RegEnergy

"An insight into strong urban - rural partnerships across North-West Europe"

IMPRINT

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FOREWORD

RENEWABLE ENERGY REGIONS

Maximise the share of renewable energies in the production and consumption mix in 9 regions of North-West Europe – that is our aim. We are 9 project partners from seven counties and seek to improve the region's carbon footprint. An important task considering that NWE is one of the EU's highest energy consuming regions, currently still heavily dependent on non-renewable energy sources.

As different as we are – from metropolitan regions, cities, rural communities, regional agencies, scientific institutions and renewable energy producers - we all adopt one common approach: building strong partnerships that connect the rural production with the urban demand of renewables.

On the following pages, we present our projects and provide insights into the challenges.

We invite you to get inspired by our experiences! Discover possibilities for turning waste into renewable energy, for the active support of municipalities for energy communities, or for smart solutions that can help dealing with limited grid capacity and an intermittent renewable energy supply.

You would like our support or to exchange ideas on how to build up your partnership? Please get in touch with us!

For the whole RegEnergy team,

S. Enke

Svenja Enke
Lead Partner, Climate Alliance

CONTENT

Ernesettle solar array, Plymouth, United Kingdom

Interreg North-West Europe RegEnergy

European Regional Development Fund

RENEWABLE ENERGY – URBAN DEMAND & RURAL SUPPY

Urban areas are heavy energy consumers with limited potential for renewable energy production. Rural areas have large capacities to offer renewable energy, but limited energy consumption.

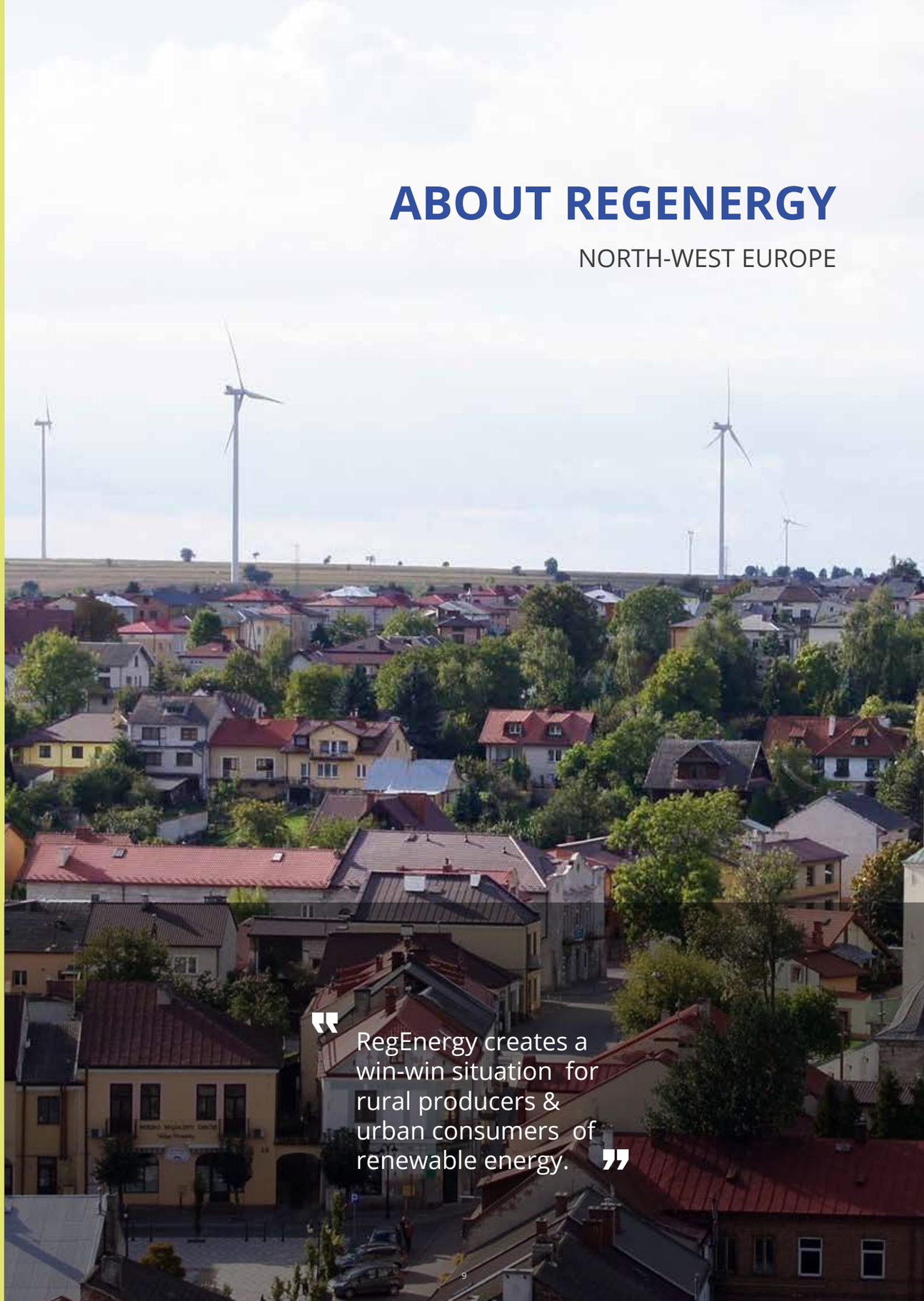
PARTNERSHIPS FOR RENEWABLE ENERGY – A WIN-WIN SITUATION

Urban consumers meet their renewable energy demands from reliable regional supplies. Rural renewable energy producers get access to urban consumers.

RegEnergy thus creates a win-win situation for rural producers and urban consumers of renewable energies.

ABOUT REGENERGY

NORTH-WEST EUROPE



THREE STRATEGIC FIELDS OF ACTION

Manifold barriers stand in the way of urban-rural partnerships. Bringing together the expertise of Metropolitan regions, cities, rural communities, regional energy agencies, scientific institutions and renewable energy producers can help to tackle those barriers.

You will discover concrete examples of partnerships and projects which address main barriers preventing the urban-rural cooperation in the field of renewable energy:

Organise urban rural partnerships for renewable energy

The elaboration and implementation of optimal institutional and administrative arrangements - such as cooperation agreements between cities and countryside – is necessary to overcome administrative barriers preventing urban-rural cooperation for renewable energy;

Connect renewable energy producers and consumers

We observe decentralised and diversified producers of RE. Producers of RE are increasingly diversified and decentralised. The development of infrastructure networks - such as networks for heat and pipelines for transport of biogas from rural to urban areas - is necessary to connect them with consumers of renewable energy;

Smart solutions for renewable energy growth

The development of technological solutions – such as smart grids or storage capacities – is necessary to manage the intermittent character of electricity production coming from regional wind and PV installations.

PARTNERS INVOLVED

- Climate Alliance (Lead Partner) | DE
- Brest métropole with ALECOB,CCKB and VDB | FR
- Flux50 with Ecopower and VUB |BE
- Plymouth City Council with Creacombe Solar CIC | GB
- Waterstromen Etten BV with Waterstromen | NL
- 3 Counties Energy Agency | IE
- PLANAIR | CH
- Waterford Institute of Technology with Údarás na Gaeltachta | IE
- Ormonde Upgrading Limited with Ormonde Organics Holdings Limited | IE

ORGANISE URBAN-RURAL PARTNERSHIPS FOR RENEWABLE ENERGY

SOLAR WIND BIOGAS BIOMASS WASTEHEAT

A NATIONWIDE NETWORK FOR RENEWABLE ENERGY REGIONS

GERMANY

Region
Rural and city regions all over Germany

Consumer / Demand by
All types

THE REGIONAL SETTING: CONTEXT AND CHALLENGES

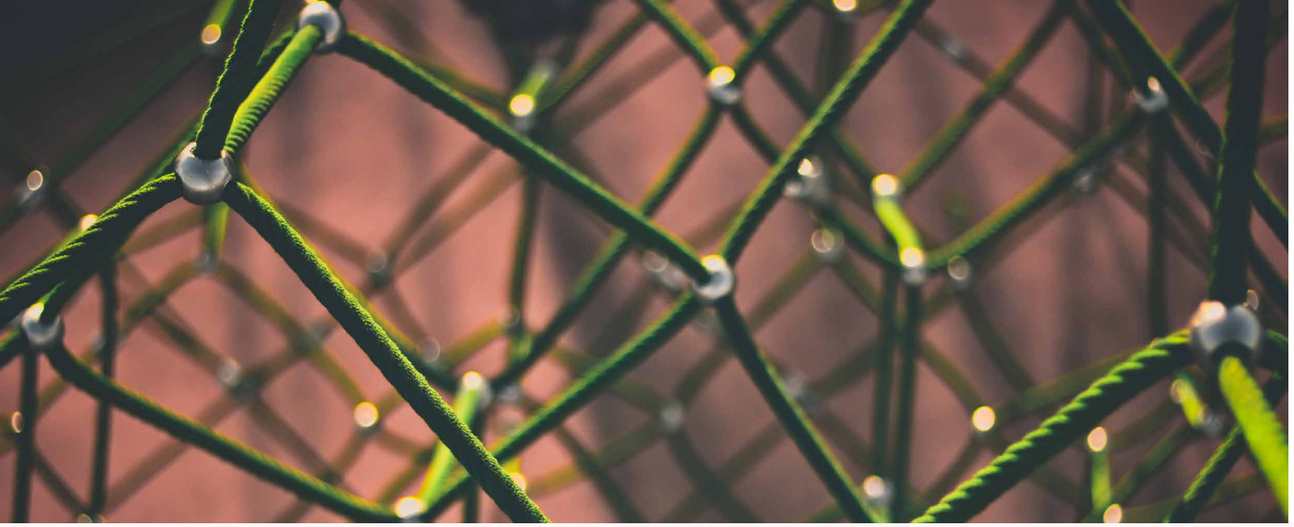
Transforming the German energy supply system towards a regional full supply of renewable energies (RE) requires a better connection between urban areas where the energy demand is high, with surrounding rural areas where capacities and land is available to produce renewable energy. To do so, a better networking of decentralized stakeholders from German regions is needed. Due to the important number of different actors with heterogeneous needs that would be involved in a potential RE network, a challenge is to reconcile their different requirements and to find compromise between the actors. Another issue in building a national network for RE is the lack of structures: not every region has a coordination office for urban-rural planning or it is undersized. As a result, there is often a lack of objectives, strategies and concepts for urban-rural projects.

To better connect urban and rural areas for the development of RE, a more precise observation of GHG emissions in both types of areas is also needed, as well as a methodology for „cumulating“ urban and peri-urban GHG emissions. Because of the different calculation methods currently used by diverse stakeholders, there is no uniform accounting basis for GHG monitoring. In Germany, the „BISKO“ methodology (Bilanzierungs-Systematik Kommunal) is a standardised balancing method for local municipalities. It is recommended and partly used as a basis for subsidies, but it is not mandatory. Internationally, a kind of standard has emerged, but it is still interpreted very differently in some cases. In the GHG assessment of energy production, too, there is as yet no uniform accounting basis. But the greatest difficulty in GHG monitoring is the data acquisition, which is time-consuming and often incomplete, due to the lack of empirical data. Data protection is another issue, as the basis of GHG calculations is municipal data. Often these cannot be assessed at all, or only incompletely, due to data protection reasons.

> “A better networking of decentralized stakeholders from German regions is needed.”

THE STRATEGY OF SUCCESS: BUILD A NATIONWIDE RENEWABLE ENERGY NETWORK

Climate Alliance is therefore building a network of German regions that explicitly promotes the exchange of best practices, implementation aids, and communication material between municipalities which are committed to the transformation of their energy system towards a decentralized full supply of RE. The Regionalverband (regional association) FrankfurtRheinMain is a frontrunner within the network due to its Regional Energy Concept “100 percent energy efficient and renewable”. The regional association consists of 75 municipalities, which are very heterogeneous in terms of size, financial and human resources. The regional association has developed an innovative “Regional Energy Concept”, which concentrates on informal activities and promotes voluntary cooperation, and organizes the cooperation of the players in the FrankfurtRheinMain region. The Regional Energy Concept concentrates



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on informal activities and promotes voluntary cooperation. It organizes the cooperation of the players in the FrankfurtRheinMain region. A large variety of measures are implemented by the regional association, such as the initiative "10,000 roofs for the energy" or „Experience Energy - Climate Protection in the FrankfurtRheinMain Region", which makes the energy transition in the region locally tangible through 9 current projects. A best practice database comprises more than 300 additional projects and is intended to encourage local and administrative decision-makers and other climate protection activists to emulate and to promote exchange among them. In the field of climate protection and energy system transformation, the regional association offers a wide range of possibilities and options for action, such as: formal planning guidelines, i.e. in particular the designation of priority areas for wind energy use as well as goals and principles for spatial planning (e.g. solar energy given priority on roofs and polluted areas, and open space installations in certain planning area categories), or informal activities e.g. commissioning of studies, implementation of model projects and procurement of funding, organisation and support of networking and cooperation, participation in working groups, provision of information and data bases (e.g. regional monitoring of energy system transformation), supra-local coordination and agreement.

The existing Climate Alliance CO_2 monitoring tool „Climate Protection Planner" will be extended by a regional dimension. This means that in future users will be able to model scenarios in which rural production and urban consumption of RE are set in relation to each other, supporting municipalities in their decision-making process. The tool analyses also the opportunity to facilitate data procurement or central data procurement in order to provide a more precise and targeted GHG monitoring.

Regionales Energiekonzept FrankfurtRheinMain

Regionalverband FrankfurtRheinMain
Klima-Energie-Portal

Klima-Bündnis

Klimaschutz-Planer

REGIONAL PARTNERS INVOLVED

- Regionalverband Region FrankfurtRheinMain and its 75 member municipalities and 6 rural districts;
- regional companies;
- associations, clubs;
- non-governmental organisations;
- representatives from science and the administrations of districts and municipalities.

RENEWABLE ENERGY: THE LEGAL FRAMEWORK IN GERMANY

(As of 2020)

Positive trends:

- Abolishment of the limitation of the expansion of PV ("PV Deckel": Compensation for solar electricity fed into the grid for new photovoltaic systems drops to zero) by July 2020
- Implementation of a building energy law (Gebäudeenergiegesetz / GEG) strengthening RE by October 2020
- Market Incentive Programme (MAP) of the Federal Ministry of Economics and Technology granting local authorities / institutions low-interest loans of up to 25 million euros, e.g. for the installation of a larger RE plant with more than 100 kilowatts heat output)

Ongoing challenges:

- Distance rule of wind turbines (1.000 meters away from residential buildings)
- NIMBY resistance by citizens to RE (e.g. in the expansion of wind energy)
- Lack of financial and human resources for climate action in municipalities

WIND SOLAR BIOMASS

MULTIFACETED AGREEMENT BETWEEN CITY AND COUNTRYSIDE

FRANCE

Region
Brest Métropole and the surrounding rural areas, Brittany, France

Renewable Energy Type
Photovoltaic, Wind, Wood

Consumer / Demand by
Public Service Buildings

THE REGIONAL SETTING: CONTEXT AND CHALLENGES

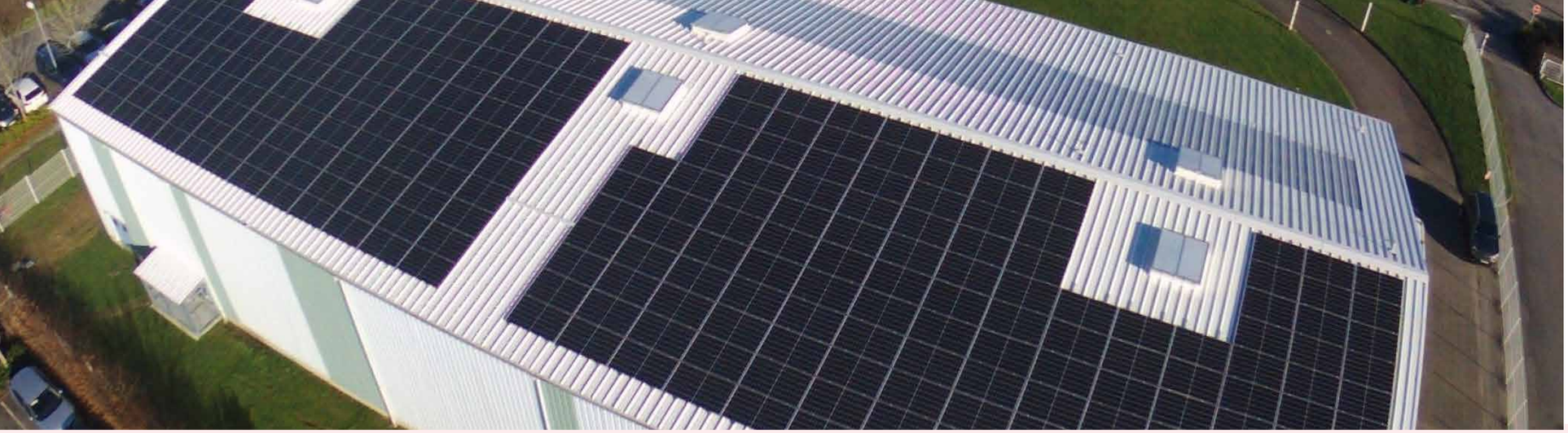
Brest Métropole has been created in 2015. As an intercommunal structure, it gathers 8 communes representing around 207,000 inhabitants. Brest is a harbour city located on the Atlantic coast in Brittany, western France. In 2015, France launched an experimental scheme to promote inter-municipal cooperation, called 'city-countryside reciprocity contracts' (in French: "contrat de réciprocité ville-campagne"). The aim is to close the gap between urban and rural areas by promoting win-win partnerships in areas such as the environment and energy transition, or the economic development. The Brest metropolitan area and the county of Central West Brittany (COB) represent the first urban-rural partnership to have officially signed a contract in 2016, defining joint workflows for economic development, culture, health, energy and the environment. The city-countryside reciprocity contract wants to valorise the complementary differences of the 2 territories: Brest Metropole (207,000 inhabitants) is marked by the presence of managerial staff and a high youth index offers services. It offers equipment and engineering which should be able to feed the COB. Reciprocally, the COB (97,000 inhabitants) is marked by the presence of farmers and workers within an overall ageing population and is mainly oriented towards production and processing. It has a preserved nature and environment that can benefit the territory of the metropolis. The cultural richness of the two territories represents an important potential for exchanges and cooperation.

However, Brest Metropole, as an urban area, will not be able to significantly develop renewable energies (RE). The general development of renewable energies in France faces several constraints:

- slowness of procedures, lack of social acceptance and of space;
- administrative processes, jurisdictions and economic models are often complex;
- common treatment of the differing solar gain of northern and southern parts of the country, making projects in the northern part less interesting (higher tariffs) for the Energy Regulation Commission (CRE), which, in turn, launches calls for tenders for the production of RE;
- in terms of investment, local authorities are not allowed to engage outside their territory, a challenge which is being tackled via the reciprocal institutional agreement.

THE STRATEGY OF SUCCESS: URBAN-RURAL CONTRACTS ACROSS ADMINISTRATIVE BOUNDARIES

Brest Metropole (BM) and the county of Central West Brittany (COB) are part of a reciprocity contract allowing them to establish a new form of inter-municipal collaboration and to overcome the institutional and administrative barriers. Brest Métropole had the idea to link the production of RE in rural areas with the consumption of heat and electricity of buildings in urban areas through detailed contractual and financial agreements between the urban consumers (which are public buildings), the local producers and the regionally centralised electricity production on the rural territory of the rural partner will be developed. The aim is to achieve the region as a regional "prosumer" involving regionally centralised and decentralised production and consumption and matching the production and consumption of electricity.



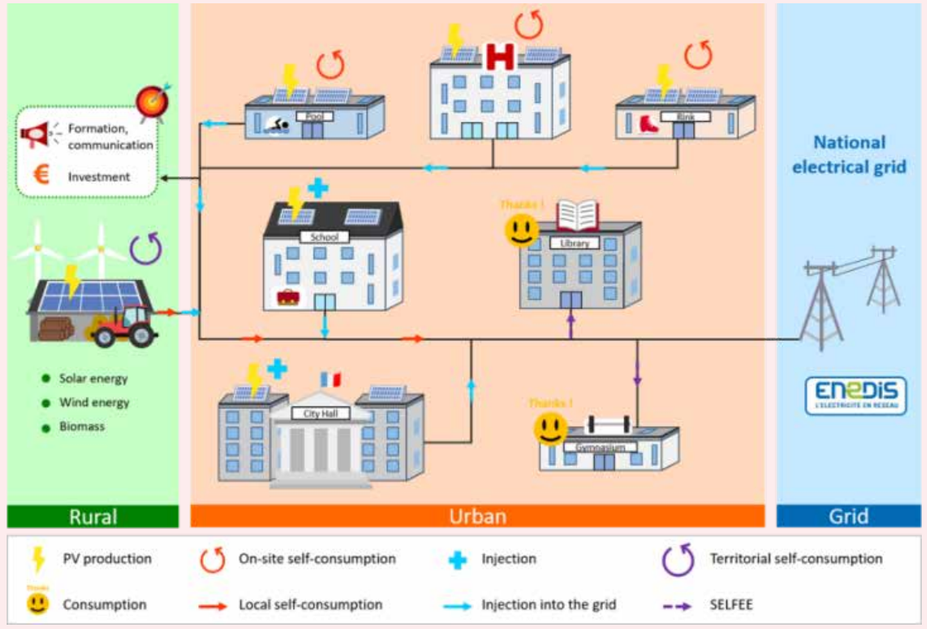
Gymnasium Le doaré,
Brest, France

This collaboration is embodied by implementing the necessary connections to the grid, which requires coping with the necessary technical and regulation constraints such as cabling, grid connection, inverter rooms, and installations for self-consumption in order to be able to validate and improve the contractual and financial agreements within the existing institutional arrangement. Working together across administrative boundaries help the territories to operationalize their cooperation by conducting concrete actions regarding RE production and the joint use of technology and know-how.

> "The aim is to achieve the region as a regional "prosumer" involving regionally centralised and decentralised production and consumption and matching the production and consumption of electricity."

Each type of energy leads to the elaboration of a specific type of contract or agreement:

- wood energy: BM is developing projects on wood-fired heating and heating networks, fuelled by wood from the forestry sector in COB. This gives rise to wood supply contracts;
- wind power: BM supports the Kreizh Breizh Community of Municipalities in its wish to take part in the governance of wind farms, directly by taking a financial stake but also by encouraging citizen financing. BM would like to bring this type of action to other local authorities in Brittany in order to territorialise energy production;
- photovoltaic energy: BM has developed a regional development strategy and tools such as the solar cadastre, which enables people to identify the sunlight potential of their roof, and thus to understand the relevance of installing solar panels. Within the framework of RegEnergy, not only solar plants are built, but BM also passes on its knowledge to the rural COB, where a solar cadastre is also being developed and further PV projects are being promoted;
- towards territorial self-consumption through the purchase of direct short-circuit electricity: BM is taking part in an experiment on the electricity market. The aim is to link the RE production and consumption of public buildings in the metropolitan area and the city of Brest, thereby avoiding the challenges of access to the grid and storage. A first contract is already in place concerning the production from waste-to-energy conversion in the Brest metropolitan area and the consumption of two buildings. In a second step, 30 buildings (4,000 Mwh) will be supplied with electricity (waste and PV from Brest Métropole). A third phase could make it possible to purchase on the market a share of the electricity produced in COB from RE sources, thereby increasing the share of RE in the energy mix consumed in the metropolitan area.



Parc éolien, bois, COB, France

Brest Métropole

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REGIONAL PARTNERS INVOLVED

- Brest Métropole (association of local authorities);
- The City of Brest;
- County of Central West Brittany (COB);
- Local agencies: Ener'gence (Energy and Climate Agency of Brest), ALECOB (Local Energy Office for Central West Brittany);
- Kreizh Breizh Community of Municipalities (CCKB);
- Public energy provider SOTRAVAL;
- Operator of territorial electricity consumption of local authorities, SELFEE.

RENEWABLE ENERGY: THE FRENCH LEGAL FRAMEWORK

(As of 2020)

Electricity from RE sources:

- Feed-in tariff scheme (20 years), degressive price fixed by law, below 100 kW on buildings;
- Premium tariff "compensation mechanism" for some RE producers;
- Tax incentives (income tax, reduced VAT rate);
- Costs borne by end consumer;
- Collective Self Consumption & Energy Communities are still in their infancy.

SOLAR

COMMUNITY-OWNED RENEWABLE ENERGY

UNITED KINGDOM

Region
South West England, United Kingdom

Renewable Energy Type
Solar farms owned by energy communities in rural areas

Consumer / Demand by
Large consumers in the city of Plymouth

THE REGIONAL SETTING: CONTEXT AND CHALLENGES

Plymouth City Council has established an independent community energy organisation, Plymouth Energy Community (PEC), in charge of developing new approaches to local energy generation, ownership and use. It has so far successfully secured over £1m in investment through crowdfunding for rooftop solar PV installations on city schools. These provide the schools with energy cost savings and surpluses are reinvested in community benefit, such as fuel poverty reduction initiatives. As the landscape of subsidies in the UK has changed, PEC is now exploring alternative business models. Rooftop solar will be developed on a commercial basis, leasing rooftops and reselling electricity by private wire where possible. Battery storage is expected to form part of this business model in the future, along with smart metering allowing aggregation of usage, purchasing, sales and demand response if sufficient scales can be achieved.

Supplying Plymouth's energy needs with renewable energy requires more space. Rooftops suitable for commercial (rather than domestic) solar PV generation are relatively limited. Whilst there is still significant potential to exploit, more sources of renewable energy are needed. The rural hinterland provides opportunity, but the networks and partnerships that would link RE generators/suppliers with consumers do not exist, neither relevant business models (the need to use a licenced commercial supplier as an intermediary is a key barrier). Grid constraints are also a significant barrier to the installation of new renewable energy capacity in the South West of England. There are rural community energy organisations outside Plymouth, but with limited capacity to create networks of rural distributed RE generators. Market constraints make the creation of such networks uneconomic at the current time, and public funding is needed to facilitate this aspect of transition. However, the energy sector is undergoing a phase of intense innovation and market reform and this constitutes both risk and opportunity for the community energy sector.

THE STRATEGY OF SUCCESS: SOLUTIONS TO MATCH SUPPLY AND DEMAND

Plymouth City Council is developing regional partnerships between rural community-owned renewable energy generators and large urban-based energy consumers. The implementation of small-scale distributed energy generation in urban environments requires commercial partnerships (building owners) and community support (including community finance in which Plymouth Energy Community has been a pioneer). Two rural energy communities are exploring practical ways to overcome the barriers with Plymouth City Council. The recipe for success is cooperation at eye level and mutual trust.

> "The recipe for success is cooperation at eye level and mutual trust."

Community ownership of the Ernesettle solar array, Plymouth

Creacombe solar farm:

Creacombe Solar C.I.C. is working with Yealm Community Energy, a member-owned Community Benefit Society established to bring local renewable energy installations into community ownership. Solutions are being explored to reduce local energy costs for the community and retain a strong local economic benefit while contributing to local and national carbon-reduction targets. It has a capacity of approx 7.3MWp generating enough electricity to power the equivalent of 2,160 typical homes and saving an estimated 3,100 tonnes of carbon dioxide annually. The site comprises three fields (approx. 11 hectares/27 acres) at Creacombe Farm, which is owned by Gnaton Farms, located between Yealmpton, Holbeton and Battisborough Cross.

Solutions are explored to match supply and demand through contractual agreements and battery storage:

- Battery storage to maximise income from local and national flexibility markets;
- Power Purchase Agreements or Contract for Difference (synthetic PPA) approach with a large urban energy consumer;
- Using procurement to ensure local benefit for public sector consumers;
- Different tariff structures depending on the matching of supply and demand.

Ernesettle Community Solar:

In 2016, 18 acres of derelict land in Ernsettle (north-west Plymouth) were transformed into a ground-mounted solar array, using £1m in community shares and providing huge benefits for the wider community. 16,000 solar panels were implemented, generating 4.1MW of clean renewable energy, enough to power over 1,000 homes.

Solutions are explored to match supply and demand through private wire and battery storage:

- Physical private wire to reduce grid charges and maximise on-site consumption;
- Battery storage used to match solar generation and onsite consumption;
- Securing a long-term off taker and increasing income to a community benefit fund;
- Early engagement with distribution system operator to identify technical solutions.

Plymouth City Council

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REGIONAL PARTNERS INVOLVED

- Energy communities such as Plymouth Energy Community;
- DSO: Western Power Distribution;
- Large consumers: Plymouth City Council;
- Licensed energy supplier: Npower;
- Legal advisors: Stephens Scown;
- Battery consultant: Argand Solutions.

RENEWABLE ENERGY: THE LEGAL FRAMEWORK IN THE UNITED KINGDOM

(As of 2020)

- Ending of the feed-in-tariff for solar installations;
- Need for a subsidy free model to increase uptake of renewable energy;
- High grid connection costs for generators and usage costs for customers;
- Regulation dictates the need for a licensed energy supplier;
- Virtual trading of energy is difficult under existing regulation.

BIOGAS WIND BIOMASS SOLAR

TOWARDS A NET ZERO CARBON SOCIETY

IRELAND

Region
Carlow, Kilkenny and Wexford regions, Ireland

Renewable Energy Type
Biogas, Wind, Biomass, Solar

Consumer / Demand by
Local Authority/Municipal Buildings, Citizens and Community groups

THE REGIONAL SETTING: CONTEXT AND CHALLENGES

The Irish counties of Carlow, Kilkenny and, Wexford belong to a rural region that has urban centres which need energy to support their industry, particularly the agri-food industry. A strong challenge is to develop the capacity for agricultural diversification and agriculture to be a net contributor to carbon sequestration through bioenergy production.

Access to funding is problematic. Recently, the national Irish Sustainable Energy Authority reduced the funding to community groups under the Communities Energy Grant scheme from 50% to 30%. This decision impacts heavily communities that want to be involved in energy efficiency and renewable energy projects. Built into the Renewable Electricity Support Scheme (RESS-1), community participation and community-led projects are pivotal to meeting a 70% renewable electricity target by 2030. T

Moreover, the number of grid connections is limited. To date, the electricity network system operators (DSO & TSO), under the Enduring Connection Policy Stage 2 (ECP-2) will only allow 15 grid connections nationwide for community-led projects. Grid connections are one of the biggest stumbling blocks and the process is complex and expensive.

Another challenge is to remove financial and institutional barriers to support communities in participating in the energy transition. Citizens and communities need to be supported both financially and technically and to be guided through the minefield of legislation and regulations around implementing energy projects. In Ireland, there is no easy way to organise citizens who want to cooperate in an energy sector for the betterment of their local communities.

THE STRATEGY OF SUCCESS: IMPLEMENT A 2-FOLD APPROACH

The 3 Counties Energy Agency aims to support the counties of Kilkenny, Carlow and, Wexford to reduce their CO2 emissions by contributing to the implementation of best practices in the field of sustainable energy. To create a net-zero carbon society a 2-fold approach is required: energy inefficiencies in our built environment must be eliminated and secondly, we must utilise renewable energy technology wherever possible. As an example, reducing Ireland's CO2 requires the creation of a business model and a route to market for renewable biogas, which can be produced in rural locations to supply urban needs. An assessment and analysis of the renewable energy production and consumption within the 3 counties area is necessary to optimise the connection between rurally produced energy and urban consumers.

Second RegEnergy Project Meeting, Waterford, Ireland

3 Counties Energy Agency

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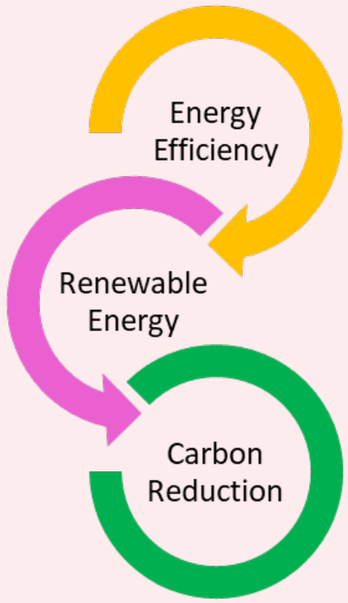
The regional agency wishes to elaborate a trusted approach to e-communities and citizen participation to achieve a net-zero carbon society e.g. through a REScoop as described by the European Federation of citizen energy cooperatives: REScoops are energy cooperatives, a business model where citizens jointly own and participate in renewable energy or energy efficiency projects. It also supports the citizens in better understanding the financial subsidies landscape, especially by deepening the state of the art solutions to overcome financial barriers or by referencing innovative financial models and EU-funded projects.



Several support schemes and financial instruments can be accessed by Energy Communities but they are challenging to access and not fit for purpose:

- Sustainable Energy Authority (SEAI) support schemes;
- Targeted Agricultural Modernisation Schemes (TAMS);
- Sustainable Support for Renewable Heat (SSRH);
- Energy Efficiency Obligation Scheme (EEOS);
- Rural Economic Development Zone (REDZ);
- Communities Energy Grant (BEC);
- Project Assistance Grant (PAG);
- Climate Action Fund (CAF);
- Leader Programme.

REGIONAL PARTNERS INVOLVED

- Ormonde Upgrading Ltd.
- Carlow County Council
- Wexford County Council
- Kilkenny County Council
- City of Callan (Kilkenny's Energy Town)
- BioXL
- Community Renewable Energy Supply (CRES)/ Community Power
- MullanGrid
- Waterford Institute of Technology

RENEWABLE ENERGY: THE LEGAL FRAMEWORK IN IRELAND

(As of 2020)

In the backdrop of EU legislation such as REDII, the recast Electricity Directive (EU 2019/944), and the recast Renewable Energy Directive (EU 2018/2001), significant progress on a range of policy areas have occurred at the national level in recent years, such as:

- Climate Action Plan;
- Renewable Electricity Support Scheme (RESS), supporting Ireland to achieve 70% renewable electricity target by 2030. Central to RESS is community participation;
- The new Programme for Government has set ambitious targets and has committed to an average 7% per annum reduction in overall GHG emissions from 2021 to 2030 and to achieve net-zero emissions by 2050.

CONNECT RENEWABLE ENERGY PRODUCERS AND CONSUMERS

BIOGAS

BIOGAS FROM WASTE WATER SUPPLIES INDUSTRIAL CONSUMER

NETHERLANDS

Region
Province of Gelderland, Netherlands

Renewable Energy Type
Biogas, bio methane

Consumer / Demand by
Large industrial consumer, small consumers

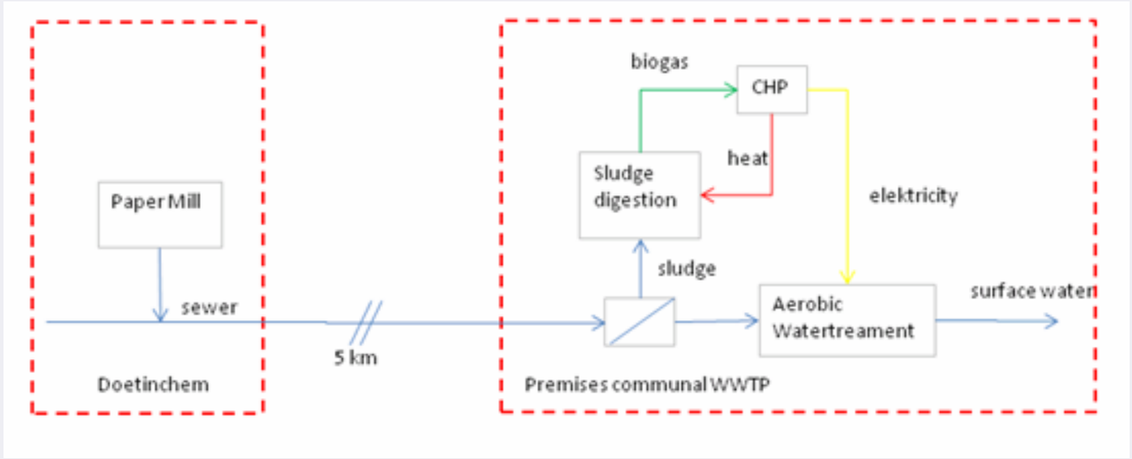
THE REGIONAL SETTING: CONTEXT AND CHALLENGES

Doetinchem is a city located in the Province of Gelderland, in eastern Netherlands, which comprises around 60,000 inhabitants. A paper mill is implemented in its industrial area, producing annually more than 1 million cubic metres carbon rich water as a byproduct. This water is currently transported together with other wastewater from Doetinchem city over a distance of 5 km to the waste water treatment plant (WWTP), located in the rural surroundings of the city. A lot can be achieved here from a sustainability point of view.

This situation leads to different challenges, that need to be faced:

- Transport the wastewater means piping through city area with many existing pipes, crossing of roads, railways, rivers and private land. To facilitate the pipes trajectory, a route was found with minimised length through private land and maximised part owned by the water board;
- The residual water from the paper factory arriving to the WWTP contains a lot of organic material and is relatively warm (approx. 35°C). Because it is mixed with other wastewater from the municipality of Doetinchem, it is not possible to utilise the organic matter and heat in the water. It leads to high electricity consumption to remove the organic matter from the water.
- High costs and hindering tariff structures: the feed in tariff from the feed-in scheme SDE++ is only applicable when it is 'fed in' in the grid and not when it is supplied directly to a consumer and the tariffs paid by large consumers for natural gas are very low. To face this issue, support was granted by the Province of Gelderland.

> In 2020, the paper mill of Doetinchem, Waterstromen and Waterschap Rijn en Ijssel signed an agreement to sustainably treat residual water from the paper mill and generate biogas in the process.



Waterschap Rijn Ijssel
wastewater treatment plant

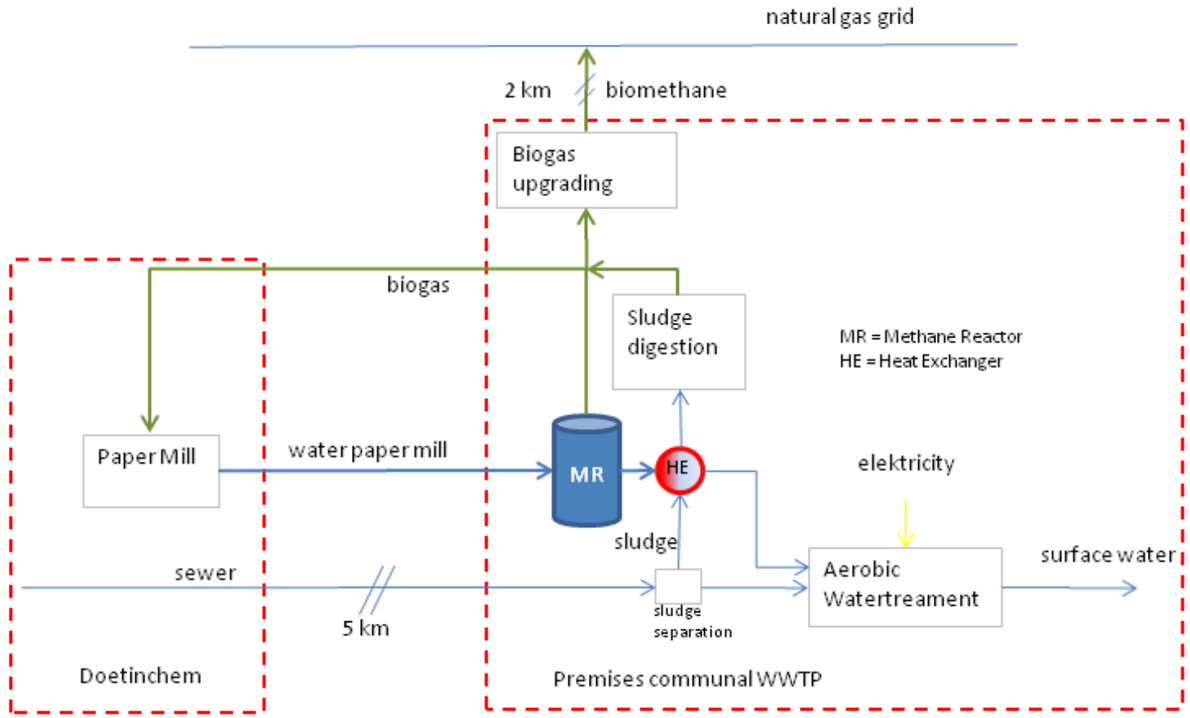
THE STRATEGY OF SUCCESS: UPGRADING WASTE WATER INTO BIOGAS

To face these different issues, a demonstration project called ‚Biogas recovery Water Paper Mill Doetinchem' has been implemented, aiming at finding an innovative waste water treatment while generating renewable energy. In 2020, the paper mill of Doetinchem, Waterstromen and Waterschap Rijn en Ijssel signed an agreement to sustainably treat residual water from the paper mill and generate biogas in the process, for the use of the paper mill. This project makes a contribution to climate protection as this sustainable treatment yields a total saving of 2,300 tonnes of CO2 per year, representing the natural gas consumption of around 1,000 households per year. In the future, biogas could be upgraded to biomethan in order to make it available to households in the municipality of Doetinchem as an alternative to natural gas.

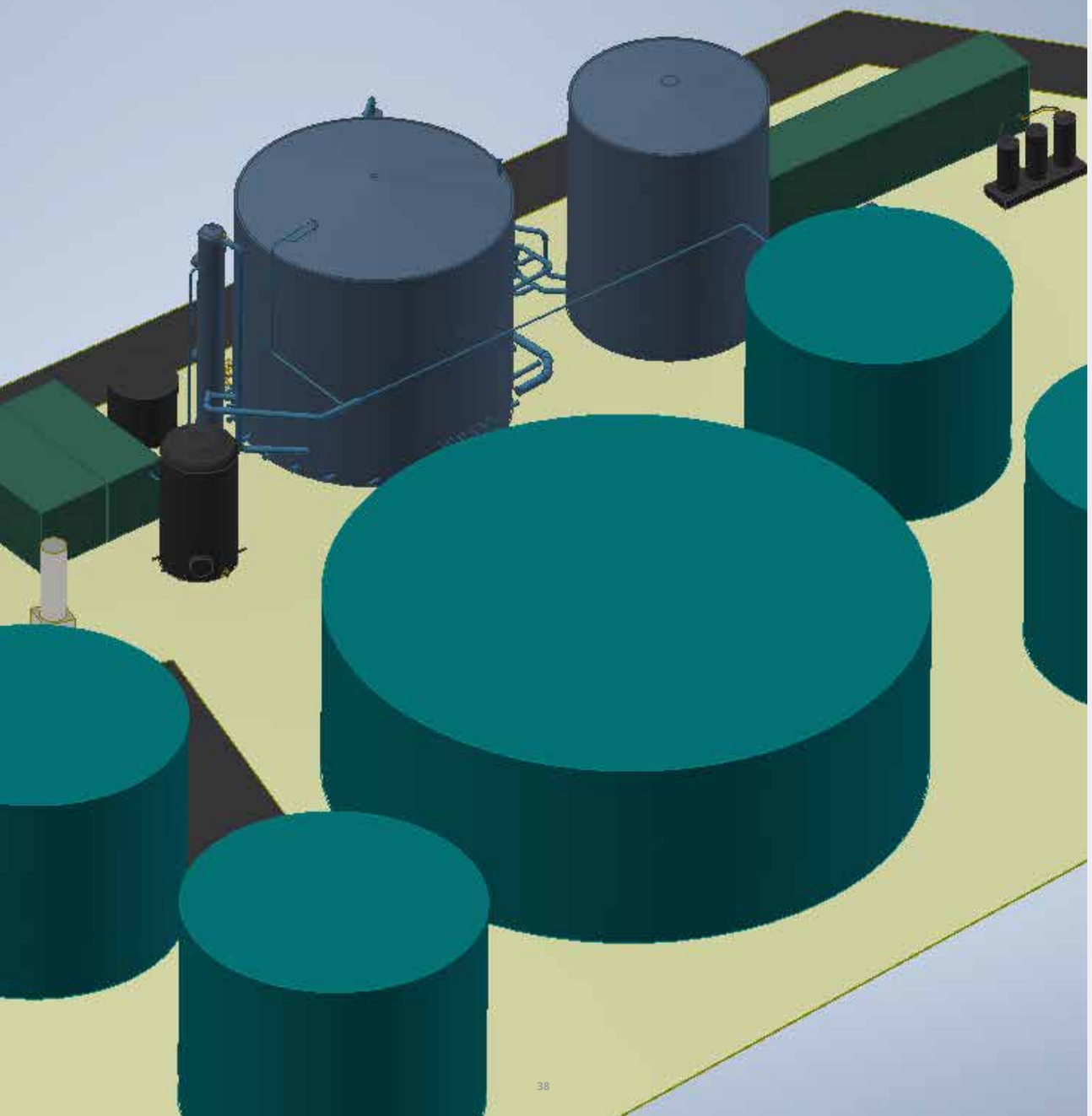
Transporting the residual water separately to the sewage treatment plant using a new pipeline makes it possible to pre-treat it and generate biogas in the process. Indeed, the waste water of the paper mill are highly concentrated in organic matter and it arrives at the Etten sewage treatment plant relatively warm (around 35 degrees). The heat from this water is used to process the waste sludge from the current water treatment plant. The new pipeline makes it possible to pre-treat this wastewater and generate biogas in the process. The water from the paper mill is pre-treated separately using a different technique (anaerobic treatment), generating biogas from the organic matter instead of using electricity to remove it. As a result, water treatment does not cost energy, but generates energy instead.

The biogas produced will be delivered to the paper mill through a new biogas pipeline. Therefore two pipes are planned connecting the both sites: one for the industrial wastewater and one for the biogas produced from it.

Another pipe is planned to connect the WWTP to the natural gas grid in a second step. The biogas will be used for steam production at the paper mill, as a substitute for natural gas. The aim is to deliver the first biogas by the end of 2021.



Waterschap Rijn Ijssel
wastewater treatment plant,
future installation (cutout)



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REGIONAL PARTNERS INVOLVED

- Waterschap Rijn en Ijssel;
- Waterstromen;
- Papierfabriek Doetinchem;
- Land owners, consumers, infrastructure providers, maintainers, biogas suppliers.

RENEWABLE ENERGY: THE LEGAL FRAMEWORK IN THE NETHERLANDS

(As of 2020)

- Feeding bio methane in natural gas system permitted;
- Premium feed-in scheme Stimulation of sustainable energy production and climate transition (SDE++, funding programme until December 2020) for renewable energy used for electricity, renewable gas, heating purposes;
- Loans, tax benefits;
- Including electricity from sewage gas (different technologies).

BIOGAS

BUILD A SUPPLY-DEMAND CHAIN FOR BIOMETHAN

IRELAND

Region
Waterford, Kilkenny and Wexford regions, Ireland

Renewable Energy
Biomethane (purified renewable biogas)

Consumer / Demand
Heat and transport applications

THE REGIONAL SETTING: CONTEXT AND CHALLENGES

The biogas / biomethane industry in Ireland is underdeveloped when compared to its EU peers. Currently biogas does not make a substantial contribution to the energy mix. However, the Sustainable Energy Authority of Ireland (SEAI) in its report entitled "Assessment of the Benefits of Biogas and Biomethane in Ireland" highlighted the significant potential for biogas production in Ireland. In this report, the SEAI estimates that if its potential is fully realised, biogas has the ability to displace up to 26.3% of Ireland's natural gas consumption by 2035. This biogas could be produced from a variety of sources including food waste, agri-food waste, organic sludges, manure and grass silage. Biomethane is biogas which has been upgraded in a manner which allows this renewable gas to be used as a direct substitute for natural fossil gas. Hence, whilst urban consumption currently relies on natural fossil gas, it is clear that the enabling of the renewable biogas industry in Ireland can displace fossil natural gas and make a significant contribution to Ireland's decarbonisation.

However, in order to achieve this, a number of barriers need to be overcome including the absence of a clearly proven business model for the sector. At present the cost of biogas production is greater than the market value of natural fossil gas. Consequently, a support scheme is required to enable the development of the biogas sector. However, whilst a number of support measures have been put in place to encourage the production of renewable electricity and heat, no specific scheme has been introduced to encourage the development to the biogas sector in Ireland. In addition, the cost of connecting biogas production facilities to the national gas grid are high and the time required to obtain a connection agreement is significant. The foregoing factors mean that producers of biogas face significant challenges in getting their product to market.

THE STRATEGY OF SUCCESS: A REGIONAL OFF-GRID SUPPLY-DEMAND CHAIN

In this context, there is a specific need to demonstrate the ability of renewable biogas to make a significant contribution to achieving Ireland's decarbonisation targets by implementing renewable energy partnerships between consumers of natural fossil gas and producers of biogas. The successful implementation of such a partnership could trigger a wider impact by raising awareness and by enhancing the confidence of consumers in urban settlements in the ability of biomethane to meet their energy needs.

The development of such a renewable energy partnership is enabled by leveraging existing infrastructure and by the development of

> "A viable off-grid solution is created through agreements and investments between the diverse producers, the supplier and the consumers in areas where it is difficult to create a local renewable energy network."


Co. Waterford, Ireland

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the biogas upgrading facility required for the production of necessary amounts of bio-methane (demand for public buildings). The biomethane can then be delivered to the urban consumers by implementing an off-grid model which sees biomethane delivered by biogas producers directly to urban customers using specialist gas transportation and storage equipment.

The challenge is on one hand to outline to energy users (such as local government agencies) the benefits of decarbonising their energy consumption by transitioning from using natural gas to using renewable biomethane. On the other hand, it is to show to rural biogas producers (including farm enterprises) that it is economically and technically feasible to upgrade rural biogas produced by them and to transport the resultant biomethane to consumers within the region. This exchange enables an entirely new value chain for renewable energy production and consumption, as currently farm/rural enterprises have no way of valorising the energy production potential of farm residues (manure, slurry) and other biomass (organic waste, surplus grass/crops). This new value chain can help in reducing GHG emissions for the farm sector in Ireland.

In this way, a viable off-grid solution is created through agreements and investments between the diverse producers, the supplier and the consumers in areas where it is difficult to create a local renewable energy network. The implementation of a pilot site in the regions help to raise awareness of urban consumers on renewable energy, to elaborate a new distributed business model which could address the issue of finding a relevant economic model for the biomethane production, and to establish a value chain for biomethane.

Ancillary equipment allowing urban consumers to receive the biomethane will be installed at selected and highly frequented sites identified by the 3 Counties Energy Agency (3cea). The installation comprises the necessary upgrading facility to purify 22.000 MWh/y of biogas, thus giving confidence that the demand of the public buildings in the 3 counties can be met by biomethane. Purification is necessary to allow the storage and transport of the biomethane and to allow customers to use this energy without making significant alternations to their existing energy infrastructure. Possible demonstration sites (e.g. public buildings) are selected by 3cea to provide excellent public show cases.

The integrated approach on the supply and demand side will allow consumers within the urban settlements of the region to meet their energy needs from renewable energy produced in the rural surroundings, leading to large CO2 emission reduction.

REGIONAL PARTNERS INVOLVED

- 3 Counties Energy Agency (3cea)

RENEWABLE ENERGY: THE LEGAL FRAMEWORK IN IRELAND

(As of 2017)

- Biogas/Biomethane – whilst support schemes have been put in place for renewable electricity, renewable heat and renewable transport fuels at the date hereof a specific support scheme has yet to be put in place for biogas/biomethane production;
- Other forms of renewable energy are considered to be less costly;
- Given the absence of a proven economic model, the value chain necessary to realise the potential for biogas production identified by the SEAI has not been put in place.

SMART SOLUTIONS FOR RENEWABLE ENERGY GROWTH

SOLAR WIND WASTE**HEAT**

RELIABLE SUPPLY FOR HIGH DEMAND CONSUMERS

BELGIUM

Region
Flanders, Belgium

Renewable Energy Type
Wind, Solar, Waste heat

Consumer / Demand by
Business Park, Hospital

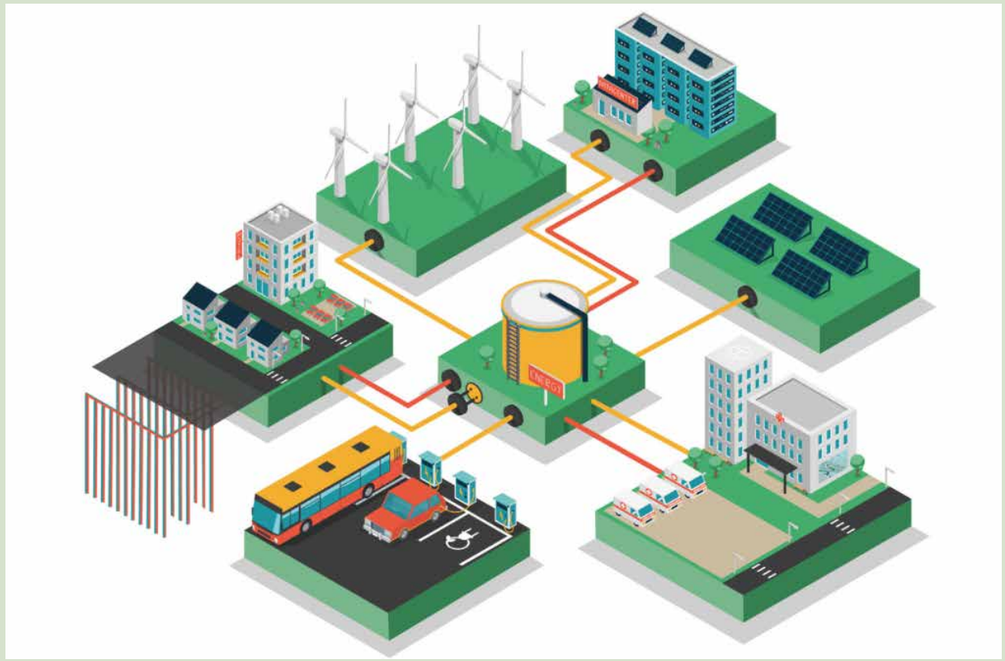
THE REGIONAL SETTING: CONTEXT AND CHALLENGES

The Green Energy Park (GEP) is located in Zellik, Flanders, in the countryside surrounding Brussels. It aims at stimulating collaboration between companies, knowledge institutions, governments and end users by offering a living lab where innovative technology and forms of cooperation can be tested in a realistic environment. The research park focuses on three areas: Energy and mobility transition, Hospital of the future and Smart regions.

The park will be equipped with a multi energy grid that consists of a (mainly) low temperature thermal grid and a large electric grid. The idea is to generate solar and wind energy directly on the Green Energy Park and use it as much as possible within the business park. All buildings of the Park can participate in the "CO_2 neutral smart multi energy grid" by supplying and consuming energy. Due to the park's location nearby a residential area, the thermal part of the grid is extended to the residential development and to the adjacent existing business area. The system can supply electricity and heat to more than 70 neighbouring companies. This creates a bi-directional interaction between the business park and the residential area.

The challenge of the project is both a technical challenge to establish a micro grid, and a social challenge to persuade the companies to actively participate in the project by connecting to the micro grid. The purpose is to offer a product to the companies, which is environmentally and economically interesting for them. Other challenges need to be overcome, such as:

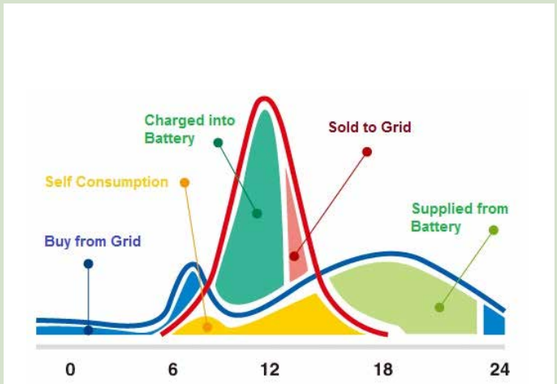
- Finding technical solutions: in order to cope with the intermittence of renewable energy sources and provide a stable energy supply throughout the year (also in case of outage in DSO network);
- Peer-to-peer energy exchange: sharing of energy between companies in a business area is not yet allowed according to Flemish regulation. The Pricing scheme in Flanders



The Smart Village Lab,
Zellik, Belgium

triples the price for peer-to-peer energy exchange over public networks – adapted cost reflective pricing is needed for shared distribution networks. Transferring energy from one entity to another is subject to grid costs and as such it is very difficult to create a profitable business case for electricity transfer;

- High requirements for the battery: the energy consuming applications (data centre, data communication) need a reliable power supply. The amount of data that needs to be transmitted, processed and stored is very large. The latency of the data is low, transmission speeds are high.



THE STRATEGY OF SUCCESS: IMPLEMENT AN INNOVATIVE MICRO GRID STORAGE TECHNOLOGY

The success of the Green Energy Park lies in the important teamwork between the GEP's stakeholders. Each stakeholder is involved in this big living lab project and brings its own contribution (e.g the Data Centre provides waste heat). Moreover, GEP has built good relationships with the responsible Distribution System Operator (DSO) of the site, who is interested in exploring the possibilities for similar situations, e.g. for the re-use of the existing grid as micro-grid. The municipality of Asse, the province of Flemish Brabant and the Flemish government are interested to position this project as strategic and to enable international parties to visit the area as one of the flagships of Flanders.

The aim is to supply the Green Energy Park with electricity and heat through a bi-directional multi-energy grid. It includes the development of energy storage systems, the integration of

"The success of the Green Energy Park lies in the important teamwork between GEP's stakeholders."

hybrid and electrical mobility as well as a thermal distribution grid on ultra-low temperature. This is where its strength lies, in its holistic approach. All companies located at the park are connected and can inject to or consume from the electrical and the thermal grid. Excess heat from the datacentre, heat pumps, cogenerations and different renewable energy sources will be added to the grid. Energy will be stored in multiple batteries, electrical cars, heat buffers and underground storage.

An innovative living lab will accommodate a wide variety of technologies. It will remain available for 20 years after completion of the project, allowing testing further new technology in real life situations. Large renewable energy sources (in total 18 MW) are being developed and connected to the business park as well as to the test facilities. Battery systems are implemented to stabilise the grid (2 MW). In the field of storage, the Living Lab will test and assess different technologies such as Advanced e-storage technologies (advanced Lithium-ion technologies, Solid state, Redox flow, LI-caps, fuel cell, 2nd life), Advanced Battery Management Systems for Hybrid Systems, or second-life batteries as reliable energy sources. Work will be led, for example, on the matching between the requirements of intermittent renewable energy systems with the specifications of the e-storage systems, or on the development of accurate, reliable and precise power electronics systems and algorithms. A Smart Village Lab will investigate how living can become smart, sustainable and energy efficient in the future: several homes will be built, in which diverse intelligent and sustainable systems will be developed. The homes will exchange electrical and thermal energy via a smart energy grid, to which collective energy systems such as neighbourhood batteries and collective charging infrastructure for electric cars are connected.

The Green Data Centre is foreseen to be constructed, to which the Green Energy Park will be attached and supported with the necessary computing power needed to develop sustainable, high-tech solutions. A micro grid powered by the residual heat of the data centre will be implemented. The University of Brussels and the University Hospital of Brussels are moving their data centre to this new infrastructure and are open to provide the waste heat to neighbouring companies and residential areas.

Flux50

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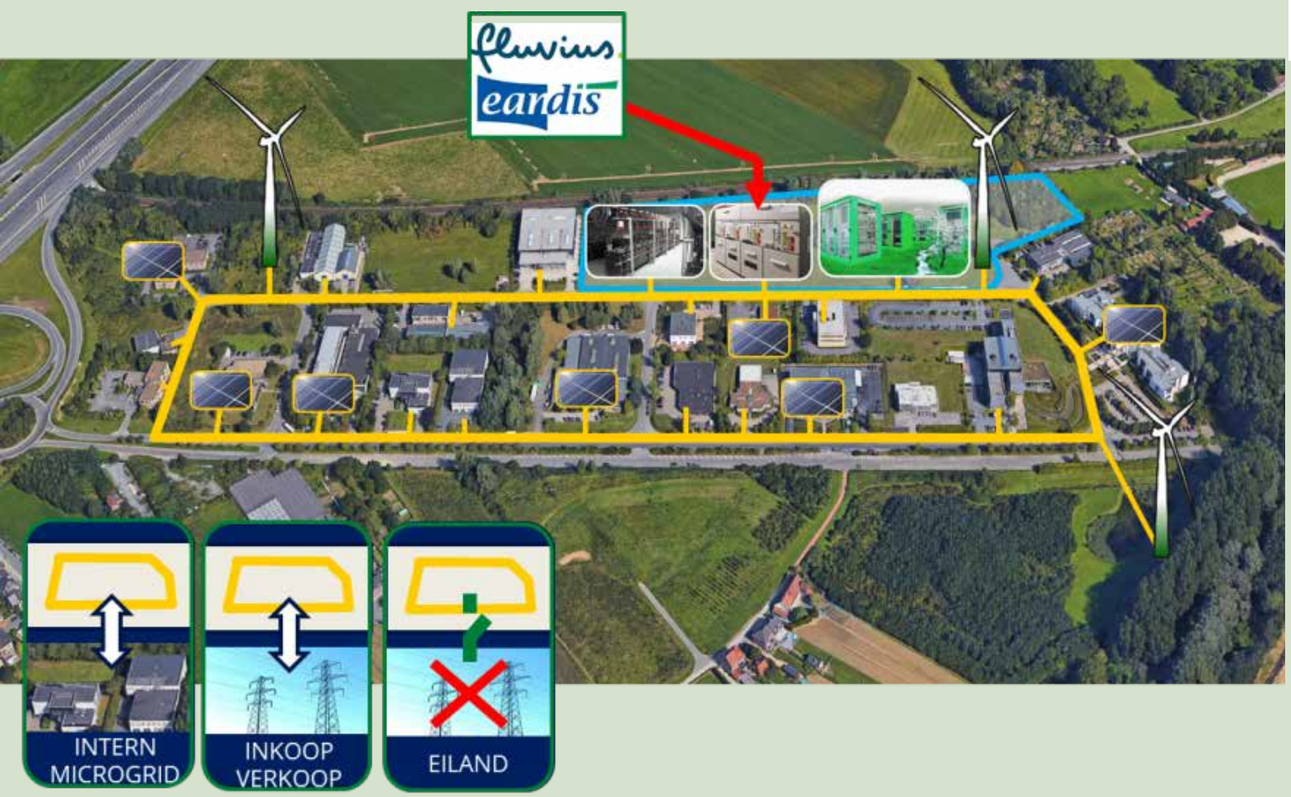


REGIONAL PARTNERS INVOLVED

- Flux50 (business support organisation, working on regulation aspects of the project);
- University of Brussels (technical specifications of the batteries);
- EcoPower (energy community working on the heat network);
- Green Energy Park (providing the business case);
- Fluvius (district system operator enabling the reuse of infrastructure);
- Province of Flemish Brabant, Municipality of Asse (administrative location of Green Energy Park).

RENEWABLE ENERGY: THE LEGAL FRAMEWORK IN FLANDERS

(As of 2020; will change in 2022)

For peer-to-peer trading of electricity:

- In general prohibited;
- Exemptions granted by the regulator for peer-to-peer direct lines;
- Closed distribution lines under very specific conditions;
- No legislation, nor support for energy communities;
- Regulatory sandbox possible;
- Pricing system focuses on self-consumption, based on a net metering scheme;
- Lack of consistency in legal and pricing system support scheme between the different regions of Belgium.

SOLAR

INTERCONNECT PHOTOVOLTAIC ENERGY AND ELECTRIC MOBILITY

SWITZERLAND

Region
Yverdon-les-Bains, Switzerland

Renewable Energy
Solar

Consumer / Demand
Business park (15 GWh per year (2019); 28 GWh per year (estimation 2025)

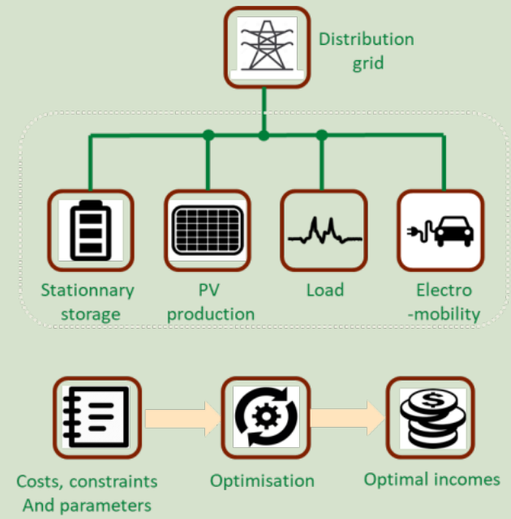
THE REGIONAL SETTING: CONTEXT AND CHALLENGES

The Canton de Vaud, Switzerland, is experiencing an important economic and demographic boom. The science and technology park Y-PARC, based in Yverdon-les-bains, is part of it: center of expertise for cybersecurity, medtech and robotics, the park comprises 70,000 m2 of offices, laboratories and production halls in 16 buildings and gathers 200 companies representing 1,800 employees. In the long term, 10,000 jobs should be created by several hundreds of companies.

The Swiss policy of self-consumption, in conjunction with the ongoing developments of e-mobility (Vehicle to Grid), offers a unique opportunity to develop business models for the coordinated use of PV and electric mobility. As Yverdon-les-Bains fosters the use of renewable energy, the city implemented in 2015 its two first public charging stations for electric vehicles, in addition to the private charging station of the Y-PARC. Important for the local DSO is to assess the impact on the grid of the development of photovoltaic energy production on one hand, and electric vehicle stations on the other hand. Integrating the electric mobility in the equation of self-consumption helps to determine the value of its flexibility as a final consumer, to answer to important questions and to take the right decisions. For example, fast charging electrical vehicles in microgrid architectures are difficult to implement, while slow charging ones offer more flexibility for the grid. The goal is to come up with interesting business models for the deployment of electrical vehicles charging stations along with local solar power production and stationary storage resources.

THE STRATEGY OF SUCCESS: JOINT DEVELOPMENT OF PHOTOVOLTAIC PRODUCTION AND ELECTRIC MOBILITY

At Y-PARC, the aim of the project is to determine the impacts of a large joint increase in photovoltaic production and in electricity needs for mobility. In partnership with the School of Management and Engineering of the Canton of Vaud and the city's industrial services, Planair is developing a business model applicable to this infrastructure. The aim is to initiate a demonstration project to test these results in a real context and on a large scale. Planair elaborated a study on the role of stationary and mobile storage in integrating high photovoltaic shares in a microgrid to balance supply and demand. It has shown amongst other things that even the highest possible photovoltaic potential on this industrial zone does not represent a problem



PLANAIR

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> "Even the highest possible photovoltaic potential on an industrial zone does not represent a problem for the grid of Y-PARC, and the introduction of mobile or stationary batteries reduces the risk even more"

for the grid of Y-PARC, and the introduction of mobile or stationary batteries reduces the risk even more and creates interesting synergies. The possibility to facilitate self-consumption with the prediction and optimization of systems is studied as well as how to make this a central pillar of local energy communities.

So far, the study underlines several outstanding results:

- The potential of 6 GW PV is within the grid's limits;
- The photovoltaic installation produces excess energy during the day, when employees' vehicles are parked in the industrial area. This synergy is used to increase self-consumption of photovoltaic energy, decrease pressure on the grid and thus improve its profitability;
- The car's batteries can be valued for peak shaving or ancillary services, in particular V2G vehicles;
- The local Distribution System Operator is at the centre of these developments but many companies cooperate in the business model to make the idea work;
- Several pricing systems are developed to integrate the flexibility of end-consumers (companies and vehicles);
- The legal and economic framework has a dominant impact on the solutions that are implemented and market actors need to learn more about the potential before implementing these smart solutions.

REGIONAL PARTNERS INVOLVED

- City of Yverdon and Canton de Vaud (RE policy objectives);
- Service des énergies d'Yverdon (DSO – operator, investor, contractor);
- Green Motion (supplier of charging stations);
- Grid Steer (grid optimisation solutions);
- Centre Suisse d'électronique et de microtechnique (CSEM).

RENEWABLE ENERGY: THE LEGAL FRAMEWORK IN SWITZERLAND

(As of 2020)

Energy policy on self-consumption since 2018:

- It is economically more interesting to self-consume then to sell back to the grid;
- Local producers and consumers can create a self-consumption group to increase self-consumption;
- The law is in constant evolution to adapt to the reality of projects (use of existing cables, pricing allowed, market liberalisation…) but the aim is clear: increase decentralized production and consumption of renewable electricity.

SOLAR WIND

A SMART PLATFORM TO OPTIMISE SUPPLY AND DEMAND

IRELAND

Region
Dingle area, Ireland

Renewable Energy
Solar, Wind

Consumer / Demand
Industrial and Commercial Consumers

THE REGIONAL SETTING: CONTEXT AND CHALLENGES

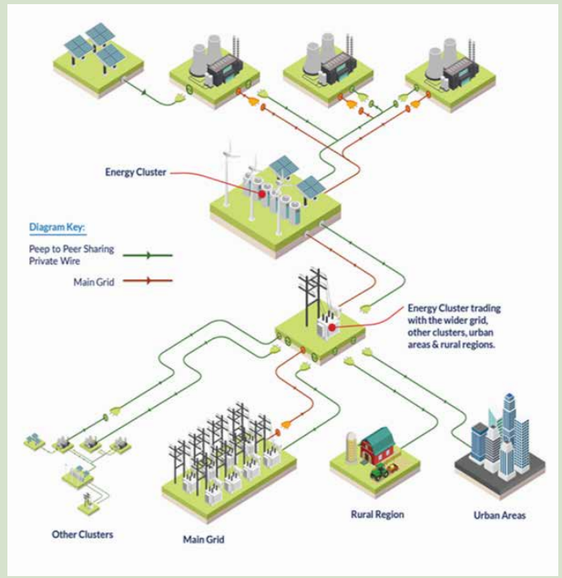
In the rural Dingle area, on the western coast of Ireland, industries and offices of the regional authority Údarás na Gaeltachta (UnG) add up to a substantial electricity consumption. To facilitate the integration of renewable energy (RE) at these distributed sites, innovative smart grid processes and a legislative framework, enabling the regional actors to function as Energy Communities and take control of their energy use as prosumers. The energy industry is going through a paradigm shift from a unidirectional, demand driven model with large centralised power generation to a market driven by smart grid ideals where supply and demand will be balanced with variable and intermittent renewable energies in a more regionalised manner. The Waterford Institute of Technology (WIT) is designing a software platform to optimise RE production and consumption with variable market prices.

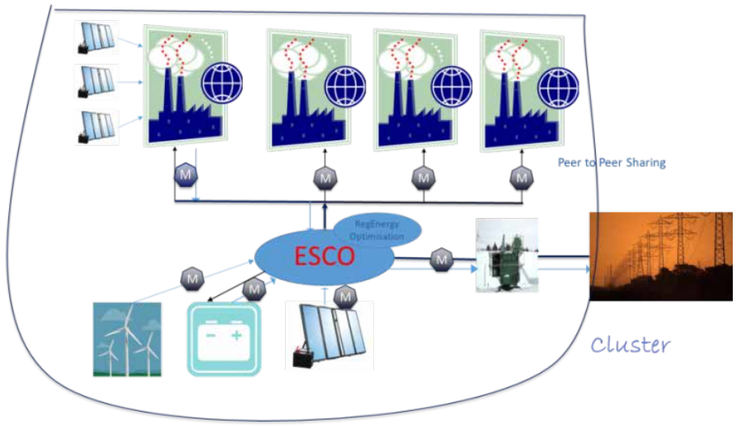
However, in order to establish this smart energy community, and as the concept of Energy Community is still in its infancy in the region, incentives and tariff structures to enable smart grid technologies are required, as well as a regulatory framework to implement EU Directives. Smart Metering is also necessary to acquire granular data and enable cluster load models.

THE STRATEGY OF SUCCESS: FROM ENERGY CLUSTER TO LOCAL COMMUNITY

The Waterford Institute of Technology is developing an optimisation platform and coordinating the implementation of smart grid technologies with the potential of being the hub of energy clusters. The future grid architecture is based on peer to peer sharing within the industrial cluster and optimisation of RE, storage and flexible loads with time of use market tariffs. In general, supply and demand can be better managed within a region by reducing energy inefficiencies. This requires intelligent systems to enable the scenarios, particularly at end user level, to satisfy demand within the peaks and troughs of the market.

Renewable energy clusters such as the UnG offices and industries can act like micro grids, trade with each other and eventually roll up to a regional and then national level to form the smart grid. These networks are based on distributed, local generation resources such as solar, wind and battery storage which can be shared in a peer to peer environment, allowing the integration of RE in local communities. The implementation of battery storage technologies assists in balancing local clusters, while modelling





the potential of renewable energy technologies in a cluster of industrial clients helps to optimise the cluster load with the market and available on-site technologies, and thus to reduce the risk for the cluster as a whole.

In this way, energy clusters help to improve regions security of supply, reduce carbon footprint and give the opportunity for energy consumers to control their energy use and become 'prosumers'. It also facilitates peak shaving, time of use tariffs and ancillary services with the wider grid. The clusters can ultimately then trade with the surrounding rural region, urban areas and other clusters. A transposition of the European Energy Policy for 2020–2030 "RED II" in the Irish context is under discussion to make the clusters function as an energy community.

Renewable energy cluster or renewable energy community?

The **renewable energy clusters** emerging now in the context of the Energy Transition are built on the complementarity of different energy sources, flexibility, as well as interconnectivity of all sorts of different actors – be they small or large, professional or not – requiring bi-directionality of energy flows.

The **renewable energy communities** are defined in the EU Renewable Energy Directive (RED II, 2018). They involve groups of citizens, social entrepreneurs, public authorities and community organisations participating directly in the energy transition by jointly investing in, producing, selling and distributing renewable energy. The definition is flexible according to local contexts and recognising that different legal and economic models abound.

If renewable energy communities and renewable energy clusters may have slightly different definitions, they are both socio-technical mirrors of the same concept: the energy clusters offer an engineering model while communities do provide a governance model, necessary in a renewable energy transition

"Renewable energy communities under the 2019 European Clean Energy Package – Governance model for the energy clusters of the future?", J.Lowitzsch, C.E.Hoicka, F.J.van Tulder

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REGIONAL PARTNERS INVOLVED

- Údarás na Gaeltachta
- Industrial and Commercial tenants
- Local Energy Communities, DSO, Regulator (CRU)

RENEWABLE ENERGY: THE LEGAL FRAMEWORK IN IRELAND

(As of 2021)

- Feed in tariff for RE for rooftop solar yet to be introduced;
- Regulatory framework for mechanisms such as peer to peer energy trading under review;
- Incentives and tariff structures to enable smart grid technologies not yet available;
- Energy Community concept still in its infancy;
- Regulatory Sandbox process to trial new concepts in early stages of discussion.

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