table 6

	D1.2	Innovator zone valorisation KPI assessment 4
	D2.4	Dissemination KPI Assessment 3
	D3.1	Summary of all international activities 3
	D3.3	Summary of SME interventions 2

Table 14 deliverables list

Task Overview

Task		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
0.1	Start-up of the cluster												
0.2	General Management												
0.3	Governance activities	d0.3											
0.4	Financial reporting			d0.1		d0.1		d0.1		d0.1		d0.1	d0.1
0.5	KPI assessment			d0.2		d0.2		d0.2		d0.2		d0.2	d0.2
0.6	Human Resources												
0.7	IP Management		d0.4										
1.1	Roadmap, project portfolio management and business plan		d1.1				d1.1				d1.1		
1.2	Consortium management												
1.3	Business modelling		d1.3										
1.4	Project preparation												
1.5	Project assessment												
1.6	Innovator zone assessment					d1.2		d1.2		d1.2		d1.2	d1.2
1.7	Coordination across innovator zones												
1.8	Management of access to cluster-specific resources and infrastructure												
2.1	Dissemination of activities				d2.1	d2.4			d2.1	d2.4			d2.1
2.2	Educational activities			d2.2				d2.2				d2.2	
2.3	Yearly symposiun				d2.3				d2.3				d2.3
2.4	Membership growth												
3.1	Internationalisation of the cluster					d3.1				d3.1			d3.1
3.2	Internationalisation of the cluster members												
3.3	Business models							d3.2				d3.2	
3.4	SME's									d3.3			d3.3
4.1	Corporate Identity	d4.1											
4.2	Website and social media		d4.2		d4.2								
4.3	Event management												
4.4	Newsletter and press releases		d4.3										
4.5	Marketing												

Table 15 task overview schedule

- **<u>On impact and KPI's</u>**

This section is based on chapter 5 of the 'Let's make a perfect cluster policy and cluster program' paper as well as on the IWT observatorium nr 79: "impact analysis of light structures. Monitoring and evaluation of clusters is indeed important yet not straightforward. " What is presented beneath is a basis for further development throughout the life cycle of the cluster. It is evident that KPI's which are relevant in the first years of the cluster lifetime become less important when the cluster and its's programs mature. The set of KPI's will therefore be subject to a yearly review, together with the programs and services running inside the cluster. Due to the strategic nature and the importance of this review, the procedure will be governed by the highest decision body of the cluster, the board of directors.

It is a continuous search for balance between the interest in obtaining cluster related information with keeping the burdens of data collection for the cluster organization deriving from the participation in monitoring and evaluation as low as possible. The figure beneath provides an overview of the key focus areas of the perfect league of the various evaluation concepts. The focus area consists of four types of key performance indicators which either have an impact om the cluster organization, cluster actors or society as a whole.

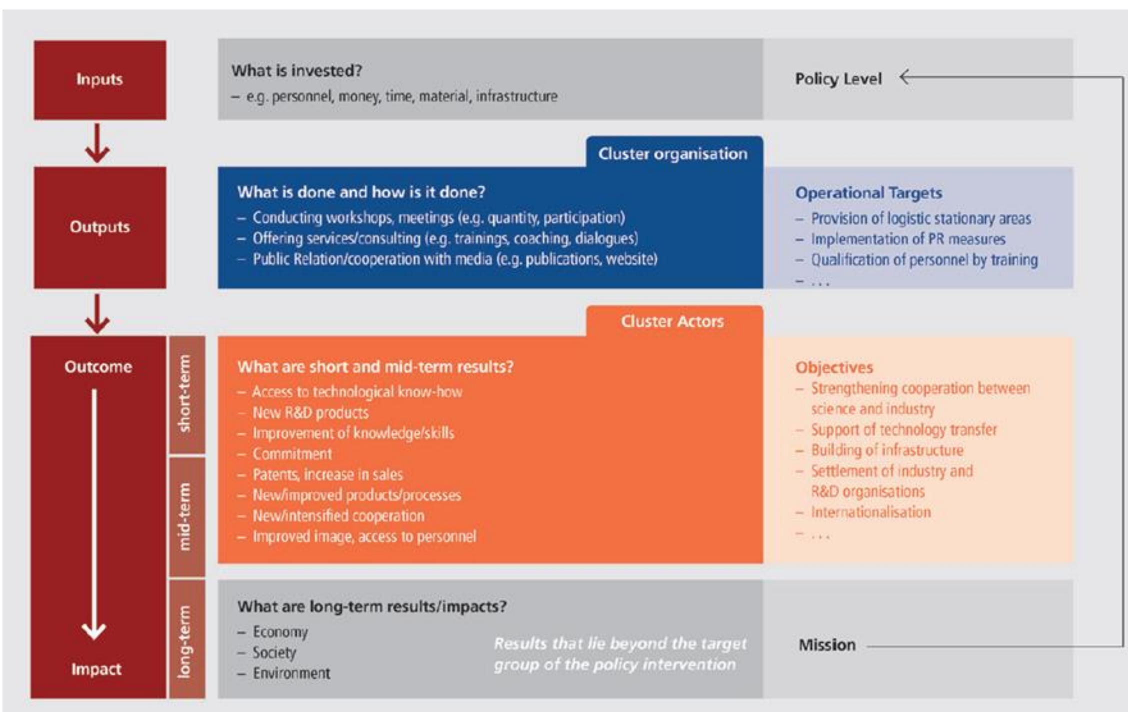


Figure 29 : key focus areas of the perfect league of the various evaluation concepts

These four types of indicators can be described by the key performance indicator for inputs, outputs, outcome and impact. The figure states the interrelationship between inputs, outputs, outcome and impact as well as their relationship to cluster organizations, cluster actors and society. A perfect strategy for monitoring, benchmarking and evaluation of clusters and cluster policies addresses each of these levels which are further developed below.

Based on international best practice, a “perfect cluster evaluation league of benchmarking, monitoring and impact analyses” consists of the following three levels which characterize the evaluation needs of clusters and cluster managers, program owners and policy makers:

1. Benchmarking and performance statistics of cluster organizations (key performance indicators focus typically on input and output)
2. Cluster program evaluation and performance statistics of cluster actors (key performance indicators focus typically on outcome)
3. Impact assessment and analyses of cluster policies (key performance indicators focus on impact)

The focus for cluster organizations itself is typically on inputs and outputs for the cluster organization, and especially the first years the proposed KPI’s will mainly be on these for three reasons:

- The outcome and impact will only start to become visible after at least three years of operation and clear effects are only expected after five years
- Performing objective outcome and Impact measurements is a difficult task which requires resources which are out of the scope of the cluster organisation and require the involvement of objective partners external to the cluster organisation.
- Experience shows that using KPI’s as a measure used to evaluate people or organisations rather than continuous improvement tends to corrupt the data, especially when the data leaves room for interpretation. This fuzziness of data is typically higher for outcome and impact KPI’s which often leave room for ample discussion.

For each of the innovator zones, a set of outcome KPI’s have been defined. These will be refined and evaluated after three years of operation of the cluster.

Benchmarking

In contrast to evaluations and economic impact assessments, benchmarking is recognised as an efficient and effective way to identify the potential of a cluster and its cluster management organisation and to develop strategic recommendations for its further development within a short time frame.

The objective of benchmarking is to learn from better performing peers or other entities in order to improve one's own structures, processes, products and services. We propose to undergo each two years a benchmarking, based on the methodology developed by VDI/VDE-IT as used in a wide range of projects, including the NGPExcellence project and the European Cluster Excellence Initiative.
This benchmarking focuses on the cluster's management organisation that is responsible for managing the cluster and its activities, and on the community of the cluster actors. Economics or other effects of the cluster on entire industrial sectors or the development of regional strengths cannot be reliably measured through benchmarking and are therefore not part of the analysis. The VDI/VDE-IT framework covers 36 indicators that analyse the cluster and the cluster management organisation with regard to six dimensions:

- The structure of the cluster
- The governance and strategy of the cluster
- The financing of the cluster's management organisation,
- Services provided by the cluster's management organisation,
- Contacts and the interaction with relevant players
- Achievement and international recognition.

Data is collected through a personal interview of two to three hours with the manager of the cluster organisation. The data is compared to a portfolio of at least 180 clusters from different European countries. The results of the analysis will allow to draw a detailed picture of the cluster as compared to its peers.

Based on the findings, recommendations for further action to improve the performance of the cluster's management organisation will be implemented.
Based on above observations, the table underneath is proposed as KPI's.

PLAN & DO		Check					Act	
Specific		Measurable		Accurate		Relevant	Timely	
Name Metric	**Category**	**Definition**	**Measurement system**	**Target**	**Goal**	**Expectation stakeholders**	**Frequency**	**Forum**
Self-sustaining	Financial	Percentage Flemish subsidies / own income	Cash flow planning	ST: 40% LT: 15 % (similar to comcl. companies)	< 40% 40% - 50% >50%	To become an autonomous organisation	Quarterly	Board of Directors
Budget horizon	Financial	Free Cash Flow/ mean monthly expenses	Cash flow planning	3 months	> 6 2 - 6 < 2	Continuity	Monthly	Management
Income	Financial	Income	Cash flow planning	see budget	see budget	Continuity	Monthly	Management
Member retention	Members	Percentage members renewing membership	Member database	100%	> 95% 85% - 95% < 85%	Remain relevant for target audience	Yearly	Management
Member growth	Members	Total amount of members	Member database	see budget	see budget	Remain relevant for target audience	Yearly	Management
Customer Satisfaction	Members	Customer Survey after each event	Surveys	9	> 8 6 - 7 < 6	Quality	Monthly	Management
Company Visits	Members	Number of potential members visited	CRM	50	>50 40 - 49 <40	Cluster Growth	Monthly	Management
Efficiency	Members	Time to Grant	Project proposals	3 months	< 4 4-5 >5	Organisational efficiency	Quarterly	Board of Directors
Manageability	Members	Mean size of project consortium	Project proposals	5	5-6 4,7 <4 , >7	Manageability consortia	Quarterly	Management
Internationalisation	Members	Project with international partners	Project database	5	5 3-4 <3	International market opportunities	Monthly	Board of Directors

SME	Business	Number of dedicated projects with SME's	Project database	12	>12 6-11 <6	Specific nature of SME's	Monthly	Management
Business Models	Business	Number of participants in a visionary group on energy	Member database of visionary group	25	>25 15-24 <15	Remain relevant for target audience	Yearly	Board of Directors
Planning	Internal management	Percentage milestones reached	Consolidated project planning	100%	> 95% 85% - 95% < 85%	Organisational efficiency	Monthly	Management
Success rate Project proposals	Internal management	Granted projects / project proposals	Project database	100%	> 80% 50 - 80 % <50%	Return on Investment	Quarterly	Management
Employee Retention	Growth and development	Percentage of employees leaving the company	Employee register	0%	0% 1-15% >15%	Continuity	Quarterly	Management
Partnerships	Growth and development	Number of partnerships with international clusters	Website	5	5 3-4 <3	International embedding and cooperation	Quarterly	Board of Directors

Table 16 KPI list

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Chapter 8: Financial Plan

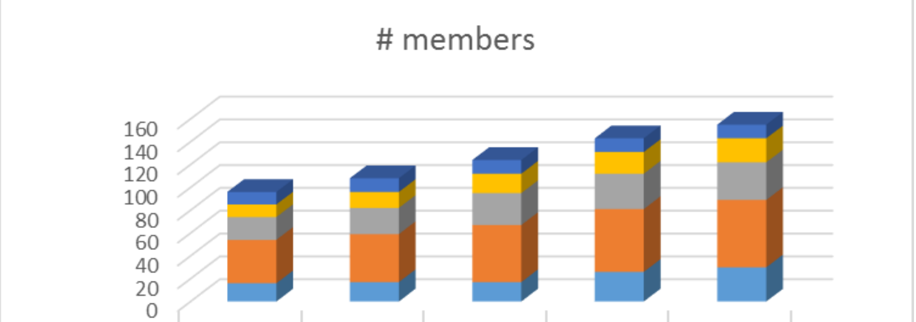
The financial plan of the Energy Cluster can be found below. The plan only applies to the cluster organisation itself and does not include any project financing.

Income

As a membership organization, it is evident that the bulk of the income originates from membership fees. In accordance with the service segmentation, the membership fee is also differentiated.

		Micro	KO	MO	GO	Other
	Network Package	750	1500	2750	5500	1500
	Business Package	1500	3000	5000	8500	2000
	Valorisation Package	5000	10000	15000	25000	2500 + 0,5 FTE

It is the ambition of the Energy Cluster to grow over the next 5 years from 96 to 155 members (Figure 30). The actual number of members of Smart Grids Flanders amount up to 86, so given the broader focus of the cluster, the number of memberships is conservative. It is also expected that during the first two years some reluctance and scepticism can exist amongst potential members. With appropriate results, this audience can be addressed in order to grow the number of members.



	Y1	Y2	Y3	Y4	Y5
Other	11	12	12	12	12
GO	11	14	17	19	21
MO	20	23	28	31	33
KO	38	42	50	55	59
Micro	16	17	17	26	30

Figure 30 energy cluster member evolution over 5 years

Next to memberships, income is further provided by a number of smaller income streams from contributions for events, and after one year from other, mainly international project finance such as the EFRO program. It is expected that these revenue streams will not exceed 20% of total revenues.

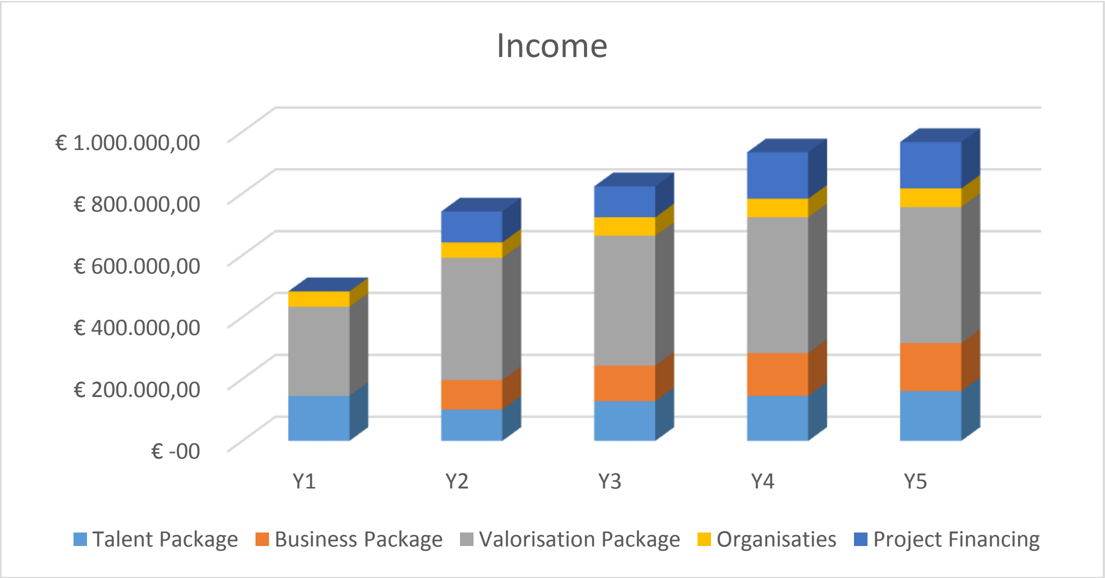


Figure 31 income Energy cluster over 5 years

Expenses

The energy Cluster will be built around the innovator zones. The initial employment of 8 people will expand after one year to eleven people. It is expected that a number of these employees will also be financed from funds outside the cluster financing.

Because the innovator zones form the backbone of the organisation, the initial focus is on their operationalization. Each innovator zone has a dedicated coordinator with significant affinity with the specific technological and market challenges. This person acts as a mediator between the various parties.

Here, these five coordinators rely on a person who is in charge of organizing the events, as well as on general administration. The organisation is overseen by a managing director who is responsible for the deployment and management of the Energy Cluster, and forms the link with the government and other stakeholders.

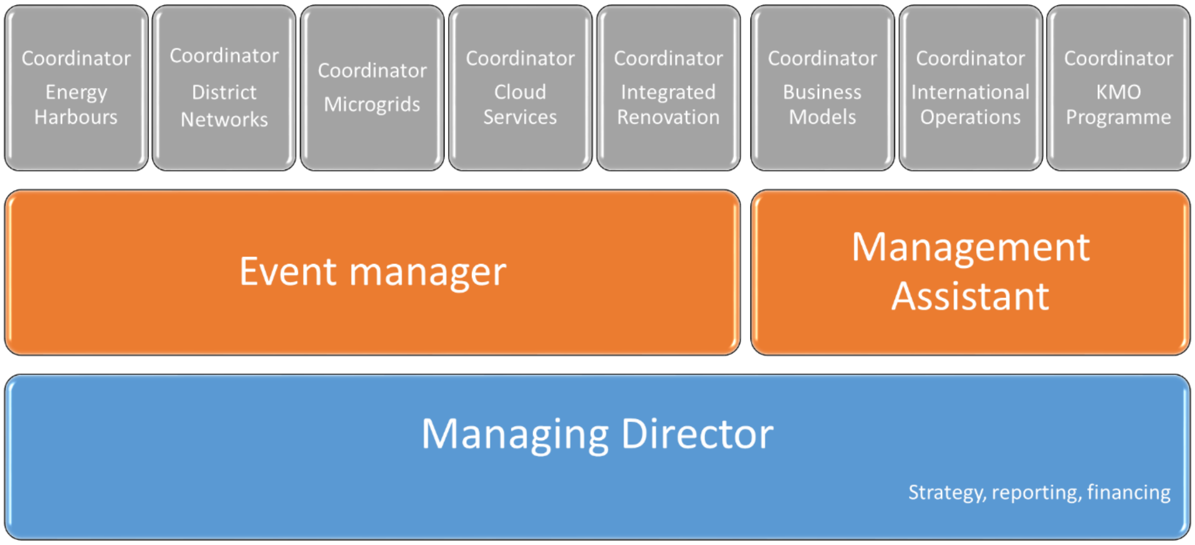


Figure 32: organizational chart of the energy cluster

In order to e.g. align the research roadmaps with the activities within the cluster, to interact on the level of testing infrastructures, to give input on the innovator zone strategies, to provide input on dissemination sessions, each research institution also provides 1/2 FTE. Likewise, the industry provides ¼ FTE in each innovator zone, taking care of the overall coordination of these sessions.

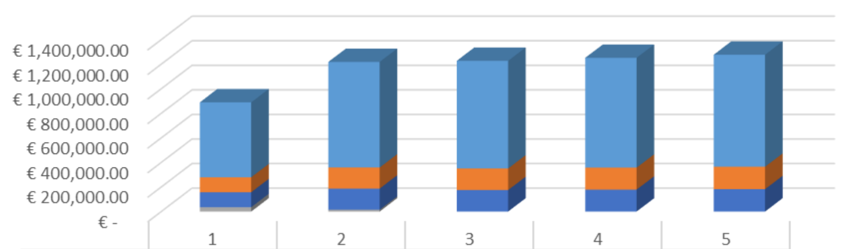
The operationalization of the innovator zones, launching the first projects in each of them and assuring the correct processes are in place is expected to take a year. After this first year, the "business package" will be started up. For this, three additional people are hired which, in consultation with the project coordinators, perform targeted actions aimed specifically at SMEs, business models and internationalization.

As confirmed by the Board of Directors and General Assembly of Smart Grids Flanders and agreed by the other organisations, the Energy Cluster will be set up as an extension to Smart Grids Flanders. The objectives, as described in this proposal are already largely incorporated in the statutes. These should be mainly adjusted to broaden the audience of the smart grid to the entire energy sector. The Executive Board and other governing bodies will be adjusted accordingly after the start of the cluster.

The wage expenditure is based on an annual total salary cost of EUR 80 000 per FTE, which corresponds to an average gross monthly salary of EUR 4100. These are indexed annually to 2%. Indirect costs are calculated in accordance with the AIO rules (20%). The direct costs are estimated at 20% of the personnel costs. These costs consist mainly of organizational and marketing costs.

The quality of the people hired by the cluster is essential for the success of it, so in order to create a balanced team, support will be hired from companies with experience and skills in balanced tam building. Their advice will also be reflected in personal development plans. For these reasons, an additional start-up budget of EUR 50.000 is foreseen spread over the first two years, mainly for legal advice, hiring support, ...

A summary of this budget in the format provided by VLAIO is attached to this proposal as Annex 8 and is summarised in the figure below.



	1	2	3	4	5
Wages	€ 610,000.00	€ 859,308.00	€ 876,494.00	€ 894,023.88	€ 911,904.36
Indirect costs	€ 122,000.00	€ 171,861.60	€ 175,298.80	€ 178,804.78	€ 182,380.87
Direct costs	€ 122,000.00	€ 171,861.60	€ 175,298.80	€ 178,804.78	€ 182,380.87
Startup costs	€ 35,000.00	€ 15,000.00			

Figure 33 : expenses Energy cluster over 5 years

Financing needs

The above analysis shows a financing need over the next five years. This indeed is a stepup in the maturity of the cluster, growing from a pure network organisation into a full developed cluster. It presents an investment in the development of an efficient corporate network. The financing need ranges between EUR 400.000 and 450.000. In order to build a financial buffer of a half year cash flow is the intention to claim an allowance of EUR 500.000 in order to ensure the long term continuity of the Energy Cluster.

The aim is to continuously increase the self-financing rate from 53 to 70% over the first five years. During the second period of 5 years the focus will be on further increasing the self-financing degree in order to reach a state in which the cluster organisation is self-sustainable.

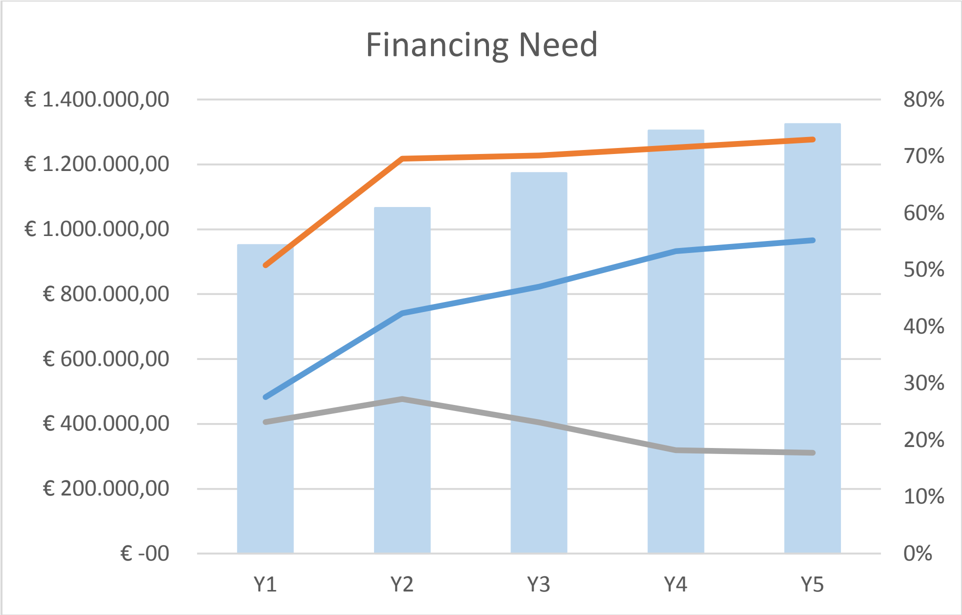


Figure 34 : financing needs Energy cluster over 5 years

Annex 1 :
companies engaged in the Flemish Energy Cluster – and target companies

Contents

By September 25, 2016 71 organizations, among which 60 companies, had already signed a Letter of Intent, engaging themselves in the Flemish Energy Cluster by signing in for either the Talent Package, Business or Valorisation package.

The companies are :

42RA	Enervalis	Matthys & Partners	Trilations
ABB	Engie	Metes	Triphase
Accenture	Ennovation	Methis Consulting	Veolia
Actility	EREA Energy	Milvus	Volta
Affluent Energy	ESAS	Niko	YouknowWatt
Alfen	Ferranti	Port of Antwerp	BEPowered
CG Holding	Fifthplay	Port of Ghent	Option
CGI	GE	Proximus	Energieconcepten
CNRood	Group Energy	ReSTore	The Appel Tree
Condugo	IncubaTHor	Robert Bosch	Tovaro
DuCoop	Infrax	SG1 Services	bvba Vermeulen
E. Van Wingen	iScencia	Siemens	Windfire
E20	Iskraemeco	Sweco	Electragral
Eandis	Living Tomorrow	ThinkE	Kritayuga
Enera	Loginco	Toreon	AE
Lampiris (in prep.)			

Other Organizations supporting the cluster are :

Agoria
EnergyVille
Iminds
Passiefhuisplatform/Pixii
Thomas More
UCLL
Universiteit Gent
Vlaamse Confederatie bouw
Voka
WTCB

Together, they represent a good mix over all the company sizes and engagement levels as can be seen in the following table.

	Micro		Small		Medium		Large		Other		Total	
	#	Value	#	Value	#	Value	#	Value	#	Value	#	
Business	2	€ 3 000,00	2	€ 6 000,00	1	€ 5 000,00	1	€ 8 500,00			6	€ 22 500,00
Talent	11	€ 8 250,00	8	€ 12 000,00	1	€ 2 750,00	6	€ 28 500,00	2	€ 4 000,00	28	€ 55 500,00
Valorisation	11	€ 55 000,00	7	€ 70 000,00	4	€ 60 000,00	7	€ 175 000,00	8	€ 19 500,00	37	€ 379 500,00
Total	**24**	**€ 66 250,00**	**17**	**€ 88 000,00**	**6**	**€ 67 750,00**	**14**	**€ 212 000,00**	**10**	**€ 23 500,00**	**71**	**€ 457 500,00**

Once the Cluster becomes operational, more companies are expected to join. The Cluster will also actively reach out to the following, non-exhaustive list of target companies per innovator zone and from a specific segment of the previously identified value chains.

1. Companies of the value chain of Energy Harbors (Ch 4.2.1)

Type	Name	Rolee
Harbor authorities, cities	Haven Gent, Stad Gent, Haven Antwerpen, Stad Antwerpen, Haven Oostende, Haven Zeebrugge	the role of the harbor authorities is generally described with the 5^E model (Exemplify, Enable, Encourage, Engage and Enforce).
Technology companies	BEP Europe (E-rational), Vanwingen, ABC, Xant, ATS, ABB, Hyrdogenics, PowerPulse, Atlas Copco,…	Technology companies provide essential technology to be tested and demonstrated within the framework of the cluster and which subsequently is made ready for international markets. Several suppliers of technological solutions should be involved : electrics,

		cogeneration, heat/cold, storage, …
Logistic companies & shipping companies	Sea Invest, natie-companies, CMB, ,…	Logistic companies are active in handling and storage of goods. They deliver the transportation services and means.
Energy consumers and producers :	Stora Enso, Arcellor Mittal, ENGIE, Eneco, EDF, BASF, Solvay, Ineos, Lanxess, Borealis, Indaver, windproducenten…	Energy consumers and –producers active specifically in the harbor and its immediate surroundings are natural partners in this, although energy-efficiency is not really their core business.
Consultancy companies + aggregators	Ingenium, Arcadis, Royal Haskonig, DNV + nieuwe aggregatoren	Consultancy companies are crucial partners in translating the opportunities into concrete business cases.
Grid operators	EANDIS, Infrax, ELIA, Fluxys	These players are important in the realization of demonstration projects, in the set-up of surroundings with few regulations, in the subsequent funneling of the products to market. The concepts should be on the same track as any future regulatory framework for the grid.

2. Companies of the value chain of Microgrids (Ch 4.2.2)

WKK	**GENSETS**	**Renewables**	**Storage**	**Integral solutions**	**Study work**

SDM projects Vapotech Continental Energy Systems Van Wingen 4Energy Ham ACV Ruisbroek Viesmann	Van Wingen Europower abc diesel Gent Eurodiesel SDMO België Hunter nv Bobindus nv Horsepower europe Cummins SMO	Intellisol Enfinity IZEN energy-systems Ikaros Xant Wase wind Colruyt Basf	Trineuron Ysebaert Antwerpen Hoppecke Enersys Studer Bluegen	Siemens ABB Schneider electric Perpeteum Engie SMA CG Power GE-Alstom ATS SPIE	Encon Tracte-bel

3. Companies of the value chain of Multi-Energy solutions for districts and business parks (Ch 4.2.3)

Type	Name	Role
Technology companies	fifthplay, CSC, Ferranti, Grontmij, Miele, BSH, Phoenix Contact, Simac, Telenet, Viessmann, Daikin, Encon, ABN, 3E, Vanparijs Engineering, Imtech, Priva, Johnson Controle, Laborelec, ACV, GlenDimplex, Atlas Copco, Van Marcke	They deliver the electrical and thermal components of the energy system, the monitoring and control systems, all able to communicate optimally with each other and interact with other components.
System integratoren	Siemens, ABB, General Electric, Schneider, Cofely Fabricom, DEME, Alstom	They deliver integral system solutions
Energy suppliers	Engie, EDF Luminus, Lampiris, ENI, RWE,	Expanding their services and invest in local products.

	Eneco, EcoPower, Aspiravi	
Project developers, (social) housing companies, designers and architects, interregional and intercommunal cooperatives	Ertzberg, Cordium, Zonnige Kempen, Re-Vive, Goedkope Woning, Tondelier Development, Matexi, Grontmij, Leiedal, IGEMO, Studiebureau Boydens, Ingenium	Project design and execution, setting the criteria and the building specifications.
ESCOs and aggregators	Actility, Restore, Enervalis	Existing aggregators and new companies setting up ESCOs. They manage the energy hub.
Grid operators	EANDIS, Infrax	These players are important in the realization of the demonstration projects, also in the case of areas with few regulations (regelluwe zones).
Cities and municipalities	Flemish centre cities	Participation in PPP and concessionairs of large district developments

4. Companies of the value chain of Energy cloud platforms (Ch 4.2.4)

Type	Name	Role
Automatisation of buildings, energy grids and industry	NIKO, DUCO,	Marketing Smart building control systems which play an important role in personal comfort, a healthy indoor climate and energy savings.
Energy suppliers	Engie, EDF Luminus, Lampiris, ENI, RWE, Eneco, EcoPower, Aspiravi	Expanding their services with real time energy supply based on data from sensors throughout the building.
IoT and data platform providers	Codit, AllThingsTalk, iXorTalk, Ordina, …	Expanding of the IoT platforms with building specific protocols, data formats and easy to handle machine learning components.
Communication Network Providers	Telenet, Belgacom, Engie (SigFox)	Grid coverage expansion to cheaper low power sensors connecting through new narrow-band

		technologies
Grid operators	EANDIS, Infrax, ELIA, Fluxys	Thers players are important in the realization of the demonstration projects, also in the case of areas with few regulations (regelluwe zones). The concepts should be on the same track as any future regulatory framework for the grid.

Atrias is a crucial player in this domain as a platform with the ambition of realizing a central clearing house for the Belgian energy market.

5. Companies of the value chain of Intelligent Renovations (Ch 4.2.5)

Type	Name	Role
Engineering and architects	Boydens, Qbus arch, Archi team, Poelmans, A2O, Think E, Cenergie	Design of integral renovation concepts.
Consultancy companies	Ingenium, Arcadis, Royal Haskonig, DNV,	Consultancy companies are crucial partners in translating the opportunities into concrete business cases.
Project developers	Bostoen, Matexi, Machiels Building Solutions	Large scale development of and investment in renovation projects, determine the level of energy ambition.
Technology companies	Technology Integrators : Alelek, Eelektromat, Domica,Bas Technology, Easy, Smart Building Controle Solar companies : Perpeteum, Carbomat, Intellisol, Enfinity,.. Home battery suppliers: Daimler, Hoppecke, Studer, Ysebaert, Trineurion, ABB, SMA, Tesla,Schneider electric, Enersys, Varta,... Thermal storage: Viessmann, Daikin,.. Home automation systems: Legrand, Niko, ABB, Qbus, Teletask,Siemens,	Technology companies deliver essential technology to the building sector, including the international market Technologies for residential use are : BIPV, DC grids and revertors, batteries, HVAC, domotics, heat storage, building components

	Domintell,…	
Renovatio contractors	Bostoen, Durabrik, Tpalm, Eribo	The contractor is the undertaker of the building project and has to apply any new technology available and they are in a good position to give feed back to the producers on the performance of the new products.
Energy consumers and producers	The building owner	Has to play an important role as forerunner when new products are put into market : they make the early adopter phase possible.
Grid operators	EANDIS, Infrax	These players are important in the realization of the demonstration projects, also in the case of areas with few regulations (regelluwe zones). The concepts should be on the same track as any future regulatory framework for the grid.
Local and regional policy	Vlaamse centrumsteden VREG	the role of the harbor authorities is generally described with the 5E model (Exemplify, Enable, Encourage, Engage and Enforce).
Production industry	BASF, Isover, Recticel, Isoproc, …	

Annex 2 :

the research institutes engaged in the Flemish Energy Cluster

Contents

In section 1.1.7.2 the research institutions EnergyVille, Ghent University and iMinds, as well as Pixii present themselves and their significant track record of collaboration with the industry. Here, some more information on each institute (e.g. further description of the laboratory facilities and international positioning) is given as background.

EnergyVille

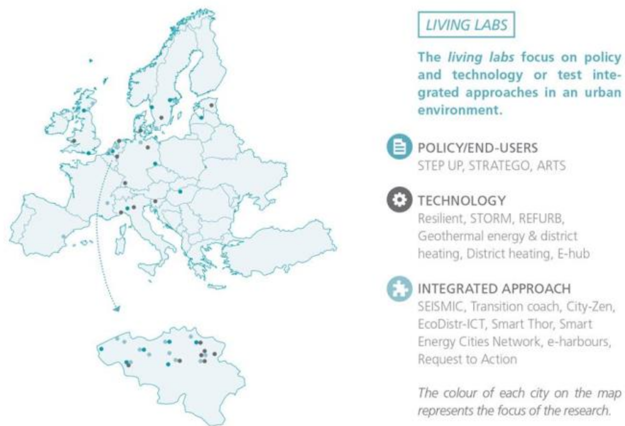
Competences

With a staff capacity of over 200 FTE focusing on smart energy systems for the urban environment alone, EnergyVille (www.energyville.be) is one of the leading knowledge collaborations in the EU in the core domain of the energy cluster.

All energy related competences of KU Leuven (university of Leuven) and VITO (Flemish institute for technological research) are combined in EnergyVille. Also with IMEC, EnergyVille offers a specific competence on photovoltaics and energy storage. The main competences of the

EnergyVille focus are summarised in the scheme below and have a complete match with the core of the energy cluster and all innovator zones. It can therefore contribute to all zones and on the interaction between the zones as well.

Research infrastructure



Recently all EnergyVille experts moved to a brand new research infrastructure with new integrated laboratories for electrical home appliances, heat conversion, heat and electricity storage and district energy management. In addition the complete campus is functioning as a unique living lab with an IT infrastructure monitoring and connecting all parts and energy vectors of the energy system. This research infrastructure and campus forms an integral part of the 100 ha Thor industrial site with incubators and training centers.
During the past years EnergyVille has established an extensive network of over 20 energy living labs in collaboration with cities and partners from energy industry.

International and EU coordinating positions

EnergyVille is embedded with strategic leading positions in major EU and international initiatives:

- Full partner and coordinator for smart cities & energy efficient cities and buildings in the European KIC InnoEnergy company, bringing knowledge to the market with an global annual budget of around 80 M€
- Chair of the Global Smart Grid Federation (international)
- Initiator and former chair of the Belgian Energy Research Alliance and representing Belgium in the EERA, European Energy Research Alliance
- Driving force initiating the Benelux Energy Expert Network

Networking and representation

- Apart from a representation in and collaboration with all relevant Flemish and Belgian industrial and policy energy platforms
- Representation in more than 5 IEA Implementing agreements on energy
- Member of different European bodies for innovation: e.g. DHC-+ (District heating & cooling), European Smart Grid Technology Platform, E2B (energy to buildings), DER Lab (laboratories on distributed energy), Smart Cities Stakeholder Platform
- Acting as expert in the SET plan (EU strategic energy technology plan) revision on behalf of different organisations.
-

In Flanders together with the industry, EnergyVille has taken the lead in the energy transition by putting smart grids on the top of the agenda with the initiation of the Smart Grid Flanders platform and the Flemish smart cities platform and the coordination of internationally awarded large scale pilot projects, e.g. LINEAR (local intelligent networks for energy active regions). EnergyVille has a strong portfolio of over 30 running EU funded projects in the core domain of the energy cluster. In these projects it often operates as a coordinator. Some of the relevant projects are mentioned in the Chapter on Innovator Zones. A complete list of relevant projects can be obtained on request.

Ghent University

Competences

Ghent University and its energy related departments (www.energy.ugent.be, www.set.ugent.be) are located in the Dutch-speaking region of Belgium. Two of the four focus areas of the energy related activities (www.energy.ugent.be) are energy efficiency in industry and energy efficiency in the built environment, relevant to all but one of the innovator zones.

The key competences relate to:

- efficiently managing energy flows at industrial sites through the development of energy systems (heat exchangers, waste heat recovery, electrical machines, internal combustion engines, intelligent power electronics, …)
- improving the energy performance of new and renovated buildings connected to the local grid, by implementing (local) storage in the grid/building, evaluating/monitoring the performance of buildings, …

Research infrastructure

Test infrastructure is available on electrical grids, power electronics and electromechanics. This includes e.g. a BELAC certified laboratory, EMC lab, a flexible micro-grid with 18 dwellings emulated and a Small Wind Turbine Field Lab. In this context Ghent Universit is member of DERLab (European Distributed Energy Resources Laboratories).
This is complemented with a unique test infrastructure on ORC, industrial heat pumps, (supercritical and compact) heat exchangers and internal combustions engines at UGent campus Technicum and UGent campus Kortrijk. Finally a test centre on building façade elements is at disposal.

Networking and representation

Several of the experts are active in national level or regional organisations, e.g. chair of Pixii (Flemish Passive House Platform, Passiefhuis-Platform), board member of the board of CoGen Vlaanderen (Flemish platform on co-Generation) and ATIC (HVAC). UGent also contributes to e.g. BERA (Belgian Energy Research Alliance).
On the international scene UGent is active via international projects and membership of international organisations. UGent is e.g. member of the Benelux Energie Expertise Netwerk. Furthermore, and member of SC77A (IEC), TC210 (CENELEC) and the technical committee of CIRED. It contribute to leading international organisations and research associations in the field of building physics, such as AIVC, ASHRAE, DBMC, IABP, IBPSA, IEA-EBC and ISIAQ., e.g. as work package leader in the recently completed project IEA-EBC Annex 58 'Reliable Building Energy Performance Characterisation Based on Full Scale Dynamic Measurements'; and work package leader in IEA-EBC Annex 68 'Design and Operational Strategies for High IAQ in Low Energy Buildings'. In addition UGent is member of the board of EUROTHERM, the European Thermal Society, member of the Scientific Committee of the Knowledge Centre on the Organic Rankine Cycle (KCORC) of American Society of Mechanical Engineers - International Gas Turbine Institute (ASME-IGTI) as specialist in heat exchangers.

iMinds

Competences

iMinds (www.iminds.be) is Flanders' digital research & entrepreneurship hub, driving digital innovation for society and economy through strategic and applied research on key digital technologies, with a special focus on the domains of Internet of Things, Data Science and Digital Trust. Over 900 researchers at the 5 Flemish universities join forces with industry and SMEs in collaborative research projects to turn digital know-how into future-proof products and services.

Furthermore, iMinds has dedicated programs (e.g. iStart - https://www.iminds.be/istart) to support tech entrepreneurs to bring their smart innovations to life, via expert coaching, facilities and pre-seed funding. iMinds' incubation program is recognised as one of the world's best by UBI Global.

Since 2009, iMinds has been actively involved in research projects on energy and smart grids providing different kinds of expertise:

- Technological research: distributed demand response coordination strategies, efficient cloud based communication platforms, characterisation and prediction of flexibility in consumption patterns via machine learning techniques, secure charging of electric vehicles, multi-standard communication for smart metering, etc.
- User research: segmentation of Flemish households with respect to energy efficiency, adoption estimation for smart energy applications and electric vehicles, co-creation of user interfaces, user acceptance of residential demand response services, etc.
- Techno-economic research: techno-economic analysis of roll-out of smart meters and public charging poles, value chain analysis for demand response services, analysis of market mechanisms and remuneration mechanisms for active network management concepts, etc.

iMinds especially can contribute to the Energy Cloud Platform innovator zone, but as ICT is an enabling technology becoming more and more important for all kinds of domains, contributions to the four other innovator zones are foreseen as well.

Research infrastructure

iMinds has several tangible test infrastructures:

- Federated beds for testing and experimentation in the field of clouds, wired and wireless communication (distributed software and service evaluation, scalability testing, protocol validation, etc.)
- Residential and office labs, for the easy integration and system testing of all kinds of sensors, appliances and services.

- City of Things (www.iminds.be/en/succeed-with-digital-research/city-of-things), an IoT smart city test infrastructure covering a large part of the city of Antwerp.

Networking and representation

On the international scene iMinds is very active in international projects (e.g. H2020, ERC, Ecsel, EIT Digital, …) in the ICT and energy domains, and is member of many international organisations. E.g. with respect to IOT/5G iMinds is founding member of AIOTI (www.aioti.eu/) and active contributor in the 5G PPP community. iMinds is also part of the European Network of Living Labs (ENoLL - www.openlivinglabs.eu/)

Pixii (Passiefhuis-Platform vzw)

Competences

Pixii’s competence relates to at least three of the suggested innovator zones. An extra added value is the fact that Pixii, as a member platform for all building actors has a very broad access to the professional building sector.

Pixii (2016) (www.pixii.be) is an independent non-profit research and education institute. It was founded as Passiefhuis-Platform vzw in 2002 from a necessity to build up and disseminate knowledge on energy efficient building to building professionals (architects, calculators, contractors, building promotors, etc.) as well as the main public. The platform aims at diffusing and transferring knowledge and research results in the field of applied technology and services for the realisation of buildings with highly efficient energy performance thus resulting in a decreasing pressure on the environment. All types of buildings are included from residential to tertiary use, newly built or in renovation. In all cases the building envelope as well as everything concerning techniques, interaction with the grid, renewables, etc. are concerned. For this purpose Pixii also performs and coordinates research (fundamental, applied, industrial, experimental development). Key element is the translation effort of Pixii in making basic research accessible for non-academic professionals. Next to that Pixii also supports and guides building companies in business modelling and strategic decision making on products and services.

Networking and representation

Research is done in close cooperation with national and international research groups and in very close interaction with the building sector and national and local governments. In that, Pixii supports the translation and subsequent implementation of research results through the whole building chain, involving every contractor and service provider in the building process (i.e. building contractors, local government, policy makers, etc) with a range of activities in communication and dissemination such as professional courses, symposia and congresses, workshops, focus groups, publications.

Annex 3 :

how the Energy Cluster will resolve market failures

Contents

What is the added value of a cluster? Why does Flanders need an Energy Cluster and above all, why does the Cluster need to get subsidized? Why would the market be incapable of handling the activities that the Cluster proposes?

Experience and history has shown that for different reasons the activities handled by the Cluster are not undertaken by commercial companies nor by any other actors, although they respond to important market failures. These market failures are off course not new and several lengthy studies (OECD, Enright...) have discussed both their nature and the role that clusters play in resolving them.
The OECD report on ‘local partnership, clusters and SME globalization’ explicitly cites two important market failures that can be resolved by developing clusters:

1. Under-provisioning of public goods

Public goods, such as education, training, infrastructure, and certain types of research can be under-supplied by markets. This is a classical market failure that all governments seek to overcome though public (or public-private) means. Small and medium sized firms, however, have a particular challenge in this area. Fragmented small and medium sized firms often find it difficult to articulate their requirements with sufficient coherence and carrying power for public authorities to respond. As a result, public goods that might benefit entire clusters of firms often are not forthcoming. In addition, small and medium sized firms often find it difficult to articulate and elicit a response to public “bads” (features that constrain whole groups of firms) which might arise from government policies or regulations. In many instances, small and medium sized firms do not have access to information about technologies, markets, competitors, new suppliers, or potential collaborators. Such firms often lack the resources to keep abreast of all the information that is relevant to their business. Moreover, for some types of information, private supply may be unforthcoming – especially where non-excludability from information is reinforced by the sheer proximity of actors in a cluster.

2. Co-ordination failures

Co-ordination failures occur when information is available and is understood, but is not acted upon because disparate actors cannot organise themselves to act in concert. It often is difficult for small and medium sized firms to organise joint activities. They might lack the capacity or the trust necessary to act in concert. Even if they do not, it is often difficult to find a forum and a neutral facilitator to aid interfirm co-ordination. In many instances, potential joint gains simply fail to materialise.

In addition to these two market failures, an important market barrier specific to the Energy sector will be resolved by the Flemish Energy Cluster:

3. Capital market barriers

The risk of innovation leakage and exploitation by competing firms puts pressure on firms to invest for quick returns (Mansfield, 1994). Technology innovation is typically a longer-term investment fraught with risks to the investor.

The service offering of the Energy cluster specifically envisages to tackle these failures and barriers in order to enhance the opportunities for the Flemish Energy sector. We'll discuss the failures one by one, with clear problem statements and an overview of the specific actions the Cluster will take to tackle them.

1. Dealing with the under-provisioning of public goods

A public good is a good or service that has two principal characteristics. First of all, one person's consumption of it does not reduce the amount of it available for other people to consume. This characteristic is called 'inexhaustibility.' Secondly, once such a good is provided, it is difficult to exclude other people from consuming it, a characteristic called 'non-excludability.' Because public goods are unpriced, markets tend to under produce them.

The cluster wants to resolve problems related to the provisioning of three specific public goods that are of particular interest to the energy sector: (1) state of the art living lab infrastructure, (2) regulation and (3) access to information. The issue of the (4) incomplete market of energy efficiency is also handled.

Problem statement: Access to state of the art living lab infrastructure

Living lab infrastructure is difficult to build up: the capital investment is considerable and at the same time the returns are highly unpredictable and have to be spread over the different companies involved. Therefore, only larger organizations can bear the investment. They are able to justify the infrastructure with their own projects. More-over such infrastructure typically

simulates the overall energy system (hardware in the loop testing such as battery emulation systems…) and targets a specific sub-system. The living lab resembles the real situation only partially.
When large scale pilots in real -life situations are carried out in a coordinated manner (cfr. Horizon 2020 projects), they are almost always limited in time. When the project is finished, more often than not, there are no funds available for a decent follow-up, for further demonstration, dissemination or learning actions. The infrastructure just 'sits' there.

Actions by the cluster to grant access to state of the art living lab infrastructure

The Flemish Energy Cluster intends to scale up lab-level technology to real-life pilot systems, tested in a real-life environment. The aim is to have several operational sites in each of the innovator zones, acting as living labs. These living labs will be used to show-off the capabilities of the Flemish energy sector on a local as well as an international level. More-over, emphasis will be put on the openness of the system, enhancing the possibilities for Flemish companies to introduce and test their technology into the living lab system.

The infrastructure facilitated by the Cluster will match the industry's needs. A management committee, representing the most important stakeholders, will ensure the aptitude of the infrastructure for the companies involved. The Cluster will ensure long-life availability of the infrastructure to interested parties and - for example - Life Long Learning programs, that want to offer training on the specific technological systems.
In order to avoid duplication, the Cluster will actively look for collaboration with other countries or other regions – the latter through Interreg schemes.

Problem statement: Regulation support

Energy has always been a highly regulated sector in Europe in general and in Belgium in particular. Next to the traditional regulatory framework, Belgium has several energy regulators, such as the VREG (Flemish), CREG (Federal), BRUGEL (Brussels) and CWaPE (Walloon region). The abundant regulations often hinder the introduction and adoption of new energy systems into the market. Changes to the legislation are complex and may result in unexpected - sometimes even undesired - side-effects. Separate entities, and especially small enterprises, typically lack the lobbying power required to influence regulation. Different actors have quite different views on what needs to change and this results in a general stand-still. Take for example the AREI that prevents the introduction of DC-distribution within houses, or the tariff policies that discourage the introduction of storage.

Sometimes the crucial role that Distribution Grid Operators (DSO's) play in the energy sector, poses a problem. These semi-public authorities are responsible for the electricity distribution on the low voltage grid. This means their attitude is crucial in all changes in the energy system.

Actions by the cluster with regard to regulation

Essentially, the Cluster will provide guidance to the regulator, by presenting him with a comprehensive view on the impact of today's regulations. The energy Cluster considers apt regulation as an essential factor in all of its innovator zones (see chapter 4.2). Three different phases can be distinguished:

1. **Identification of the hurdles caused by legislation**. Each organization has a good view on the show-stoppers due to legislation for his own technology. The cluster will group these show-stoppers per innovator zone and discuss them with DSO's, regulators as well as government in order to find acceptable solutions.
2. **Introduction of areas with alternative regulatory conditions**. When necessary for the operation of an innovator zone, the Cluster will strive to create a temporary zone with supportive legislation for the energy system/living lab that will be deployed. This supportive legislation will be introduced in close collaboration with the government. Recent actions have been undertaken on a political level in order to enable such regulatory exceptions.
3. **Feedback to the government**. At the end of the living lab projects, a report will be created showing the effect of the changes in legislation and/or energy policy that were under scrutiny. As such, it will be easier to evaluate potential modifications in legislation.

The energy cluster has involved the DSO's from the very start. They have helped defining the innovator zones in order to ensure their collaboration in each of the living labs. They have expressed that they find it worthwhile to investigate new business models in order to accommodate the changes in the market.

The actions connected to making living lab infrastructure available and to modifying the existing regulations are taken up in **the valorization package** of the differentiated service offering by the

Energy Cluster. Companies with the highest level of engagement in the Cluster will benefit from them.

Problem statement: Access to information

Facilitating the transition to a new energy system entails much more than just introducing new technologies to the market. Stakeholders need to be convinced. During the Cluster creation process, several organizations pointed out that most end users and stakeholders are not aware of the potential of several solutions. Indeed, information is ubiquitous available on the world wide web, yet it is not categorized nor presented in a consistent way. Often, dissemination is limited to the inner group of companies and organizations present in user boards.

Actions by the cluster to make information accessible

In addition to creating five innovator zones, the Cluster wants to share the information and insights gained in its living labs as broad as possible using different mechanisms, such as

1. A website/ app containing the competences and pilot projects of the Flemish companies
2. Dissemination actions towards the energy sector as a whole, through events, newsletters, press releases and articles, social media groups… Once again, the Cluster can build on the foundations laid by Smart Grids Flanders
3. Involving the end users (consumers / prosumers / government / intermediaries such as installers of energy systems)
4. Organising a yearly symposium involving academic as well as international players

The Cluster will – in other words – make optimal use of the living labs as a show case. It is essential to trigger people, to inform them and create enthusiasm and awareness. Raising awareness is the best way to ensure a new energy system will be accepted by a large community.

These actions are taken up in **the talent package** inside the differentiated service offering of the energy cluster. This means they are available to companies at all levels of engagement in the Cluster (see chapter 3).

Problem statement: the incomplete market of energy efficiency

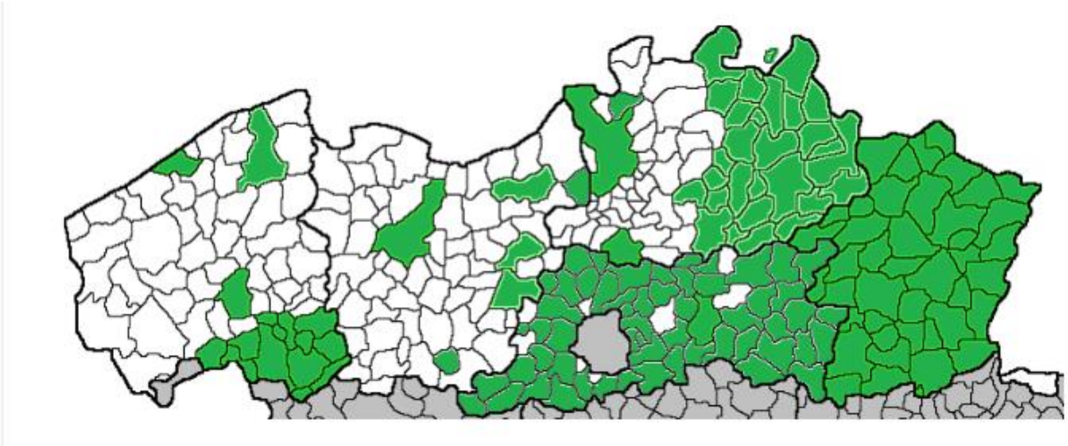
The realization of energy efficiency forms an incomplete market and this fact poses additional challenges. Energy efficiency is generally purchased as an attribute of a product intended to provide some other service. Fuel economy in automobiles, for example, is one of a large number of features that come in a package for most automobile models. If higher fuel economy were treated as an optional item, available at a higher price, then consumers would have a choice of efficiency levels. But such a separate option does not exist at present. Circumstances often constrain choices of efficiency. For example, the complexity of design, construction, and operation of commercial buildings provide powerful disincentives to producing an efficient building (Lovins, 1992).

Actions by the cluster to handle the specific energy efficiency market

The emphasis on durability is gradually growing. Two important levers for this are:

1. The Covenant of Mayors – signed by half of all Flemish municipalities

   The Covenant of Mayors is the mainstream European initiative involving local and regional authorities in the fight against climate change and developing a more sustainable energy future for our cities. It is a voluntary commitment by signatories to meet and exceed the EU 20% CO_2 reduction objective through increased energy efficiency and the development of renewable energy sources. The Covenant of Mayors was launched in 2008 by the European Commission, with the support of the Committee of the Regions and the European Parliament. It provides a bottom-up support for the implementation of the EU Climate and Energy Package, adopted in 2008 by heads of state and government.



   Half of the Flemish cities and municipalities have signed the Covenant of Mayors. Signatories of the first hour were Antwerp, Genk, Ghent and Hasselt. Afterwards Ostend and Louvain followed, and in 2012 Roeselare and Mechelen joined. In late 2011 all 44 Limburg municipalities at once; sustaining the goal of a climate-neutral Limburg.

As a result, one can see a growing interest from the municipalities to realize energy efficient projects. Also, more and more cities and communities put stringent requirements when redeveloping existing brownfields such as 'Petroleum Zuid' in Antwerp or 'Nieuwe Dokken' in Ghent. Nevertheless, one can see that there is a lack of information on how to realize such energy efficient and self-sustaining areas. The project proposal on 'Nieuwe Dokken' that is part of the innovator zone on multi-energy solutions at district level is an example of the willingness to acquire such knowledge.

The Energy Cluster wants to build on this momentum and will also focus on dissemination of this knowledge and best practices, both to the municipalities as to the project developers of brownfield sites. Therefore, contacts have been made with the VVSG (Flemish Association of Cities and Municipalities) as well with the cities of Ghent and Antwerp. These contacts will be further deepened once the Cluster is operational.

2. Climate Conference of Parties (COP)

   Parties to the U.N. Framework Convention on Climate Change (UNFCCC) reached a landmark agreement on December 12, 2015 in Paris, charting a fundamentally new course in the two-decade-old global climate effort.

   As the end product of a four-year long negotiating round, the new treaty resulted in a common framework that commits all countries to put forward their best efforts and continue to do so in the years ahead. This includes, for the first time, requirements that all parties report regularly on their emissions and implementation efforts. International reviewers will see to this.

   At the opening day of the summit, no less than 150 presidents and prime ministers were present, the largest ever single-day gathering of heads of state. Impetus came also from a vast array of 'non-state actors', including governors, mayors and CEOs.

   Large energy-consumers worldwide are trying to understand the implications of the historic Paris treaty, and the paths to implementation that will be discussed at COP22 in November 2016, in Marrakech. The industry is becoming increasingly aware that important changes need to be made on the short term.

The Flemish Energy Cluster wants to build on this momentum by disseminating best practices. We aim to help the Flemish industry realize new concepts such as virtual power plants.

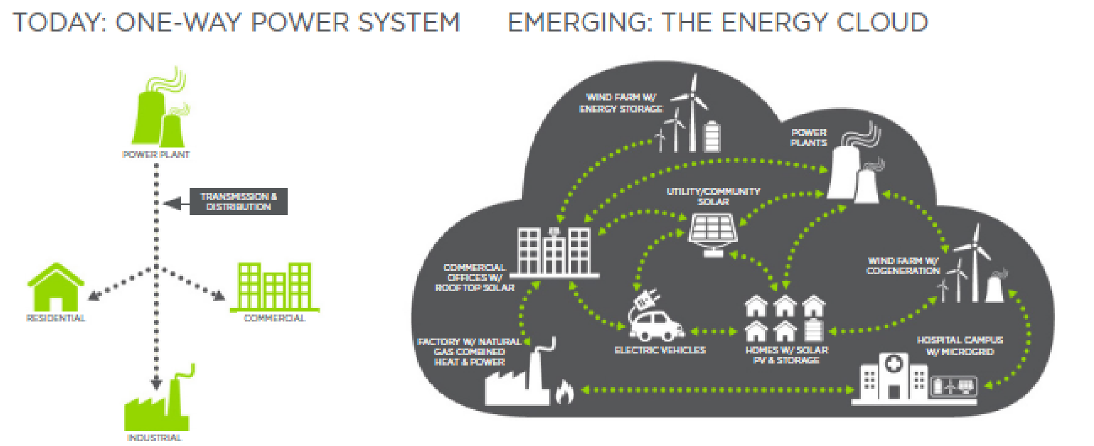
These actions are taken up in **both the valorization and the talent package** of the differentiated service offering by the Energy Cluster.

2. Dealing with co-ordination failures

Problem statement

The power sector is going through an historic transformation towards an *Energy Cloud*. In the new energy landscape, we are shifting away from a one-way power system relying upon large centralized generation plants and conventional transmission and distribution (T&D) infrastructure, and we are moving towards a highly networked ecosystem of twoway power flows and digitally enabled intelligent grid architecture. This shift creates a dynamic energy ecosystem that leverages ubiquitous connectivity, intelligent sensors and devices, information and operations technology, and data-driven machine-learning functionality across the grid value chain. This ecosystem will be far more sophisticated than the legacy hub-and-spoke model in use today.

Depicted in the figure below, the Energy Cloud will usher in widespread disruptive changes in the way energy is produced and consumed globally. Utility industry innovation is currently moving beyond one-off, standalone technologies (e.g., renewables) and the pairing of these technologies (e.g., solar plus storage) toward the orchestration of complex ecosystems of technologies working in concert to deliver more flexible, responsive, and customer-centric services. In this complex eco-system, no single party has been able to stand out as the orchestrator of the system. Moreover, the ecosystem is combining expertise from different industry sectors that don't share a history of co-operating, nor a common vocabulary.

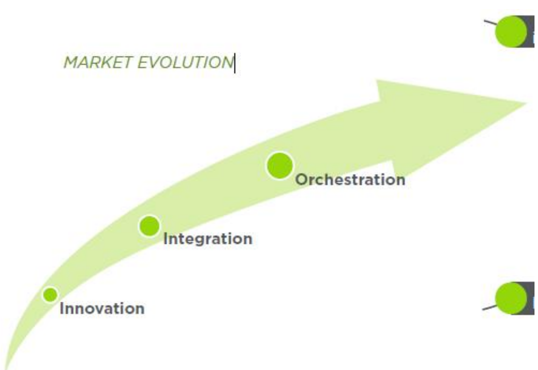


 Source: Navigant

- Large, centrally located generation facilities
- Designed for one-way energy flow
- Utility controlled
- Technologically inflexible
- Simple market structures and transactions
- Highly regulated (rate base) and pass through

- Distributed energy resources
- Multiple inputs and users, supporting two-way energy flows
- Digitalization of the electric-mechanical infrastructure: smart grid and
- behind the meter energy management systems
- Flexible, dynamic, and resilient
- Complex market structures and transactions
- Regulation changing rapidly around renewables, distributed generation (solar, microgrid, storage), net metering etc.

Actions by the cluster



The Cluster wants to bring organizations from this complex ecosystem together and facilitate their collaboration in the evolving energy sector. The Cluster takes up the task of facilitating this cooperation process during the defining, the operational and the follow-up phase of the living labs. By doing so, any lack in expertise and/or market partners will be identified early in the process and interested parties will be contacted. The Cluster itself will not act as a commercial organization in such undertakings.

In the emerging broad and complex ecosystem, the Cluster wants to bring competences together from different industry sectors, both within and outside the energy sector. Inside the energy sector, the emphasis will be put on electricity and heat, as well as on the intelligent combination of both. In order to reach its goals, the Cluster will also attract competencies of the construction, IT and financial industry. The presence and support of the different sector federations is essential for the success of the Cluster and should be seen as a key asset in the task to bring together consortia.

This need for collaboration and orchestration is the fundament of the **service offering** of the Energy Cluster and is present in all packages, for companies at all levels of engagement.

3. Dealing with Capital market barriers

Problem statement

Energy prices, as a component of the profitability of an investment, are subject to large fluctuations. The uncertainty about future energy prices, especially in the short term, seems to be an important barrier. Such uncertainties often lead to higher perceived risks, and therefore to more stringent investment criteria and a higher hurdle rate (Hassett and Metcalf, 1993; Sanstad et al., 1995). An important reason for high hurdle rates is capital availability. Capital rationing is often used within firms as an allocation means for investments, leading to hurdle rates that are much higher than the cost of capital, especially for small projects *(source: Ross, 1986).*

Actions by the cluster

The Cluster will set up trajectories in which new business models are created by experts from the financial sector as well as companies active in the Cluster. During roundtables, both sectors can become better acquainted with each other's business. Other actions will focus on one specific company or innovator zone, in order to increase the chances of attracting finance and the valorization potential on the market. Business schools like Vlerick are already assessing the potential of new business models in the field of battery storage in the project 'GREAT'. Accelerator programs such as the Knowledge and Innovation Center InnoEnergy are searching for partners in order to create effective teams to create new ventures. Rather then re-inventing the wheel, the Energy Cluster will support existing actions by making them known to relevant players.

Providing one-on-one support to organizations in general and SME's in particular is necessary, when it comes to the creation of new business models or ways to attract capital and adapt processes to operate in a global environment. This need led to the definition of the business package. Creating new business models for the sector as a whole forms an essential part of both **the business and the valorization package.**

Annex 4 :

Full presentation of the first projects per innovator zone

Contents

The following annex describes some of the project ideas that are on the way to be turned into project proposals. The entire procedure that we intent to perform for each of the project ideas is described in the WP-1 of the project plan included in the project proposal. The actual status of these ideas are first versions of the two-pagers. Their maturity ranges from first ideas up to

consortia that already met several times. During the next months, meetings will be set up in order to further detail the two pagers and to create a business model canvas out of them. The process of this detailing will run in parallel with the application process in order to reduce the start-up time when the energy cluster turns into reality.
All the project ideas are open for additional partners joining the consortium and a broad consulting procedure within the organizations that signed a Letter of Interest is running in order to ensure a broad engagement.
Nonetheless, we think it is very valuable to include them in the proposal in order to provide a good view on the topics industry is interested in as well as the actual status of the ideas and the work going on to mature them.

1. Energy harbors: Presentation of project “Demonstration of different storage solutions in a future electricity system” (see 4.2.1.5)
2. Microgrids: Presentation of project “Microgrids used as a local grid with a minimum dependency on fossil sources and the distribution grid by surveillance of maximizing the local energetic balance immediately.” (see 4.2.2.5)
3. Multi-energy solutions at district level – Presentation of project “The Thor-site: enhancing multi-energy technology” as well as of the project “A business case for a local smart grid – De Nieuwe Dokken Gent” (see 4.2.3.6)
4. Energy Cloud Platform – Presentation of project “The IoT Energy Cloud Accelerator” (see 4.2.4.5)
5. Intelligent Renovation towards Energy Neutral Buildings with building integrated energy storage and productions – Presentation of project “The power backbone for IoT devices – Intelligent low voltage direct current distribution network within a building with broadband data communication capabilities”. (see 4.2.5.4) as well as deep renovation of collective buildings with focus on upscaling.

1. Energy harbors: Presentation of project “Demonstration of different storage solutions in a future electricity system”

Title of the project	Demonstration of different storage solutions in a future electricity system
Contact person:	Geert Schrooten & Thomas Desnijder
Innovator Zone	Port areas (Antwerp and Ghent)

Which change in the energy system is addressed and how is it demonstrated?

The electricity system is currently facing the massive introduction of renewable energy sources (wind, sun,…). The introduction of these intermittent production assets makes continuous balancing of production and demand of electricity more and more challenging. The electricity system of the future will therefore need to have (additional) electricity storage possibilities. Storage can be done on a short time basis (batteries, power-to-power), but excess electricity production can also be used to create other useful energy vectors (power-to-heat, power to hydrogen, power to methanol, …).

The harbor areas are complex nodes of energy systems with different energy vectors geographically very close to each other. Therefore, the port of Antwerp and the port of Ghent harbor areas are ideally fit to demonstrate different kind of electricity storage solutions as part of a future energy system.

How does the proposed energy system relate to other international lighthouse projects and how can the products and know-how resulting out of the project be valorized?

This demonstration project concerns 2 pilots:

- The port of Antwerp will focus on the conversion of wind energy and industrial CO_2 into methanol. The produced methanol can be used as a transport fuel for the road sector (blending with gasoline) or as a marine fuel. Alternatively, the produced methanol can be used as a chemical building block in different chemical processes within the port of Antwerp.
- The port of Ghent will focus on the storage of solar energy in batteries and the conversion into hydrogen. As the port of Ghent is an industrial port, the local demand of electricity and industrial gasses like for example hydrogen is high. Antwerp and Ghent are multi-modal hotspots in Flanders so the fuel demand is potentially high. The transition from fossil based fuels to alternative/low carbon transport fuels starts here. There is a strong link with IBN project ‘Power-To-Gas’ in which TerraNova Solar nv is partner. This IBN project focuses on the valorization of hydrogen into a transport fuel. Power-to-hydrogen-to-fuel will be covered by this IBN in the global ‘demonstration of different storage solutions in a future electricity system’ speerpuntproject (see schematic overview of Power-to-battery-to-hydrogen project).

The business case of both pilots is based on grid stability on one hand and the conversion into transport fuels on the other hand. The demonstration of viable business cases for the above mentioned pilots leads to know-how that can be valorized throughout Europe (and more), as all electricity systems face the challenges of massive introduction of renewables and the need for storage.

These kind of projects are surely of interest to the European Union and the European Commission, as different kind of European programs for realizing storage capacity are currently being elaborated.

Which companies and other organizations are present inside the supply change and which role do they

For realization of the pilots, following organizations have been identified:

- Antwerp port authority: manager of the port area and owner of the land where the pilot will be realized.

- Ghent port authority: manager of the port area

  ➔ Both organizations have ambitious policies with regard to sustainability and renewable energy in the port area and can be seen as facilitators in order to realize demonstration projects. Possibly, these organizations can also foresee financial impulses.

- Antwerp port authority is majority shareholder of NV Wind aan de Stroom, a company which operates the largest onshore wind park in Flanders within the Antwerp port area.

- In Ghent, the largest solar park of the Benelux situated in the north of the port is owned by private company Terranova Solar nv. Terranova Solar is also landlord of the terrain. The batteries and hydrogen power plant will be built on the same premises.

- Engineering and consulting companies, research institutions (not yet identified): In order to start the pilots, a number of feasibility analyses (technical and economical) will need to be carried out.

- Contractors (not yet identified): Tendering procedures will be put in place in order to find the suitable contractors.

- Regional, national or European authorities: The above mentioned projects will need financial support from regional, national or European authorities in order to be built.

- Transmission system operator (TSO) and/or distribution system operator (DSO): close collaboration with TSO and DSO will be required in order to technically realize the project, but also to create the necessary (demonstration) contracts for realizing grid stability with the pilots.

Special attention will need to be given to the specific tendering procedures that need to be followed by the Port Authorities. These tendering procedures follow strict procedures in order to allow for European competition. Naming specific companies is in conflict to these procedures. This particular situation will need to be investigated closer during the feasibility phase

Describe alternative approaches to realize this light house project.

Currently, the Antwerp port authority and the Ghent port authority will initiate in order to start up the 2 pilots.

Ideally, a cluster of companies willing to invest in the above mentioned demonstration projects is formed. The Antwerp port authority and the Ghent port authority will at that moment give the lead to the formed consortium of companies and merely act as a facilitator.

Should a consortium not be found, Antwerp port authority and Ghent port authority will evaluate whether they can take the lead for the entire process and realize the project themselves as a project manager. At this moment, this is not the preferred way forward.

Which technological/economical/regulatory advancements need to be taken in order to realize the lighthouse project? How do they relate to the current state of the art in Flanders/worldwide?

Economical:

- ➔ Remuneration contracts for delivering grid services on a modest scale (100 kW – 5 MW) need to be elaborated further by the TSO.
- ➔ Preliminary business cases show low return on investments (from a private investor's point of view). Relatively high CAPEX and unsure operational incomes make the business case risky.

Regulatory:

- ➔ In order to realize the demonstration project, the creation of a 'low regulation zone' could be considered. This should help the timely realization of the demonstration project

Technological:

- ➔ The technological challenges to be dealt with in the pilots, seem to be manageable at this moment in time.

Which actions are required in order to come to a full business plan and project proposal and how will you achieve these actions?

In order to elaborate a full business plan, following actions are already ongoing:

- ➔ Formation of a cluster of investors;
- ➔ Site selection.

As soon as the above steps are finalized, the consortium of investors will need to carry out detailed technical, legal and financial analyses. This also includes negotiations with contractors and TSO/DSO in order to create legally binding contracts. At the same time, financial support decisions form regional, national or European authorities need to be obtained.

It is to be expected that these analyses will take at least between 1 and 2 years (starting from January 2017).

If these steps are successfully, the consortium of investors will create a special purpose vehicle, which can start managing the building and operating process.

Which additional know-how is still needed to optimally realize this project? Which needs arise/ can be fed back to the regulatory system?

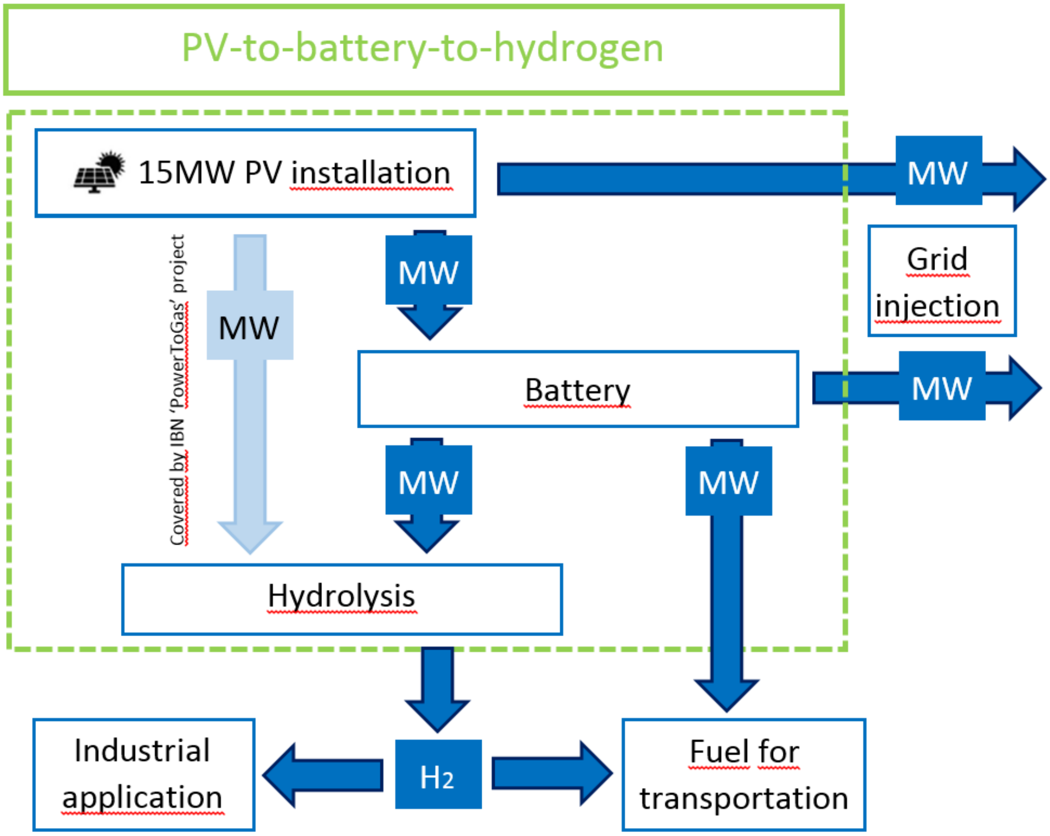
Pilot 'Power to methanol':

- ➔ profound knowledge of the current methanol-market and the possibilities to blend methanol into gasoline
- ➔ profound knowledge of the ways to label the produced methanol as a synthetic renewable fuel as meant in the Fuel Quality Directive.
- ➔ …

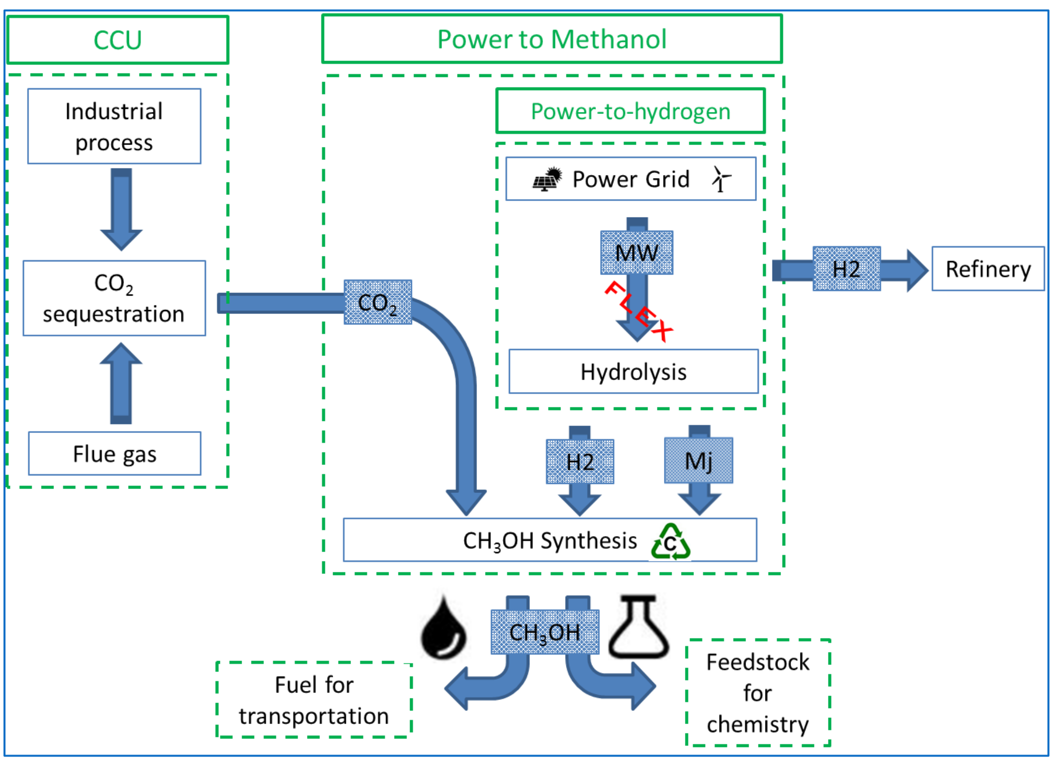
Pilot 'PV to batteries and hydrogen':

- ➔ Knowledge of the market of truck and vehicle manufacturers and the transition to alternative fuels.
- ➔ Knowledge regarding safety in production and storage of hydrogen.
- ➔ Knowledge on how to match this pilot with the Clean Power for Transport Directive.

Schematic overview of Power-to-battery-to-hydrogen project (Port of Ghent)



Schematic overview of Power-to-Methanol project (Antwerp Port Authority)



Port of Antwerp	**Havenbedrijf Antwerpen**

Description of the legal entity: Havenbedrijf Antwerpen, NV van publiek recht

Turnover: +/- 300 M€	**Number of Employees: +/- 1.600**

Relevance to the energy cluster proposal: PARTNER will focus its' participation on the following aspects:

- Realization of demonstration project with regard to power to methanol

How company's profile matches the activities of the energy cluster:
One of the goals of Havenbedrijf Antwerpen is to realize a sustainable port area. Sustainability with regard to energy production, energy use, energy efficiency and stability of the electricity system is of key importance for Havenbedrijf Antwerpen.

Description of the profile of the persons responsible for cluster actions:

Geert Schrooten, project manager energy

Didier Van Osselaer, manager energy development.

Relevant publications (up to 5), and/or products, services (including widely-used datasets or software), or other achievements relevant to the energy cluster:

- Realization of largest onshore wind turbine park within the port of Antwerp
- Realization of smart usage of energy of wind turbine in a cooling warehouse (Luiknatie)
- E-harbours, analysis of smart grid concepts within a harbour region

Relevant projects (up to 5) and activities connected to the energy cluster:

- See above

Description of any significant infrastructure and/or any major items of technical equipment, relevant to the energy cluster:

- See above

PORT OF GHENT	**Havenbedrijf Gent**

Description of the legal entity: Havenbedrijf Gent, nv van publiek recht

Turnover: +/- 36M€	**Number of Employees: +/- 160**

Relevance to the energy cluster proposal: PARTNER will focus its' participation on the following aspects:

- Realization of demonstration projects in innovator zone 'Energiehavens'

How company's profile matches the activities of the energy cluster:
Strategic plan Port of Gent 2010-2020 describes the importance of cleantech, energy efficiency, renewables, multi-modality, … This project is an integrated pilot with an positive impact on a lot of our strategic goals.

Description of the profile of the persons responsible for cluster actions:

Thomas Desnijder, Beleidsmedewerker Energie

Relevant publications (up to 5), and/or products, services (including widely-used datasets or software), or other achievements relevant to the energy cluster:

- Interreg Duurzame Zeehavens: inventorization of rest- and side streams to have an overview of supply and demand in the port area. (Privacy and IP of data is key issue).
- Focus on Cleantech in the port of Ghent strategic plan 2010-2020
- Development of onshore power supply at multiple voltage

Relevant projects (up to 5) and activities connected to the energy cluster:

- See above

Description of any significant infrastructure and/or any major items of technical equipment, relevant to the energy cluster:

- See above

2. Microgrids: Presentation of project "Microgrids used as a local grid with a minimum dependency on fossil sources and the distribution grid by surveillance of maximizing the local energetic balance immediately."

Title of the project	Micro grids used as a local grid
Contact person:	Peter Van Den Heede
Innovator Zone	Microgrids

Which change in the energy system is addressed and how is it demonstrated?
The roll out of intermittent renewable sources is changing the energy landscape. Typical for renewables is the availability of about 1000h eq. energy a year for solar and about 2000h eq. for wind energy. Leaving the additional 6500h energy to be balanced? The solution is a micro grid used as a local grid with a minimum dependency on fossil sources and the distribution grid by surveillance of maximizing the local energetic balance immediately.
How does the proposed energy system relate to other international lighthouse projects and how can the products and know-how resulting out of the project be valorized?
It is our aim to build an open system for micro grids via a building block concept. A building block could be (non-exhaustive list) a CHP, Gen set, PV technologies, on shore wind turbines, storage units (batteries, flywheels, hydro, super caps..) Grid-active and grid-interactive inverter systems, distribution related components e.o. This must be completed with all types of functional block control systems. The interconnecting technology may be single- or three-phase AC, low-voltage DC or a hybrid Since a smart Micro grid must be able to combine those functional blocks on both predictable and heuristic base, there is the need of a multi-agent structure with the aim to keep energetic balance all over the network on quasi instantaneous base. A software system based on machine learning algorithms can integrate any building block by any player in the field fitting connectivity standards, achieving true interoperability, which is often a problem in practice. As a novel approach, the software will optimize the system during a learning phase, wherein multi objective are put forward: e.g. local instantaneous balancing of power, matching generation and demand over a given time frame and the provision of ancillary services. Such systems must find a balance between efficiency, sustainability and asset lifetime. The implementation in a real testing ground is not feasible yet. An oriented approach, where on a technology independent way all new concepts will be developed and build up on a free programmable and free configurable test platform under real load conditions. The approach contains three stages: control layers development, lab testing and a living lab validation with actionable customers on an external site, implementing circular economy principles (see picture).. Due to this general approach, new technological solutions or building blocks will be non-limitative. To conserve and to distribute the knowledge in Flanders an expert group will be formed out of these three steps.
Which companies and other organizations are present inside the supply change and which role do they play?

The pilot project will be hosted on a local real site. For the setup of the independent micro grid control system we will start with a first group of companies building up the basic structure. Once this is build up every company interested in one of the “building blocks” can add their own solution or system to the basic structure to test the functionality and integration possibilities.
The companies that will be involved in the building of this micro grid using an test platform under real conditions are: Eandis, ABB, Triphase, Enervalis , Van Wingen, Vyncke , Engielab, and storage companies (tbc). Since the city of Kortrijk is interested to offer a site for real life demonstration, the test platform can be build and programmed as a copy of the real testing ground. The further development under real conditions will make a high chance to become operational within the best possible timings.
Roles:
Eandis: integration in the local distribution grid, will help finding the right location(s)
ABB: Delivering all components needed to protect the micro Grid installation and use 4Q filter technology and Solar convertors
Triphase:
Enervalis: Software development based on machine learning algorithms enabling the integration of several building blocks.
Ghent University/Lemcko lab is willing to provide both high skill knowledge and all research infrastructures and even enlarge it with the needed additional components and open software in order to build up a test platform to an actually testing ground and to test the micro grid set up in a controlled environment in the first wave before the real life start in the field.
Van Wingen: Integrating reciprocating engines, diesel and gas, in power generation applications Aim is to integrate and to demonstrate Mini-CHP running on hydrogen in the micro grid, compatible with the other blocks..

City of Kortrijk: Is willing to provide a full micro grid concept including most of the buildings (UGent and HoWest are the owner of the other buildings), RES and end users as a testing ground

Thor park, housing EnergyVille: use of the interconnected labs for micro grid technology and integration thereof (battery lab, solar test site, home energy technology lab with AC and DC grid, matrix grid lab with RTDS and HIL converter system to emulate any grid) and the the SmarThor platform for outdoor testing on campus in a “regulation-free” setting
Engie lab:
Vyncke: Small windturbines

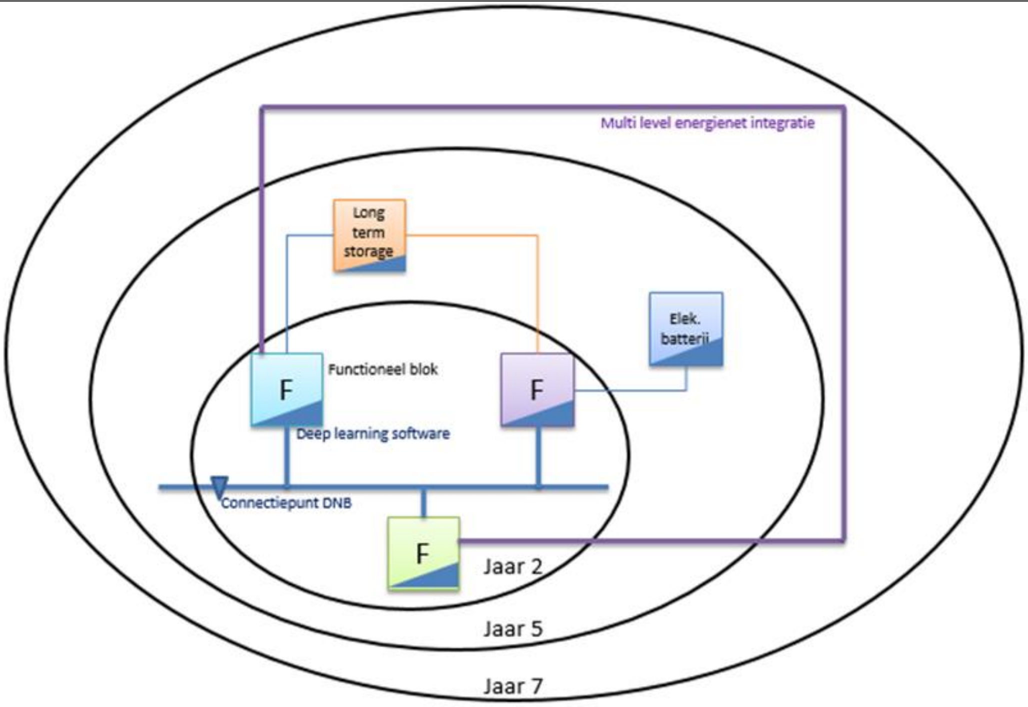
Describe alternative approaches to realize this light house project.

Alternative approach could be the setup of a micro grid with several different industries but which a software development focused on the product data of the solutions provided by the participating companies. This will give a dedicated micro grid solution as outcome which include several building blocks but not open for new solutions without new programming work and not able to optimize the global solution.
Second alternative is to build different solutions only in test platform environment, emulating real conditions, but without real tests in green-or brownfields. The results gathered from those situations will never be transferable to other situations/locations/configurations and not provide general future solutions...

Which technological/economical/regulatory advancements need to be taken in order to realize the lighthouse project? How do they relate to the current state of the art in Flanders/worldwide?

The differentiator in our micro grid project is the self-learning concept based on software offering multiple variations on the micro grid setup. The first wave of technologies using proprietary control systems, mainly aiming at local balancing and just voltage control as a single ancillary services are available today The optimization possibilities are new for this solution, especially when efficiency goals and asset life time are combined. The solutions offered in the third wave (see picture) are new developments based on existing technologies but offering a circular economy model. This total package is much more effective as the existing solutions today. In a market with an annual growth rate of +17% will this offer the Flemish companies involved a unique possibility to play an important role on a world scale level. Locally in Flanders this system can be used for regions or quarters with high risk on grid congestions or voltage instabilities, for high penetrations of RES sources and or for balancing support in the grid. For that reason regulation, and possibly grid codes (e.g. for LVDC), have to be adapted or expanded towards the possibility to share the demand- response balance and ancillary services such as voltage support and reserves on a local base in between different participants. Also for military depots, data centers, airports, hospitals, universities and other critical environments. A standardization for market roles and responsibilities will be needed to keep the whole grid in balance. Standards could be based on USEF and/or Open ADR created for this. The local grid is prone to high frequency disturbances in the distribution grid caused by the high penetration of PV installations. Avoiding these phenomena's will be part of our project scoop.
Which actions are required in order to come to a full business plan and project proposal and how will you achieve these actions?
We have to set up a core team with companies covering all building blocks of a Smart Grid. To keep it open for all Flemish companies active in this area we should have one company for each of the building blocks of the micro grid.. The software needed for this "open" concept can come from a few Flemish companies active in this field. We need to invest only in a few building blocks for the first wave as the Micro grid in the DER lab has already a lot of these building blocks connected. The city of Kortrijk is offering us a real quarter where the whole concept can be implemented during wave 2. The project is named Energy Island Kortrijk Weide . As the DSO Eandis is involved the grid infrastructure can be optimized for this purpose as well. Next step is the importance of a low regulation zone for this area to make it possible to share and balance the available energy and keep the balance in the local micro grid. This is only possible with new regulations. Finally we have to involve new technologies for the third wave. The business plan for this third wave will be a best estimate as some of the needed technologies, regulations and exchanged the electrical part with district heating, hydrogen and other solutions. How to achieve.. We started with a small working group to define the scoop. Now this core team will expand with companies covering all building blocks. They will build the concept under the lead of a full time team leader foreseen in the governance model of the Speerpuntcluster Energy. With clear KPI's for each of the three steps we will guarantee the output in each of the waves. A group of experts in the different domains are needed to succeed this ambitious plan. There is the need of scientific support, but more important from the industry who is involved in the Micro grid concept. A consortium of Industrial partners, completed with academic experts is needed to create a critical mass to succeed in this concept. The same consortium also can be involved to both disseminate and secure the gathered knowledge in Flanders and in a later phase over Europe.
Which additional know-how is still needed to optimally realize this project? Which needs arise/ can be fed back to the regulatory system?

Adaptation of the regulatory frame work to “open” the possibility to shape this micro grid. Our work group will create a proposal for these adaptations and will open the line for common discussions. In addition we need the knowhow for the deep learning algorithms needed for the open structure we want to create. Additional technical knowhow in third wave solutions will be required.

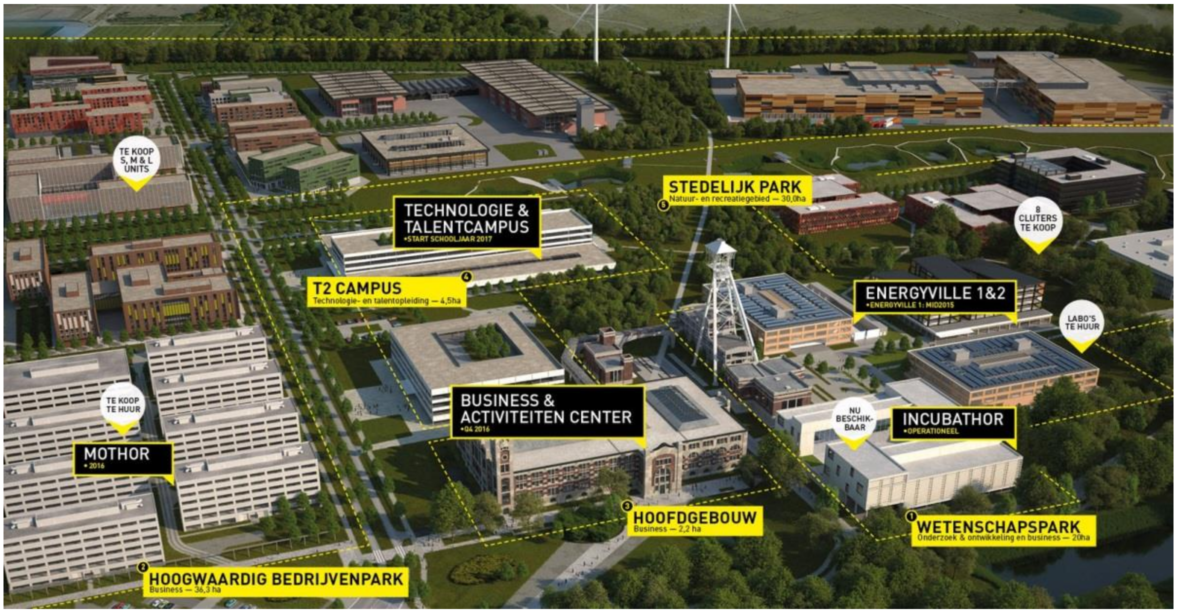


3. Multi-energy solutions at district level – Presentation of project "The Thor-site: enhancing multi-energy technology" (see 4.3.2.6)

Title of the project proposal:	The Thor-site: enhancing multi-energy technology
Contact person:	Wim Cardinaels, EnergyVille
Innovator Zone	Multi-energy operation in districts
Which change in the energy system is addressed and how is it demonstrated?	
The main objective of this project is to reduce CO2 emissions while guaranteeing security of supply and offering energy services at competitive prices by developing market models and ESCO services for on-site integration of energy flows in a district with mixed functionalities (small industry, education, hospitals, sport facilities, residential,…). It focuses on the improved system flexibility by combining complementary conversion and storage technologies bringing energy vectors as heat, cold and electricity in one common market platform. Appliances like HVAC, heat pumps, cogeneration, advanced thermal energy storage are interconnected via 4th generation heat networks and equipped with improved flexibility features and enabled to high interoperability. On the Thor-site the Flemish industry can tackle this challenge in a real district development with international visibility.	
How does the proposed energy system relate to other international lighthouse projects and how can the products and know-how resulting out of the project be valorized?	
The project is linked to the completed infrastructure/investments on the Thor-site, the EnergyVille Labs and to the planned infrastructure investments. In the coming 2 years the Thor-site is expected to expand to an innovation zone with a unique combination of functionalities (industry, education, leisure, research,..), international visibility and sustainability ambition (CO_2 neutral). The industrial partners involved build on their recent co-operation in internationally awarded living labs (e.g. ISGAN awarded LINEAR project with Fifthplay, grid operators). A recently initiated research project, called SmarThor coordinated by EnergyVille, provides an excellent monitoring infrastructure and basic control platform ready for access and follow-up of different industrial components. The project can be further embedded in the sustainability initiatives of the city of Genk (e.g. initiative to launch smart thermostats). The first steps in the valorization of the products are secured through the specific focus on IoT and a link with other living labs that will be established.	
Which companies and other organizations are present inside the supply change and which role do they	

Industry to be involved on the level of energy components: Niko, Fifthplay, ABB, Van Wingen, Daikin, Atlas Copco, Priva; acting as suppliers and developers of intelligent heat pumps, co-generation, ORCs, plugs Industry to be involved on the level of IT services: Ferranti, Belgacom, Actility, Ordina; acting as suppliers of IT platforms and service software Industry to be involved on the level of energy services: Condugo, Enervalis, Nuhma, grid operators acting, as providers of energy management/services at site/district level. In total about 14 industrial companies equally distributed over 3 parts of the value chain (components, IT, energy services), with about half of them SME's. The Flemish developers and distributors of energy components as heat pumps, small scale cogeneration, e.g. micro-cogen, ORC, HVAC, electric boilers are given access to function under real conditions in the district energy system with extended monitoring and control facilities. This allows them to optimize their components with improved control intelligence and/or service functionalities: e.g. intelligent boiler providing peak shaving. The objective is to realize in a first phase at least 4 improved Flemish technologies able to operate in a full flexible energy district. A new control platform will be installed in the available IT-infrastructure on the Thor-site with special attention for interoperability with the different energy components. Exchange on standardization and optimization of pilot projects with e.g. USEF (the Universal Smart Energy Framework), based in the Netherlands, is relevant in this context. Partners of the Flemish Energy Cluster (e.g. ABB) are already active in USEF.
Describe alternative approaches to realize this light house project.
An alternative is that the individual companies develop separately the required knowledge to arrive to the required product improvement, this would however require substantial investments in infrastructure or time consuming trial and error development in multiple circumstances. The Thor-site provides a unique development environment due to its monitoring facilities, real working conditions and regulation exemption conditions. An added value of the energy cluster could be to develop a portfolio of living labs of energy districts as a learning platform, in this case the Thor-site could function as a starting base for further replication and form an essential part of the industrial learning process.
Which technological/economical/regulatory advancements need to be taken in order to realize the lighthouse project? How do they relate to the current state of the art in Flanders/worldwide?
On technological level an enhanced standardization for the communication between energy components is required. This challenge is tackled in the project itself (see e.g. USEF for a state of the art). The interoperability solution should be combined with a proper solution for data management. For this purpose several IT partners are included and a link can be established with the "Innovator zone" on Energy Clouds in the Energy Cluster where the big data approach is tackled. Since several partners are now working with protected data a proper combination between "small" and "big" clouds needs to be found. The breakthrough on economic level is expected to come from the business models from aggregators which are already active. This will increase the value of the enhanced flexibility energy components (heat pumps, boilers, storage, HVAC,…). It is expected that the combination of functionalities in a district will provide ample opportunities to combine load profiles and exchange energy flows between buildings with different functions. On the regulatory part, for Flanders, currently regulation exemption zone negotiations have been initiated with the Flemish government to establish a unique innovation environment at the Thor-site. Relevant regulatory conditions (eg. On energy flow exchange between buildings) have already been specified.

Which actions are required in order to come to a full business plan and project proposal and how will you achieve these actions?
• A comparative business cases analysis needs to be completed for the different potential energy components. Based on other European and Flemish projects where preparatory work on flexibility opportunities has been performed, this can be performed on short term. The results will influence which companies will take a first lead in the project for enhanced flexibility development. In the business model the question should also be addressed whether Flemish companies could sell their “flexibility” knowledge to foreign energy technology manufacturers. • In parallel the energy service provider business model(s) for districts needs to be explicated, since these will be the driving force for the implementation of the enhanced technologies. Therefore the role of aggregators and services providers in the project is essential. • An extensive list of currently planned district developments needs to be composed for Flanders and the neighbor countries to establish a view on the replication challenges and as such on the detailed set up of the project. • A consortium agreement needs to be established between the project partners specifying the IP conditions, accessibility of data and also the physical access conditions to the energy infrastructure of the Thor-site. • The regulation exemption condition negotiations need to be completed and applied. The project with a budget of around €7 million, would run from 2017 to 2020, but also offers a perspective to address two additional market segments with the Flemish industry on longer term: • 4th generation heating/cooling grids: currently Flanders is one of the leaders in the European research on smart heating and cooling grids, and Flemish investors are preparing new district heating/cooling projects; Flemish companies have joined their efforts in the Flemish Heating Network to prepare this market. • At the same time a large Flemish initiative has been launched to integrate deep geothermal plants in energy hubs. This is a complementary project to the proposed idea to be integrated by the year 2019.
Which additional know-how is still needed to optimally realise this project? Which needs arise/ can be fed back to the regulatory system?
The main focus of the required additional know-how during the project is the interoperability, embedded control intelligence and user interaction facilities of specific energy components for districts integrating electricity, heat and cold. This cannot rely only on simulations but needs to come from real life operations. If these enhanced functionalities are applied in innovatieve multi-energy service models under regulation exemption conditions, the lessons learnt can improve future policies and legislation on energy pricing, market roles and exchange of energy flows between buildings.



Thor-site: a combination of functionalities with high sustainability ambitions

4. Multi-energy solutions at district level – "A business case for a local smart grid – De Nieuwe Dokken, Ghent" (see 4.3.2.6)

Title of the project	A business case for a local smart grid – De Nieuwe Dokken Ghent
Contact person:	Peter De Smet – DuCoop +32.496.511.284 –
Innovator Zone	Energy cluster – Multi-energy solutions at district level

Which change in the energy system is addressed and how is it demonstrated?

Grid balance

How to shave peak load and make optimal use of (locally) produced renewable energy for local consumption through demand side management, grid level storage and a local grid for communal energy need. Securing the grid balance will prevent blackouts.

Demand side management

As more renewable energy is produced, the availability of power in the net depends on nature (sun, wind). The need for electricity does not balance the availability. So, in general, there is a need for tuning between supply and demand. As supply is only to a limited extent steerable, there is an obvious need for demand side management.

Energy management for EV-charging

As sustainable mobility is a major focus point for the new district, there is a risk for a large peak demand (up to 50 electrical car charging points and 50+ bicycle charging points). Smart charging points, connected to a smart local grid could reduce the peak load significantly. The load pattern should be flexible according to the availability of power in the grid, the need for fast or slow charging depending on the time the car needs to be available with full battery.

In a next step car batteries might be unloaded in order to balance the grid.

Energy management for smart home appliances

Inside the homes inhabitants might make use of smart home appliances. To a certain degree demand side management can be applied in the homes (home dryers, dish washer, …).

How does the proposed energy system relate to other international lighthouse projects and how can the products and know-how resulting out of the project be valorized?

Indeed, the above mentioned needs do not only exist in the project in Ghent. Other districts where renewable energy is implemented and EV-charging rolled-out similar problems may arise and might provide a good accelerator point. As such, the experience and collaborations developed in this lighthouse project can be translated to different green and brownfields both within Flanders and broader within Europe.

Solutions that are implemented (open source) can be applied in other projects elsewhere in Europe and one can see first results from Horizon 2020 projects popping up in leading countries such as Copenhagen. Real-life demonstrations of holistic demand side management systems are however scarce in Europe.

Which companies and other organizations are present inside the supply chain and which role do they

The city of Gent: initiated a sustainability calculator for new developments in Gent through which this project was selected. The city also granted a long term concession to DuCoop to run the district heating and other services.
Schipperskaai Development: a consortium of 3 building companies (Re-Vive, Vanhaerents, Van Roey) that is committed to implement the sustainability ambitions in the new district and to establish the housing project (approx.. 400 dwellings).
Farys Solar: This company is related to the Ghent water company Farys and is a shareholder of DuCoop. By means of a subcontract Farys Solar will alsodeliver administrative and maintenance services to DuCoop.
Rebel: an expert financial modelling company involved in modelling the business case.
ABB: involved to provide and develop power and automation technologies for the smart applications
SF1: involved for app-development,conceptual consultancy on smart grid applications and integration of all the components in a platform/smart system.
Ingenium: engineering of district heating and electrical applications

Describe alternative approaches to realize this light house project.

If the project would be realized with smart technology or demand side management, less grid balance would be the result. More investments in a more powerful net would be necessary to finance more capacity. Also EV-charging would only be possible for limited power.

Which technological/economical/regulatory advancements need to be taken in order to realize the lighthouse project? How do they relate to the current state of the art in Flanders/worldwide?

Regulatory:

- Private grid: DuCoop will need to connect rooftop PV across the new district to 1 central EAN-connection and redistribute electricity through a grid for electrical charging points. Both grids will partly have to run over the public domain.
- Low tension smart Island Aggregation

Technological:

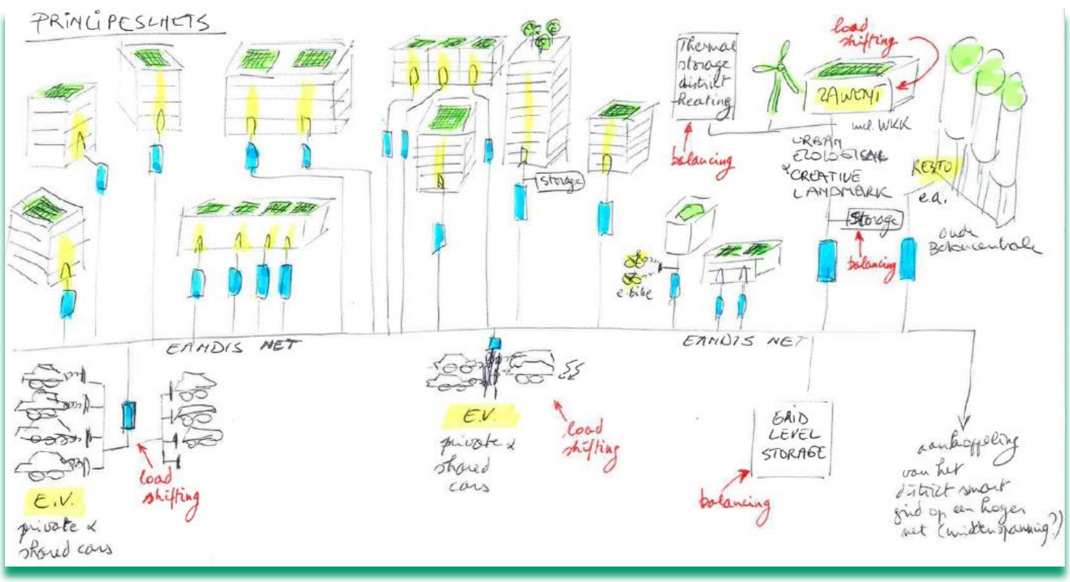
- Smart charging points: software development to allow charging/discharging in connection with tailor made demand from end users.
- Demand side management systems
- Integration systems in the smart grid, platform

Which actions are required in order to come to a full business plan and project proposal and how will you achieve these actions?

Overall software development needs to steer the smart applications, taking into account the different energy producers (PV, CHP, potentially also small wind turbines) and the needs and priorities of different consumers: DuCoop (technical equipment such as pumps, filters, tanks, …), users of charging points (when will they need availability of how many kWh?).

Which additional know-how is still needed to optimally realize this project? Which needs arise/ can be fed back to the regulatory system?

From a technological point of view the mentioned partners have the capacity to develop the project and most know-how that will be generated is on the level of putting technology into practice and integrating different systems. As such, a large parametrization and software component can be expected. Regulatory boundaries may arise.


PRINCIPESCHETS
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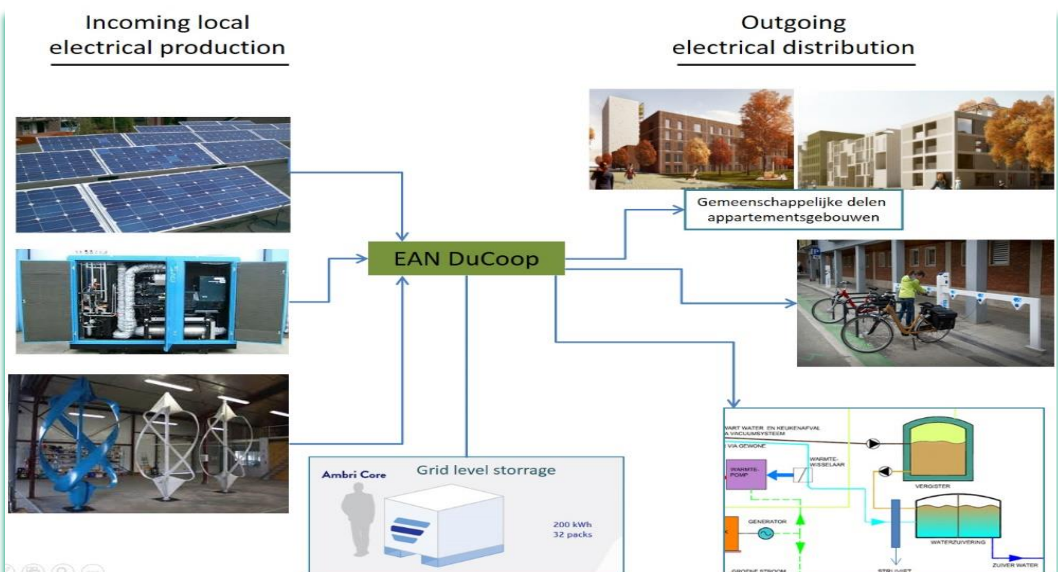

Incoming local electrical production
Outgoing electrical distribution
EAN DuCoop
Gemeenschappelijke delen appartementsgebouwen
Ambri Core
Grid level storrage
200 kWh
32 packs

	Company Name: DuCoop cvba

Description of the legal entity: DuCoop is a cooperative Energy Service Company, created to run innovative sustainable energy and water sanitation systems for the 'Nieuwe Dokken' in Gent. Founding members and current shareholders are Clean Energy Innovative Projects, Schipperskaai Development and Farys. When residents move into the new build district they will also become shareholders.

Turnover: Start up, expected to run about 400.000€ /year after completion.	**Number of Employees: 5 steering group members, 1 bio engineer.**

Relevance to the energy cluster proposal: PARTNER will focus its' participation on the following aspects:

- Operational testing ground for a smart grid
- Creating an innovative business model for peak shaving and optimal use of locally produced renewable energy

How company's profile matches the activities of the energy cluster: DuCoop has a 50 year concession to deliver sustainable services to a new build district of 400 households and a range of small businesses and public buildings (school, sports facility and nursery). Services range from district heating, local water sanitation with nutrient recovery and sustainable electric mobility. A small but dedicated team is committed to integrate a range of innovations and demonstrate financial viability.

Description of the profile of the persons responsible for cluster actions:

Peter De Smet (Male) started his career with retail company Colruyt as marketer and HR officer (training). After several career steps in marketing, sales, communication and project management, he worked 11 years as director of Greenpeace Belgium where he focused on issues related to climate change. In 2009 he started Clean Energy Invest: an investment fund for investments in renewable energy. Today he oversees investments in solar, wind, hydro, biogas, renewable heat and recycling of waste heat. Since 2013 he was the driver behind DuCoop and the cooperation with the project developer and the city of Gent.

Relevant publications (up to 5), and/or products, services (including widely-used datasets or software), or other achievements relevant to the energy cluster:

- Feasibility study on recycling waste heat from public sewers in Flanders (MIP)
- Practical experience and business case for recycling waste heat from public sewers in Leuven (VEA)
- Feasibility study on a Zero Waste Water with Energy and Nutrient Recycling (MIP)
- Business model for Zero Waste Water with Energy and Nutrient Recycling (in cooperation

with Rebel)
Description of any significant infrastructure and/or any major items of technical equipment, relevant to the energy cluster: • PV parks, CHP, grid level storage, Electrical equipment related to district heating, local water sanitation and charging equipment for diverse electrical vehicles (all to be invested as off 2018).

5. Energy Cloud Platform – Presentation of project 'The IoT Energy Cloud Accelerator' (see 4.2.4.5)

The IoT energy cloud accelerator

Project concept

A unifying energy cloud

Energy is one of the major application areas for connected devices and the Internet of Things. Consistently connecting all those – existing and future – devices, servicing them, capturing their dataflow and making it available for value-added applications represents a major opportunity to boost an entire economic sector comprising both advanced manufacturing and high-margin services. The key precondition to success, however, is to develop sufficient scale from the onset.

Flanders can capitalize on its (knowledge) potential in this field if it manages to become a large-scale staging ground for launching IoT applications and end-to-end solutions easily, quickly and decisively. By unifying its fragmented internal market and infrastructure for energy data and services, it can be the area where the commercial validation takes place before blanket roll-outs across Europe are started.

The accelerator for Digital Energy

The IoT Energy Cloud is to become a fixture of the new energy landscape of Flanders. It will be a true accelerator environment, allowing faster introduction of advanced and innovative products and services on Digital Energy. The infrastructure (hardware, software, communication), data usage rights and organisational setup all need to singlemindedly support the mission of being an accelerator with (commercial) value added in the market place.

Realising this ambition requires building a unified/standardized IoT (energy) cloud that

- centralizes, captures and processes data fully automatically at an industrial scale (i.e. billions of datapoints per day). Data will come directly from connected devices or through open, standardized and well-documented APIs that enable the exchange of data and information with vendor-specific clouds.
  All demonstrators in the innovator zones of the Flemish Energy Cluster will incorporate such devices and use the APIs from the onset to turn the energy cloud into the central hub it needs to be.
  Specific attention will go to APIs/continued compatibility with new and existing DSO-systems such as smart meters.

- integrates with systems for the efficient, large-scale rollout, monitoring and servicing of connected devices (i.e. thousands of interventions per day).

- supports scenarios (=use cases, developed by third parties) for creating and using clusters of smart homes, buildings and industrial installations for value-added applications.

- fully guarantees privacy (of individual data), data security and transparency.

Project goals and tasks

The project can be split into four main tasks, each one realizing one of the ambitions set out above.

Industrial-scale cloud infrastructure and interfaces

The scale and ambition of the energy cloud require building upon pre-existing infrastructure to quickly gain both the expertise and the scale needed. The latter is absolutely crucial - there is no point in starting small with a minimal pilot setup. A true accelerator, after all, offers a real-life environment for creating scale and impact.

Efforts will be focused on

- Identifying existing infrastructure and vendor-specific clouds

- Defining the fundamental conditions for data ownership, access, usage and for openness. This includes defining the ways in which aggregate data will be made available (transparently) to third parties for further development.

- Specifying the APIs between the energy cloud and a) individual devices; b) vendor-specific clouds; d) relevant DSO-systems and d) users/developers of applications

- Setting criteria for and selecting providers of the core energy cloud infrastructure.

- Ensuring the connection of (a) each of the demonstrator projects within the Flemish Energy Cluster; (b) as many commercially available IoT devices as possible from device vendors around the globe like cars, solar panels, wind generators, white goods, central Heating systems, … and (c) as many software applications as possible that use of the Flemish Energy Cloud from users like IoT device vendors, software developers, research institutes and service providers like energy providers, energy service providers, telecom providers, insurance companies, security service providers, …

Integration with large-scale rollout, monitoring and servicing

Fast and decisive rollouts of IoT/energy applications requires not only the ICT backbone, as developed in the previous paragraph, but also the capacity to get large numbers of devices into the field quickly and keep them operating at minimal costs. This requires coordination and automation.

Efforts will be focused on

- Identifying existing solutions for supporting large-scale device roll-out, monitoring and servicing
- Defining minimal KPIs for such services to qualify for supporting the energy cloud
- Specifying the API between the energy cloud and the supporting services
- Implementing the interface between the Energy Cloud and qualifying services
- Rolling out connected devices on a large scale in each of the demonstrator projects within the Flemish Energy Cluster. User groups can be a sounding board that helps in finetuning the rollout to the specificities of each demonstrator.

Scenarios for value-added services

The value of the energy cloud is evident through the scenarios that it enables. Those are valuable, but complex use cases, involving several parties and driven by intelligence gained from data from different sources. The aggregated data made available to third parties (as referred to in the first task), are the starting point.

The initial focus will be on scenarios where aggregated data can be used for services at the level of smart homes, buildings and industrial installations. Other services will appear later on, through the inputs from third parties.

Efforts will be focused on

- Defining a scenario revolving around clusters of smart homes or buildings.
- Defining a scenario revolving around clusters of industrial installations.
- Implementing the scenarios
- Inviting/challenging third parties to define additional scenarios, potentially with a broader scope.

Data privacy, security and transparency

The central nature of the Energy Cloud requires a very high extent of attention being given to privacy, security and transparency. In addition to incorporating those aspects in each of the previous task, a separate one is needed to review and update the rules and systems that will be put in place.

Efforts will be focused on

- Reviewing the rules for data access, ownership, usage and for openness
- Reviewing the API-specifications and their implementation
- Monitoring international best practices on data privacy and security, specifically in the field of energy.

Potential

The IoT energy cloud as an accelerator for Digital Energy, has very significant potential both in terms of job creation as in terms of export potential.

General market potential

The global market for IoT in smart homes alone has been growing by 27% annually since 2012 and is expected to continue along this trajectory until at least 2022. Its total market size will reach 240 billion, half of which is made up of services - ranging from installation over servicing and maintenance to monitoring. This brings a wealth of lower and medium-skilled jobs with it, in addition to the high-skilled jobs that are needed for designing, implementing and operating the systems behind the cloud and related IoT.

The presence of a well-functioning, large-scale cloud in Flanders is a major trump card to attract the kind of advanced manufacturing that is needed for integrated IoT solutions (i.e. setups of connected devices).

Belgium, which on a global level is akin to a larger city presents the ideal environment for IoT to take hold). In line with the forecasts mentioned above, the market size could grow to 375 million by 2022 - equivalent to 5000 new, direct jobs.

In terms of export potential the value of having a staging platform for rapid deployment and validation cannot be understated. Both domestic companies as well as international players will use it as their entry point to the whole of Europe.

Given the huge potential of the large-scale energy cloud, we expect the government to be a driving force in advocating, facilitating and accelerating the large-scale nature of it.

Extending an internationally proven concept

Digital Energy – which broadly refers to the dominance of data and ICT in managing and optimizing the entire energy system – is seen as thé main driver of the (r)evolution that is starting to take hold internationally. The need for centralized and standardized cloud environments is clear and has already led to initiatives in several countries. These also surpass the level of mere projects and exist as commercial offerings, sometimes in the shape of new companies.

Two notable examples are the Green Button Initiative in the United States and mPare in the Netherlands. Both focus on making consumers' energy data available to them via centralized portals.

The Energy Cloud extends those ideas to build a true accelerator, explicitely boosting the widely-expected appearance of new products and services built on top of this wealth of energy data.

Targeted companies

A consortium that can make the cloud happen

This project needs to be supported by companies with competences on cloud infrastructure (hardware and software), large-scale rollout and servicing of connected devices; and advanced data analysis for energy management applications.

Within the current line-up of the Energy Cluster, Condugo, Eandis, ESAS, IncubaThor, Niko and Proximus have already indicated strong support to the Energy Cloud Accelerator.

The eventual consortium has to be focused and streamlined to bring the Flemish Energy Cloud into existence. Contributing parties should therefore meet at least the criteria below:

- Endorsing the fundamental concepts of large scale, transparency and interconnection/collaboration that are at the heart of this project;

- Bringing to the table relevant and complementary competences in at least one of the areas/tasks outlined in this document;

- Being prepared to invest time and resources in the collective effort that is required over the medium term;

- Being willing to join the exploitation under a shared business model, both nationally and internationally

Supporting user groups

As outlined before, the Energy Cloud Accelerator will be connected to each of the demonstrator projects of the Flemish Energy Cluster.

To support this connection, user groups can be created, covering the initial focus areas of smart homes; buildings; and industrial installations. This should lead to specific solutions tailored to the needs of each of the demonstrators (e.g. direct connection to the cloud of each of the generic building blocks for microgrids; energy cloud enabled devices for smart homes...)

6. Intelligent Renovation towards Energy Neutral Buildings with building integrated energy storage and productions – Presentation of project “The power backbone for IoT devices – Intelligent low voltage direct current distribution network within a building with broadband data communication capabilities”. (see 4.2.5.4)

Introduction. Europe’s transition to a new low carbon energy economy requires more than switching to renewables. To meet Europe’s goal of generating 80 percent of its energy requirements from renewable sources by 2050, changes will have to be made on numerous levels, from the major European power grids and the distribution networks to factories, homes, and offices.

The potential for change is particularly high in homes and offices. Today, we are living in a digital world, a pervasive computing environment with devices that are almost all 100% DC (direct-current voltage). Looking under the covers, lots of things convert to or from DC, in fact, anything with a logic chip in it is using DC. All of these DC devices require conversion of the building’s 230-volt AC (alternating-current voltage) into DC for use.

Furthermore, an increasing number of buildings are now equipped with rooftop solar panels, which natively generate DC that must be converted to AC to tie into the building’s electric system, only later to be reconverted to DC for many end uses. The same applies to the DC output of the upcoming BIPV solar panels and storage batteries. All these DC-AC-DC conversions result in substantial energy losses because of inefficient rectifiers and adapters. In addition these changes challenge the standard electrical installation practices in terms of installation and materials used.

One solution to minimize these conversion losses is a intelligent DC nanogrid (iDC), which is a safe-to-touch low voltage direct current distribution network within a building that like the Internet, has a layered architecture. The intelligent DC nano-grid not only provides DC power to all types of devices at, say 48 volts but it is also a local broadband data communication network where each socket is interactive instead of passive as they are in a conventional AC system.

Problems, the need and the solution.

Problem #1 : Wasted Energy in AC-DC transmission: According to the Energy Information Agency (EIA), the fastest growing portion of residential electricity use is consumer electronics and small appliances (IoT devices, computers, monitors, LED lighting and other household electronics).

These devices primarily run on DC power; almost all of them uses either external adapters or have their own internal power supply unit (PSU) that converts AC into DC required by the device. Because these adapters and PSUs are usually made of cheap components to mini-mize costs, their conversion efficiency is relatively low – in other words they transform part of the electricity into unwanted heat. Many of these devices have a conversion efficiency of no better than 80 percent and some low-end devices have efficiencies as low as 65 percent in converting power. One estimate says 18 % of all electricity used in the typical home is lost to conversion of AC to DC power to run DC devices. Efficiency improvements in adapters and power supplies are being realised, but part of that gain is lost due to the growth of the number of devices at home."

Problem #2 : Underutilisation of renewable energy: More locally generated renewable energy could be used by introducing batteries and demand side management. Unfortunately, due to the conversion required to use the DC power produced by rooftop solar photovoltaic (PV) and BiPV-panels to AC power to be loaded to the grid, up to a fifth of the system's output is lost at the inverter. The same is true for any battery used to store solar output or provide back-up power in the case of an outage. Furthermore, charging an electric car may involve losing as much as 16% of the energy converting AC power to the DC power to be stored in the vehicle's on-board batteries.

Problem #3 : High utility costs due to inefficient buildings: According to data from the European Commission, buildings are responsible for 40% of energy consumption and 36% of CO_2 emissions in the EU. One of the main reasons of building inefficiency is out-dated electrical installations. By improving the energy efficiency of buildings, EU total energy consumption could be reduced by 6% and CO_2 emissions would be lower by about 5%. Meanwhile, energy costs are always a concern for European households. While spending on energy has risen significantly between 2002 and 2016, households have not seen a com-parable increase in their disposable income. As a result of this, expenditure on household energy is now equivalent to 5.5% of household disposable income for the average house-hold, up from 3.3% in 2002.

Problem #4 : Cost and complexity of structured cabling: In recent years growing data usage is the driver for fast data transfer inside workplaces, which was so far covered by structured cabling. In the same period, high-speed broadband connections started being affordable also for the household.
New emerging IoT / ICT applications, rendering outdated telephone cabling in buildings insufficient for today's needs, while Wi-Fi local networks due to low signal quality often suffers from limited coverage range making structured cabling a need for living spaces. Due to its architecture, which uses the star topology, a structured cabling installation requires a large quantity of cable, making it costly and complicated to install.

The Need. There is a need for new enabling technologies for emerging energy structures (like the IoT ready micro-grids) to modernize the home power grid in line with the evolution of the digital world to ensure affordable energy and a secure local data communications network that may serve as the power backbone for all kind of IoT devices and applications.

The iDC solution. *Matthys&Partners (MaPa)* has worked out the *iDC concept*, an intelligent safe-to-touch DC nanogrid for new and renovated buildings, which integrates power and broadband data communication on a building scale, simplifies cabling and gathers power usage data for local energy management applications outperforming AC energy management tools. The *iDC concept* is not only a power distribution network but also a broadband local data communication network, much like a regular LAN-network. Each wall socket is interactive instead of passive as in traditional AC power installations.

This intelligent DC nanogrid will enable a 30-40% reduction of the overall building energy consumption compared to an AC IoT device home, thus reducing utility bills, greenhouse emissions and upgrading the energy efficiency of buildings.It is especially advantageous for households with or considering a local battery storage and/or Photo Voltaic installation and/or BIPV panels, and/or an electric vehicle charging, since the DC power produced can be directly fed to the loads, with the possibility of isolating from the grid entirely, continuing to supply critical loads in case of a power outage.

The project. The project is being initiated by MaPa, Triphase, Enervalis and Vito-Energyville. The purpose of the project is, along with SME-partners, to jointly design, develop, demonstrate the iDC solution in an operational building and /or a neighbourhood of 20 houses. This includes a full scale (with local energy production and storage) demonstration and deployment of the iDC concept in a real-life environment. The outcome of the life-demonstration is the validation and exhibition the iDC technology and its performance.
The next step is to make the iDC products "manufacturability "ready for manufacturing locally.

Provionally overview of supporting companies:
Companies/organisations eligible to support the project are:

System integrator:	ABB
Socket and App supplier:	Niko-fifthplay
Cable manufacturer/supplier:	Nexans
Energy supplier:	Engie
Grid operator:	Eandis-Infrax,
Building construction company:	Interbuild (BAM)
Building advisory partner:	Dubo Limburg
Telecom operator:	Proximus or Telenet.
Umbrella organisation electrical sector:	Volta

The market potential. Flanders, but also Europe faces the challenge to rennovate a huge part of its current build-ings and construct new ones for those where rennovation is not appropriate. The iDC con-cept provides an enabling technology for a modernised home power grid, which will provide the foundations for various home innovations, serving and stimulating the growth of home battery and IoT home energy services markets.

The primary end user of iDC solution is the residential building construction industry. This industry is focusing on making a profit while having a negligible (or even a beneficial) impact on the environ-ment. For a large part due to the high demands of EU regulation and national governmental incen-tives. Key for their decision-making is the total cost of ownership (TCO), because more of these build-ings companies will take operational support and maintenance engagements towards their end-customers (e.g. building cooperation). The iDC solution offers better TCO and longer operational life-long engagement for their customers.

Initially the iDC project partners will focus on the construction industry in the Netherlands and Belgium, and then through the established relationship expand through these channel partners on European scale. Keeping in mind that iDC is an early technology it will enter a whole new market segment. Based upon market research by the partners the potential market (2020-2030 period) for new and renovated buildings is estimated at 1,5 million for the Netherlands and 0,9 million for Belgium.

The iDC current main potential clients are for the Netherland the Royal BAM Group, Volcker-Wessels and Heijmans and for Belgium Interbuild and Dublo Limburg and associates.

Competition. The iDC technology is a new technological solution for which no alternatives are on the market. The main difference to all other available solutions is that the iDC solution is an open network, which will allow other potential providers to build applications on top of the network.

The main solutions by players in the industry claiming to be close to an integrated solution are compared to iDC in table below.

Competitor branch	Competitor's Name & Solution
DC net	Pica-Schneider-Emerson: This is a closed network, is static and without any flexibility for any further energy savings applications. Compared to the iDC solution there will not be any extended energy savings possible. Furthermore no proactive communication for data exchange is possible.
Power-over-Ethernet (PoE)	Cisco systems, PowerDsine: Allows IP telephones, wireless LAN access points and other embedded computer alliances to receive power and data over existing CATS and LAN cabling. The power supply is 50VDC and the power capacity is limited to 100W, which is well suited for LED lighting and small consumer devices like smart phones. Big disadvantages are the limited power capacity and more complex cabling (star network)
Power-over-USB	Comparable to PoE, with power supply of 5VDC (20V) and power capacity of 100W. Due to the low power supply, high current is needed (e.g. 20A for 100W!) and therefore cable losses are high.

Pica Energy is the closest with iDC in terms of architecture, but it uses 380Vdc voltage, which is not as safe for inhabited spaces as the low-voltage iDC. It is a proven fact that the higher the voltage, the higher the possibility and severity of an electric shock. The more advanced management options from competitors belong to Schneider Electric's solution, but this is still an AC microgrid, so the disadvantage of power conversions remains.

iDC is obviously the only microgrid solution operating with DC voltage and integrating all the state of the art building energy management and smart grid functions, such as demand-response (interaction with utility operator), demand management (turning off non-critical loads at peak time), tariff management (selling energy when tariffs are more favourable), VPP creation by joining several buildings on the same network etc.

Developments over time. It is the intention to form an industrial alliance which will include energy grid operators (DSO), building companies and product and application developers.

Once the iDC is introduced in the European market, it will enable an eco-system to evolve around it. Making iDC an open standard, value co-creation can be achieved by several stakeholders developing applications around it. For example, Enervalis intend to leverage their software development expertise to develop an electrical accumulation heating system that integrates perfectly with the iDC, taking measurements from multiple interactive nodes in each room and using machine learning algorithms to optimise temperature and humidity conditions. Other plans include leveraging the multiple measurement points offered by the iDC to develop a person localisation software offering assistance for mentally disabeled people.

7. Intelligent Renovation towards Energy Neutral Buildings with building integrated energy storage and productions – Presentation of project "CO-UP (Collective Upgrade Projects)"

The following proposal is more of a generalized description of a potential project idea coming from a few building companies, active in project development and production of components and installations, who are now in the process of engaging with several knowledge institutes and local authorities.

The overall intention of this project is to overcome a lack of comprehensive knowledge about how much energy flexibility different building types, in this case target buildings are collective residential building with a focus on social housing, and their usage may be able to offer in future energy systems (IEA task 67). This energy flexibility is not only offered by integrating new types of installations, but also building components and building techniques have a major influence on the energy performance of a building. There are already several projects and living labs (see further in project proposal) going on on single family houses and collective residential buildings and it is the intention of using the (preliminary) results of these projects to further upgrade and to specialize this on a very specific type of housing with a very typical usage. In this respect social housing demands the implementation of techniques in very different ways as is the case in owned properties resulting in e.g. more centralized control systems.

Some members of the consortium are still in the process of seeking engagement. The project also involves several building sites, since implementation of Best Available Techniques requires several testing grounds. Finding these project development sites requires the interaction with and the engagement of local authorities. The consortium needed for the execution of such a project is therefor quite large and consists of several different kinds of organizations. It was not feasible to form the project consortium with all the right partners in the available limited time frame.

Also, it is the intention of using these testing grounds as living labs for the (preliminary) outcome of several other projects, conducted within other innovation zones of this cluster. The fact that any implementable results from the other innovation zones are not yet readily available for this project, justifies partly the incompleteness of concrete leads in this proposal.

It is however the intention of landing with this by the end of 2016. The involved companies will have at that time project development sites, the engagement of the local authorities and the knowledge institutes, the best available techniques to be tested and leads from other innovator zones to start working on.

Title of the project	CO-UP (Collective Upgrade Projects)
Contact person:	To be determined
Innovator Zone	Buildings
Which change in the energy system is addressed and how is it demonstrated?	

40% of the total final energy use in the EU is used in buildings, 2/3rds of that is situated in residential buildings and 70% is due to heating and cooling, the highest percentage of all the OECD subregions. Fossil fuels directly and indirectly form the primary production sources. A direct strategy to reach **deep energy and emissions reduction** is, among others, through applying a combination of best available technologies and new techniques on renovation of buildings both **in the building envelope as in its building components, in space heating and cooling systems, in relighting and in use.** With a rate of new construction of about 1% annually, the main contribution towards ambitious energy efficiency targets will need to come from **renovation** projects. The existing building stock, all typologies from residential to tertiary buildings, has a long term potential for saving energy. The impact of renovating **the existing building stock** also contributes to a major enhancement in energy-efficiency, since this stock is outdated and predates for a major part any energy-efficiency regulation. Also large fractions of the existing building stock are **collective residential buildings, among which social housing**. This lighthouse project addresses the deep renovation of these specific types of building and demonstrates the best practices in techniques, financing and management leveraging on the similarities of the individual dwellings in collective estates. The aim is to provide an energy flexible building stock of social housing with a minimal impact on the energy system.
How does the proposed energy system relate to other international lighthouse projects and how can the products and know-how resulting out of the project be valorized?

Overall one has **IEA task 67** which relates to the EU SET initiative on deep renovation. Energy flexibility in buildings will play an important role in facilitating energy systems based entirely on renewable energy sources. Flexibility is necessary to control the energy consumption to match the actual energy generation from various energy sources such as solar and wind power. However, there is lack of comprehensive knowledge about how much energy flexibility different building types and their usage may be able to offer to the future energy systems. The aim of IEA task 67 is to initiate research projects and lighthouse projects in European member countries and provide them with a dissemination platform. The knowledge is shared with all members. It is the intention, since Belgium is represented in this IEA task, to present the findings of this lighthouse project to al European members within this task 67 consortium thus providing a strong gateway for Belgian companies to international marketing opportunities. On the other hand knowledge input and a view on new trends is determining for a quick launch of a qualitative lighthouse project. Projects such as the EU-FP7-**Concerto project Eco-life**, the **H2020 Rennovates** project with Flemish (e.g. EnergyVille and Enervalis) and Dutch partners focusing on the "Stroomversnelling" project with 100.000 renovations with '**0 op de meter**' dwelling. Germany, France and the UK have similar projects focusing on upgrading specific estates. In Flandres, too, the '**kennisplatform woningrenovatie'** is currently demonstrating and will be monitoring 10 different approaches to accelerate the rate of renovation with new or existing building techniques and installations, 4 of which focus on collective buildings, These living labs in which the industry is strongly involved form an ideal platform for further innovation in products and services and the upscaling from family housing to larger buildings and the lessons learned will be implemented on a larger scale in this lighthouse project. An additional benefit of upgrading collective residential buildings is that it makes them attractive locations for energy grids and district heating/cooling projects which would allow this project to link with projects in the other innovator zones. Within the same innovator zone, other project consortia can use this lighthouse project as a testing ground and living lab. These projects typically need a large alpha customer to be able to offset the initial investments. Due to the volume it represents and the associated scale effects, the lighthouse project can also help to overcome the market failure that trumps the adoption of and investment in R&D for building materials and HVAC. Within this lighthouse project focus will be on social housing or housing for low income since this presents an extra challenge on use and behavior and financial restrictions. If classic public tendering procedures are followed, social housing authorities would issue tenders to contractors, who would then order what is available from manufacturers today. The social housing estates will be renovated, but the tight budget and non-specific products will reduce the impact of these renovations. By using new systems for large scale deep renovations the cost and rate of the renovation can be enhanced with a considerable long term energy reduction as main target. In addition the combination of materials and energy use should be investigated for the commercial breakthrough. The main set-up is to realize within 3 years a zero energy house renovation by Flemish contractors and within a 15% budget top-over compared to traditional BEN buildings. After 3 years, training courses will be set up in order to teach utility constructors to handle the new techniques.
Which companies and other organizations are present inside the supply chain and which role do they play?

The supply chain for a coordinated action towards social housing is still complex: - local housing authority (e.g. De goedkope woning, Kortrijk; Woonhaven, Antwerpen, Stad Gent, Genk, Mechelen, Leuven) typically take the lead in the project, here the link with a network of Flemish cities is essential to pick the most appropriate site or combination of sites. - local government: urban planning and social services (OCMW) needs to approve the project and collateral infra - regional housing authority (VMSW) needs to provide the budget when relevant - regional governments (Vlaamse regering): this implies additional challenges such as social housing budget/rules and public tendering - Contractors (typically up to 20 different (sub)contractors for 1 project) need to execute the renovation - Building material/HVAC manufacturers and smart home product suppliers provide (bespoke) products - Architects design the project - Engineers check the performance - Utilities and DNC's (e.g. Engie, EANDIS, Infrax) provide additional budget through subsidies and grid connection service options Although the new construction market has shifted towards high energy performance buildings over the last 10 years, the small scale of individual renovation projects entail high costs for project design and limit the ability of manufacturers to provide affordable products for renovations. Drawing together a group of leading producers and social housing authorities in this lighthouse project overcomes this.
Describe alternative approaches to realize this lighthouse project.
Strict regulations will in time result in new, fast and affordable renovation systems since market tends to shift towards consumer needs. These consumer needs will be steered by regulative authorities. A considerable lagging period has to be taken into account since authorities need time to develop and implement the new regulations, followed by a relative slow consumer response on the new building criteria and finally the market to respond with new systems, products and services. Especially the latter will take considerable time when no testing grounds for the industry are available, with expensive and time consuming trial and error based testing performed by individual companies with limited integral knowledge.
Which technological/economical/regulatory advancements need to be taken in order to realize the lighthouse project? How do they relate to the current state of the art in Flanders/worldwide?
The lessons learned from the 'proeftuin' projects are: - the current financing mechanism and rules for budget allocation that social housing companies need to work with restrict the capabilities of social housing authorities to tackle their estates coherently - budget caps and rents that are not related to energy performance trump the ambitions of the local housing authorities and lead to suboptimal renovations - public tendering rules make it extremely difficult to involve contractors and manufacturers in the planning stage of a project. Pooling different projects and providing open market and technical analysis on that pool of upcoming projects will help overcome the disconnection between these parties described above. Also previous smart cities projects as STEP-UP and ECO-District provide input for this. Limited experience with this kind of setup has been gathered in Flanders through FedESCO and group tenderings for fuels and solar panels. In The Netherlands the pooling included in the 'nul op de meter' project leads to a considerable leap forward in the specification of prefabricated building envelopes and HVAC systems. In the UK, pooling of cavity wall insulation actions lead to a series of technical break throughs and considerable overal cost reductions.
Which actions are required in order to come to a full business plan and project proposal and how will you achieve these actions?

- Social housing authorities need to participate by providing details about their estates in need of renovation

=> we have contacts with a number of local housing authorities (in different Flemish cities), and the ambition first step is to bring a number of leaders in these authorities together to define their options

- The regional social housing authority, in collaboration with the regional government, needs to provide the tools to make a coordinated action on collective estates possible: suspend some of the restricting rules on budget allocation, provide legal council for the development of standardized tender documents as an outcome of the pooling activity

=> Lobbying with the administration of the regional housing authority and competent authorities

- Local governments need to coordinate their infra activities with the plans of the local housing authorities and provide fora that allow to fan out the collective upgrade to other local stakeholders

=> Involve local governments of the local housing authorities

- Manufacturers need to be provided with a framework that will allow them to generate a return for their engagement in and contribution to the pooling activity that is compatible with public tendering rules

=> a number of brainstorming sessions on how this could be achieved

- The pooling activity needs to be fed with input from academia and research bodies (EnergyVille, Ghent University, WTCB, Pixii) to come to technically acceptable solutions and products. These parties also need to provide validation of the performance of the lighthouse project.

=> EnergyVille, Ghent University, VCB and Pixii currently have a number of research projects that deal with topics directly related to the issues raised in this proposal. These can be pooled and shared with the parties involved in the lighthouse project.

Which additional know-how is still needed to optimally realize this project? Which needs arise/ can be fed back to the regulatory system?

The main know-how still needed is how to maximize scaling effects. This will at the same time be the feedback to the regulatory system:

- what are the effective performance and cost gains achieved through the scaling up
- what performance checks are the most useful and cost effective in collective estates (as opposed to individual projects)

Annex 5 :

governance

Contents

General Assembly

Role

Represent the different stakeholders of the cluster

Responsibilities

1) Appoint Board of Directors

2) Represent the shareholder visions

3) Discharge of Board of Directors

4) Approve changes to the statutes of the organizations

5) Approve yearly accounts

Composition

- All members (companies/research centres and federations) at valorization level have voting rights

- All members (companies/research centres and federations) at business level without voting rights →observers

- Government or public agencies representatives/ bodies without voting rights →observers

Frequency (at least) Once a year

Board of directors

Role

Ensure a coherent strategy and governance for the cluster

Responsibilities

1) Recruit, supervise, retain, evaluate and compensate the manager

2) Provide direction for the organization. →determine, adapt and guard the strategic orientation of the organization (vision, mission, strategic plan)

3) Establish a policy based governance system.

4) Govern the organization and the relationship with the CEO.

5) Fiduciary duty to protect the organization's assets and member's investment.

6) Monitor and control function (KPI's).

7) Approve all contracts with the government and public agencies/authorities (e.g. subsidies…)

8) Approve all decisions on grants to companies

Composition

- nine companies of which one is coming from each of the innovator zones, one of these is elected as chairman, care is taken to reflect all membership levels and company sizes

- two representatives from the scientific partners

- two representatives from member federations

- two representatives from the DSO's

- one representative from the government = observer

- general director (without voting rights)

Frequency (at least) 4 times a year

Management team

Role

Ensure an effective and efficient execution of the operational activities within the cluster

Responsibilities

1) daily co-ordination of the cluster organization activities

2) monitoring of the progress within the cluster

3) contingency planning

4) process management

5) preparation of all information to the board of directors

6) discussion HR-issues

7) preparation of reports to the Flemish government

Composition

- CEO
- Each of the innovator zone managers
- Each of the business facilitators

Frequency Each week

Steering Committee

Role

Ensure consistent operations across all innovator zones and between innovator zones and stakeholders (universities, federations, …)

Responsibilities

1) Detect common ground across innovator zones

2) Identify and resolve gaps in knowledge needed to ensure proper operation of the zones

3) Identify and propose synergies with planned and running research activities

4) Ensure consistency across innovator zones

5) Share best practices

6) Maintain a general roadmap across all innovator zones

Composition

- CEO
- Each of the innovator zone managers
- A representative of each of the relevant external stakeholders including knowledge centers

Frequency Once a month

The energy cluster will be built upon the existing people and experience of Smart Grids Flanders and additional competences will be attracted as soon as the cluster comes into operation. Three people active inside Smart Grids Flanders will however be co-ordinating this growth.

Back in 2011, Frederik Loeckx was one of the founding fathers of Smart Grids Flanders. After working for 6 years as project leader and country leader in a security software company, Frederik worked for 4 year as innovation advisor at the Flemish government. He specifically helped SME's realising innovation projects through ameliorating their processes, partner them with other organizations when expertise was lacking and helping them to attract funding. After 4 years, Frederik became one of the founders of Triphase, a spin-off producing research equipment for the niche of energy systems research (battery coupled systems, electric vehicles, power hardware in the loop simulators, …). Through organic growth, Triphase grew to 17 people with a customer base worldwide from Chile to Japan, Singapore, … As CEO of Triphase, Frederik was one of the founders of the Smart Grids Flanders and is still representing Triphase in the Board of Directors of Smart Grids Flanders. From within the board of directors, Frederik was one of the striving forces behind the cluster proposal. From June 1th, Frederik was appointed general director of Smart Grids Flanders and is working dedicated to the realisation of the energy cluster.

Before Frederik joined Smart Grids Flanders, Heidi Lenaerts was the general director of Smart Grids Flanders. After being responsible at the university of Leuven for one of the first pilot projects on smart meters in Flanders, she joined Smart Grids Flanders in 2011 and built up a considerable network in the Flemish energy sector. She gained considerable expertise in organising events and schools as well as organising brain storm events in the area of innovation. Inside the cluster; Heidi will continue this task, leading one of the innovator zones within the cluster.

Natacha De Brouwer was the second employee of Smart Grids Flanders and is taking care of the back-office and administration of Smart Grids Flanders. She will continue to do so also for the cluster.

Next to these three people, several people already showed interest in working for the energy cluster. These contacts will be taken up again as certainty on funding for the cluster is given.

Management Committee innovator zone

Role

Daily management and coordination of the activities within each innovator zone

Responsibilities

1) daily co-ordination of the innovator zone activities

2) monitoring progress within the innovator zone

3) contingency planning

4) detect and discuss mutual interests across participants/projects

5) provide information to the management team

6) discuss new potential projects and funding opportunities

Composition

- Innovator zone manager
- Representative from each of the projects running in the innovator zone programme
- Where relevant scientific partner(s)

Frequency Each two weeks

Industrial Advisory Board (when applicable)

Role

Provide objective advice to the management team and board of directors on general cluster issues, including funding decisions from an industrial point of view (valorization potential)

Responsibilities

- Investigate and score innovator zone project proposals requesting cluster specific funding
- Share insights on general tendencies in cluster management
- Share insights on best practices in business modelling
- Investigate mutual co-operation

Composition

- CEO of the cluster
- Representatives from international federations and organizations active in the energy sector

Frequency ad hoc

Scientific Advisory Board (when applicable)

Role

Provide objective advice to the management team and board of directors on general cluster issues, including funding decisions from an academic point of view (state of the art)

Responsibilities

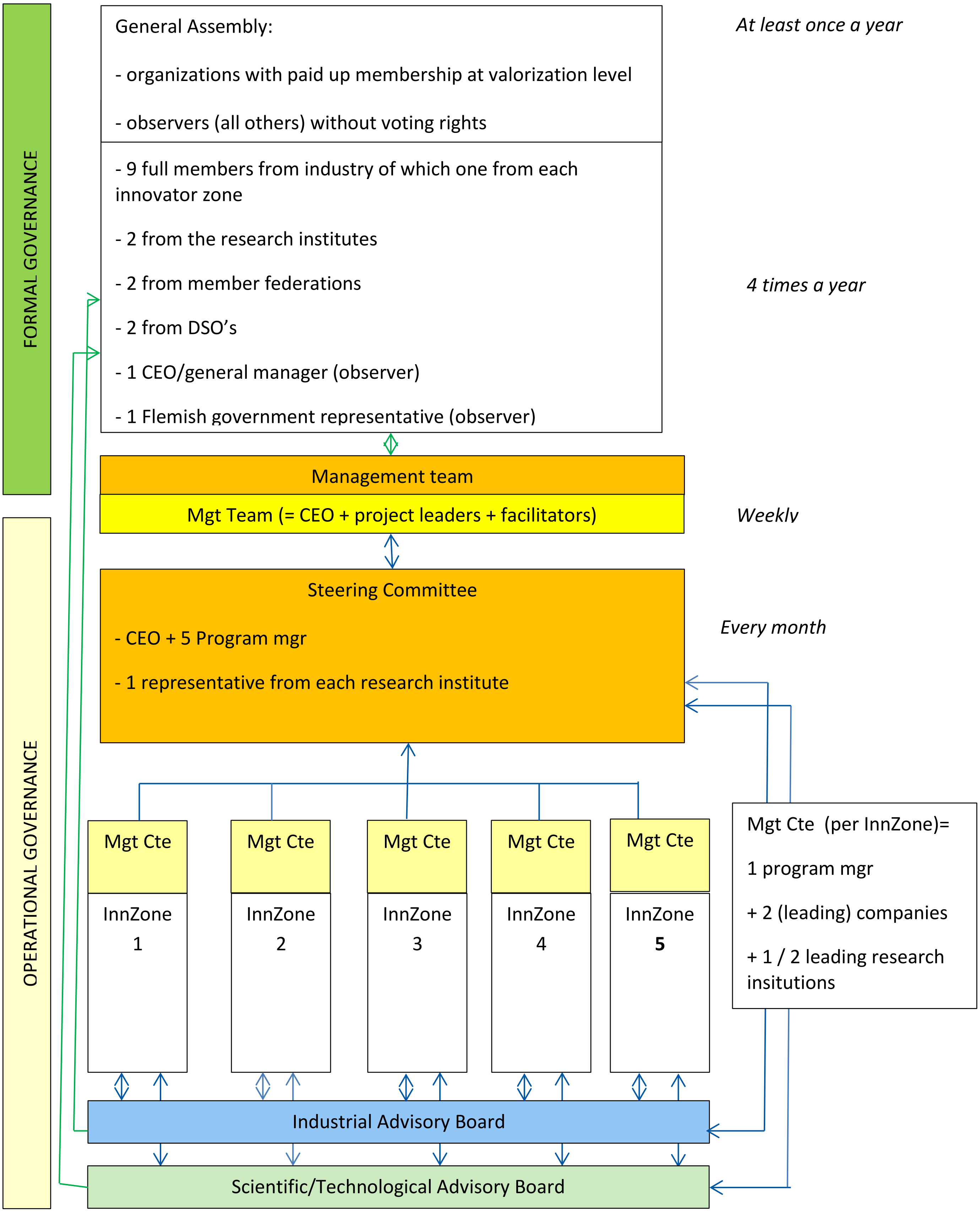
- Investigate and score innovator zone project proposals requesting cluster specific funding
- Share insights on general technological tendencies
- Investigate mutual co-operation

Composition

- CEO of the cluster
- Representatives from international federations and organizations active in the energy sector
- Representatives from the research organizations active in the cluster.

Frequency

Governance structure



Annex 6 :

project selection

The Energy Cluster will be responsible to govern the specific cluster allocated financial means, available next to the operational budget. For the first three years, the Energy cluster wants two govern two specific financial resources:

- Co-financing budget for international programmes such as Interreg
- Long-term financing for close to the market innovation trajects (TRL 5-8)

Co-financing budget

In order to operate in the Interreg environment and position the cluster in an international ecosystem, a form of cofinancing is always asked for. The budget will be allocated by the cluster itself based on the specific needs of the innovator zones. Yearly, the aim is to engage in two major or three smaller infrastructure projects, spread over the innovator zones.

Close to the market innovation trajects

Bi-annually, a call will be launched for close to the market innovation projects with a duration period of five years, demonstrating the integration of different technologies and products in real life cases. The projects will be realised in a 0.5-1.5-2-1 scheme. After 2 years, a review involving an international panel will be organised in order to assess the progress, decide on further financial support and make suggestions for the next two (or one) year (s). Each period will have its own focus:

- The first half year will be dedicated to business plan generation. Each Innovation traject starts with a so called Work Package 0 (WP0). This is a feasibility study dedicated to the analysis and development of the business opportunity. Such analysis will have to be defended in front of a thematic field assessment committee which, at a formal gate review, will determine if the project can continue or not receiving funding. Those projects not succeeding at the gate review will be cancelled. The funding allocation for the WP0 is limited to a maximum of 50 kEURO. If there is a need for a higher funding this should be explained specifically.

- The following 1.5 years will focus on the realisation/adaptation of the products of the different companies, creating one comprehensive system together with an enhanced business plan on the exploitation of the projects, providing more focus on the provision of an integrated valorisation traject of the project.

- In the next two years, the focus will be twofold. First part of the focus is on demonstration in real-life circumstances and with real-life customers. This also involves assisting the cluster association itself with dissemination of the results and infrastructure to both local end users as international partners that could have an interest in collaboration on the infrastructure. The second focus is on assessing the business plan based on the learning the demonstrator. At the end of this stage, a shared marketing and valorisation plan is expected which will form the basis for the second evaluation

- In a last phase, dissemination will take place based on the marketing and valorisation plan, agreed within the previous project step, along with final fine-tuning of the products and removing the hurdles coming out of the assessment within the living labs. These activities might for example also involve the creation of joint training plans and training certification. This last step will only last one year.

The selection procedure will based on existing procedures such as the one from the KIC-Innoenergy. Some general principles:

- The grant decision will be approved by the Energy Cluster based on advice from external assessors. To this extent a scientific and industrial advisory board will be put into place with international members external to the cluster or its members.

- In order to facilitate the selection process, the assessment providing access to 50kEuro support in order to perform feasibility studies, business plans as well as prepare the full application, will be made by the Board of Directors.

- The selection process will be carried out whenever possible in a single stage procedure in order to enable a swift decision within a 2 months' timeline

Each innovator zone is expected to represent projects of 2.5 MEuro yearly, leading 12.5 MEuro in general. On the long run, the financing is expected to come 1/3 from Industry, 1/3 from local and 1/3 from the local government.

The calls will never be launched without consultation and approval by VLAIO.

Annex 7 :

IP model

Traditionally, IP models have been focussing on both pre-competitive as competitive phases. Models have been created (e.g. IMEC programmes) for the specific nature of pre-competitive collaboration between companies and research centres. This typically involves the creation of shared foreground pools to which all participating organisations have access in order not to hinder the commercialisation of the products resulting out of the shared foreground IP. In addition, the research centre also ensures Freedom to Operate in order to conduct further research based on the IP it generates insides its different research projects. Eventually, IP can be protected in a way of shared patents with royalty-free and transferable access to the partners participating in the programme.

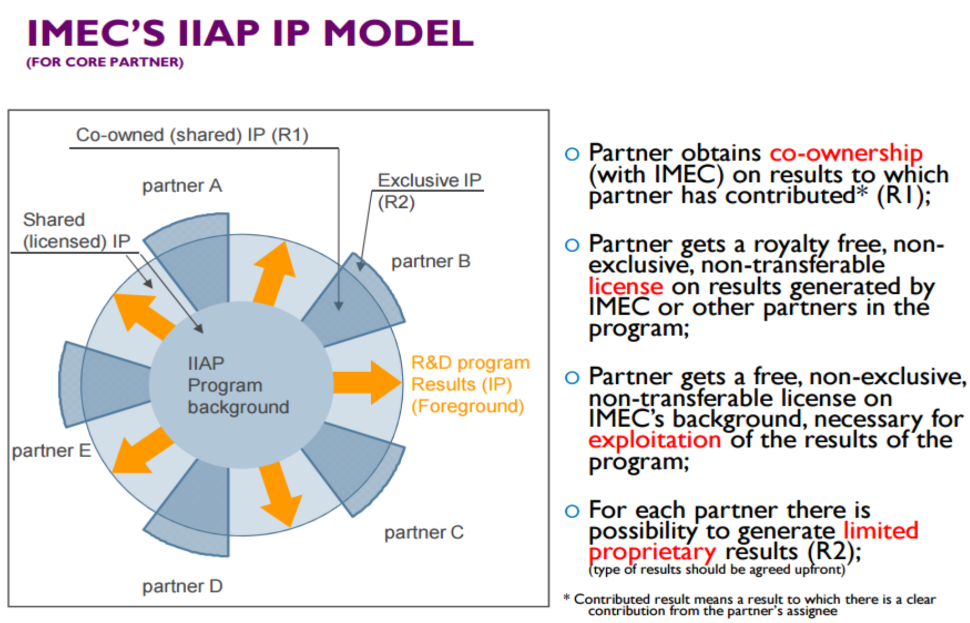


Figure: IMEC IIAP IP Model

In contrast, in the competitive phase, IP is seen as a prime asset protecting the specific features of the product resulting out of the research. In this case, valorisation of the IP for other entities (including the research organisations) is blocked.

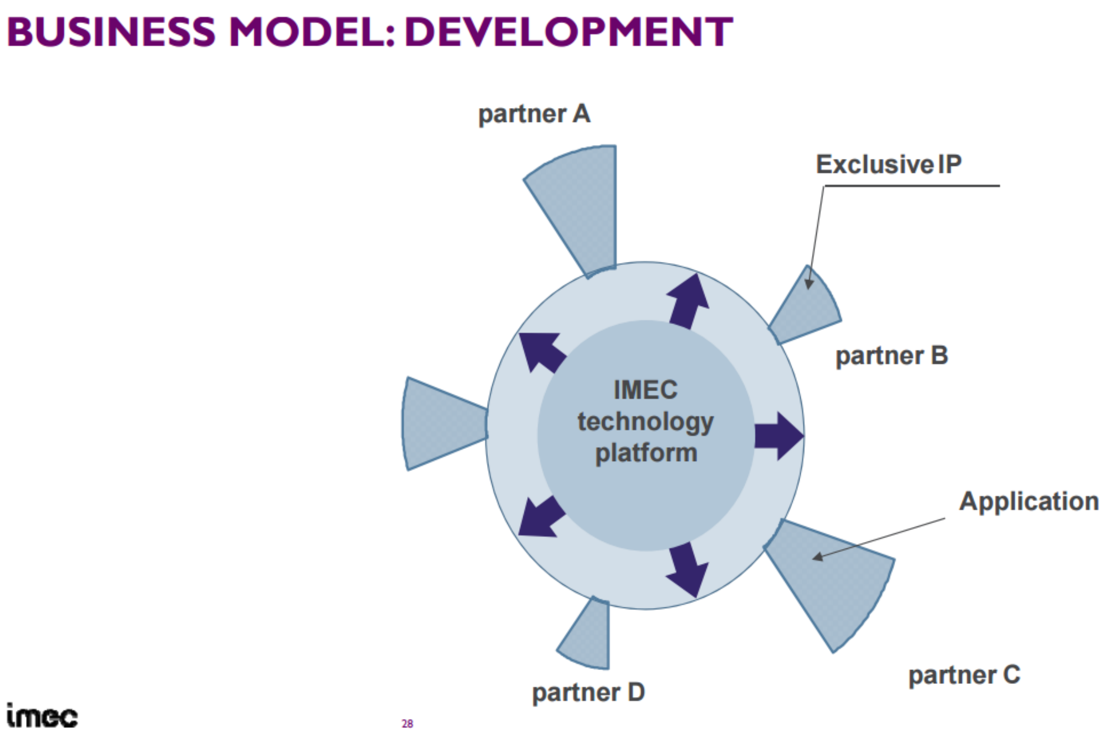


Figure 1: IMEC IP Model – business development

With the integration challenge becoming more and more complex, essential know how is needed on how to create and demonstrate a working system out of different energy components. This IP is typically difficult to protect formally and is protected as company secrets. However, this know-how is becoming valuable and integration companies are turning this know-how into economical value. One can observe however that this know-how becomes difficult to build up and also becomes essential for product companies in order to achieve competitive advantages over competitors.

As such, there is a growing need, both from the viewpoint of integrators as producing companies, to create an IP model for this integration know-how. While on the other side of the innovation and valorisation chain compared to the precompetitive phase, the nature of knowledge sharing and IP creation is very comparable. The different actors in each of the innovator zones face the need to create shared know how on integrating products and on creating business models to put the system into the market. This know-how is crucial yet not the prime focus of the different companies.

In the first half year of the cluster operation, the IP model will be reflected upon the same philosophy as the pre-competitive models and will be used throughout each of the innovator zones.

Special care will be taken in order to agree on the access conditions to the infrastructure used within the cluster and the infrastructure resulting out of the projects performed within the cluster to assure fair conditions in view of both the demonstration and valorisation of the results as well as to ensure compatibility with the European rules concerning state aid.

Annex 8 :

project budget according to VLAIO format

Kostenstaat aanvraag : Smart Grids Flanders

Projectgegevens	
Projecttitel:	Energy Cluster
Projectnummer (indien gekend):	
Naam organisatie:	Smart Grids Flanders
Contactpersoon voor bijkomende informatie (naam, telefoonnummer en emailadres):	Frederik Loeckx, +32 485 801 252, frederik.loeckx@smartgridsflanders.be

PERSONEEL
(organisaties die werken op basis van marktverloning)

Werknemers (w), werknemers met variabel loon (wv), onbezoldigden (o) en factuerenden (f) (1)

Personeel		Jaarlijks brutoloon of jaarlijkse kost (€)(2)			Extralegale voordelen (3) *zet "x" indien van toepassing*						in te zetten mensmaanden op het project				**Personeelskost op het project (€)**
Naam of personeelscategorie	Code (1)	Jaar 1	Jaar 2	Jaar 3	bedrijfswagen	woon-werk	maaltijdcheques	Hospitalisatie	groepsverzekering	toeslag	Jaar 1	Jaar 2	Jaar 3	totaal	
Algemeen directeur	w	60 000	60 600	61 812	x		x	x	x	1,67	12	12	12	**36**	**304 628**
Projectleider Innovatorzone Energiehavens	w	48 000	48 480	49 450	x		x	x	x	1,67	12	12	12	**36**	**243 702**
Projectleider Innovatorzone Microgrids	w	48 000	48 480	49 450	x		x	x	x	1,67	12	12	12	**36**	**243 702**
Projectleider Innovatorzone Multi-Energynetworks	w	48 000	48 480	49 450	x		x	x	x	1,67	12	12	12	**36**	**243 702**
Projectleider Innovatorzone Intelligente renovatie	w	48 000	48 480	49 450	x		x	x	x	1,67	12	12	12	**36**	**243 702**
Projectleider Innovatorzone Cloud	w	48 000	48 480	49 450	x		x	x	x	1,67	12	12	12	**36**	**243 702**
Eventmanager	w	36 000	36 360	37 087	x		x	x	x	1,67	12	12	12	**36**	**182 777**
Secretaresse	w	30 000	30 300	30 906			x	x	x	1,64	12	12	12	**36**	**149 578**
Facilitator KMO	w	48 000	48 480	49 450	x		x	x	x	1,67		12	12	**24**	**163 542**
Facilitator Internationalisatie	w	48 000	48 480	49 450	x		x	x	x	1,67		12	12	**24**	**163 542**
Facilitator business modellen	w	48 000	48 480	49 450	x		x	x	x	1,67		12	12	**24**	**163 542**
										1,00				**0**	**0**
										1,00				**0**	**0**
Subtotaal											**96**	**132**	**132**	**360**	**2 346 122**

1. De kolom ‘code’ moet ingevuld worden met 1 van volgende codes. Velden die niet relevant zijn voor een code zullen grijs kleuren, d.w.z. niet in te vullen.
w: voor projectleden met een werknemersstatuut
wv: voor projectleden met een werknemersstatuut die een variabele verloning ontvangen. Deze variabele verloning mag bij het brutoloon geteld worden en moet in de tabel hieronder toegelicht worden.
o: (onbezoldigde) voor projectleden die zichzelf geen loon uitkeren.
f: voor projectleden die gefactureerd worden. Deze categorie moet in de tabel hieronder toegelicht worden.
Bedrijfsleiders die zich een loon laten uitbetalen vallen ook onder deze categorie. Onder jaarlijks loonkost wordt verstaan (i) het loon zoals vermeld onder vak 9 van de fiscale fiche 281.20 en (ii) de sociale lasten. Voordelen mbt groepsverzekering/aanvullend pensioen, huisvestingskosten, auto,...worden door het Agentschap Innoveren en Ondernemen niet aanvaard als personeelskost vermits deze aftrekbaar zijn in de vennootschapsbelasting. Enkel en alleen als deze voordelen belast worden als voordeel alle aard (en aldus vermeld op fiche 281.20) zijn deze aanvaardbaar als personeelskost.
2. U vult het factuurbedrag in, of de jaarlijkse brutoloonkost. Het jaarlijks brutoloon is de kost van 12 maandlonen, excl. vakantiegeld en 13de maand. De kost moet steeds worden uitgedrukt als een 100% tewerkstelling. Dit kunt u doen door de reële kost te delen door het tewerkingstellingspercentage van uw arbeidsovereenkomst. Dit is niet de bezettingsgraad op het project ; deze wordt opgegeven in de kolom 'ingezette mensmaanden op het project'.
Een voorbeeld : X werkt deeltijds (50%) en zijn brutoloon = 2.000 EUR/mnd. Dan wordt de totale jaarlijks brutoloon = (2.000*12)/50% = 48.000 EUR.
Indien deze persoon voltijds op het project werkt (=bezettingsgraad), moeten er jaarlijks 6 mensmaanden gerapporteerd worden.
3. Andere extralegale voordelen dan vermeld in deze tabel worden niet aanvaard. De combinatie woonwerkverkeer en bedrijfswagen is niet mogelijk.

Toelichting bij de Personeelskosten

toelichting variabele verloning:

toelichting medewerkers op factuurbasis (langlopend engagement, nood aan en omvang van overige kosten):

Andere:

OVERIGE KOSTEN (directe en indirecte kosten)				
INDIRECTE overige kosten				
Personeel	mensmaanden	mensjaren	indirecte kost / mensjaar (€)(4)	**indirecte kost (€)**
totaal	360,00	30,00	20 000	**600 000**

4. Standaard wordt in dit veld het maximum van 20.000 EUR voorgesteld. Indien men echter verwacht dat deze kosten lager liggen, moet dit bedrag gewijzigd worden

DIRECTE overige kosten				
Geef de totale directe kost (€):				**469 224**
Bij projecttypes, georganiseerd in oproepen, vragen wij u in onderstaande tabel deze directe overige kosten verder te specifiëren.				
Omschrijving	kost (€)	afschrijfkost (€)(6)	bezettingsgraad (6)	**ingebracht (€)**
				0
				0
				0
				0
				0
				0
				0
				0
				0
				0
				0
				0
Totaal				0

6. Het afschrijfregime komt overeen met de eigen boekhoudkundige verwerking. Indien het materiaal niet wordt afgeschreven moet de kolom afschrijfkost en bezettingsgraad niet worden ingevuld.

Controleberekening maximaal inbrengbare DIRECTE overige kosten (5)	
mensmaanden personeel	360
mensjaren	30
max. overige kost/mensjaar (€)	40 000
berekende max. overige kost (€)	1 200 000
verminderd met indirecte kost (€)	600 000
berekende max. DIRECTE overige kost (€)	600 000
De totale in te brengen overige kost (direct + indirect) is aldus :	**€ 1 069 224**

5. Deze tabel berekent de maximale overige kost op basis van 40.000 euro per mensjaar.

Toelichting bij de overige DIRECTE kosten
Indien gewenst kan u hier de directe kosten verder toelichten. Een belangrijk onderdeel van de activiteiten ondernomen in de cluster bestaan uit het organiseren van verschillende event in het kader van disseminatie. Als we uitgaan van een gemiddelde historische kost van 2500 Euro per event, 26 events per jaar, en dit drie jaar lang, betekent dit reeds een directe kost van 195 000 Euro.

GROTE ONDERAANNEMINGEN (vanaf 8.500 euro excl BTW)				
Naam van de onderaannemer	Omschrijving	kostendriver (aantal mensmaanden; aantal testen; …)	Land	Kost (€)
	Opstartkosten			25 000
	Aanwervingskosten			25 000

Toelichting bij de grote onderaannemingen
Grote onderaannemingen (vanaf 8.500 euro) moeten afzonderlijk begroot worden, ook al is er nog ruimte binnen de overige kosten. Deze onderaannemingen moeten gemotiveerd worden hetzij via een offerte, factuur van vergelijkbare opdracht of een gemotiveerde kostenschatting in bijlage of hieronder.

Totaal				50 000

GROTE Kost	
Omschrijving en motivatie van de grote kost	**Kost (€)**
Totaal	0

Toelichting bij de grote kost

Grote kosten worden uitzonderlijk toegestaan, mits grondige motivatie. Ze zijn duidelijk identificeerbaar in een projectbegroting en ze zijn van die aard dat ze niet kunnen beschouwd worden als grote onderaanneming. Uit de motivatie moet blijken dat het (maximaal toegelaten) bedrag 'overige kosten' in de projectbegroting niet volstaat om de 'grote kost' op te vangen en er moet duidelijk uitgelegd worden waaruit de grote kosten bestaan (aan de hand van offertes, auditverslagen).

Totalen				
Mensmaanden	jaar 1	jaar 2	jaar 3	Totaal
	96	132	132	552
Personeelskosten				2 346 122
Overige kosten				1 069 224
Grote Onderaannemingen				50 000
Grote Kost				0
Totaal (€)				**3 465 347**
Gevraagd subsidiepercentage				**0,0%**
Gevraagde subsidie				0

De aanvrager neemt er kennis van dat het Agentschap Innoveren en Ondernemen steeds de subsidie kan herzien en terugvorderen indien een partij met het oog op de subsidie of enig ander aan de overeenkomst verbonden voordeel, onjuiste of onvolledige verklaringen heeft afgelegd.