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The Urban Lab of Europe !

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Project led by the City of Viladecans



**ENERGY
TRANSITION**



The Vilawatt project

The project aims to establish an Innovative Public-Private-Citizen Governance Partnership at local level (PPCP). This entity will have, for the first time, the Municipality of Viladecans together with the local businesses and the citizens of Viladecans as its members. Its mission will be to promote and ensure a secure, clean and efficient use of energy. This new PPCP will be the central hub that will manage the new local tools for the transition: energy supply, energy currency, energy savings services, deep energy renovation investments and renewable energy production.

The new entity will create a Local Energy Operator that will be the local energy supplier and the renewable energy producer, and an Energy Savings Company, offering energy savings services and energy renovation investment to all the members. The Capitalisation of the Energy Savings will allow the new entity to focus on the investment of deep energy renovations, sharing among the local community the economic risks of that energy saving operations that are not economically attractive.

The creation of this PPCP structure is a completely new approach. It will help to inject a broader set of skills and talent, a more diligent and responsive work culture into the municipality machinery, create a solid foundation for innovative thinking and creativity, empower the community, share common risks and face unbalanced situations. The community energy savings capitalisation will provide funds for new deep energy renovation investments.

A new energy currency linked to energy savings will be created, and it will work as an incentive to energy efficiency and as a mechanism to increase economic capacity of vulnerable economic groups. At the same time this alternative currency will strengthen the local economy by assuring a local cycle of the money.

Partnership:

- Ajuntament de Viladecans
- Agència d'ecologia urbana de Barcelona - Public agency
- UBIQUAT TECHNOLOGIES S.L. - Private company
- ICAEN - Institut Català de l'Energia - Research centre
- Associació LIMA - Low Impact Mediterranean Architecture - Non Profit Association
- CERCLE GESPROMAT S.L. - Private Company
- EGM - Private Company
- VIGEM - Viladecans Grup d'Empreses Municipals, S.L. and VIMED - Municipally-owned company
- Viladecans Grup d'Empreses Municipals, S.L. - Municipally-owned company
- CICLICA SCCL - Cooperative

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1 Executive Summary

The municipality of Viladecans is aiming to fulfil with the EPBD (2010) and EED (2012) directives inserting a district deep energy renovation at the core of a sustainable urban development initiative encompassing participated governance, circular economy and capacity building.

This project focuses on the dense Montserratina District (30% of the city population), with a lower-than-average annual district income and a higher-than-average final energy consumption, despite its fuel poverty.

The project will create a Public-Private-Citizenship-Partnership (PPCP) and a Local Energy Operator (LEO), respectively governance and executive body, which will involve all municipality stakeholders in managing and implementing Viladecans' energy transition.

The transition will start with the deep energy renovations of 60 dwellings (demo-renovations) and the renegotiation of new optimised energy contracts for the entire citizenship. In parallel, several capacity building and stakeholder engagement initiatives will train energy consumers (i.e. the citizens) and workforce, generating awareness on energy efficiency matters and a local specialised industry cluster. The savings generated as a result will be converted in an alternative currency, the Vilawatt, that will be utilised locally by the citizens and, therefore, re-injected to boost the local economy.

The project has concluded its study period and is now entering the implementation phase almost on track, having managed to sort out its legal structure and to gain the necessary traction for an effective change management.

Going forward, Viladecans should carefully manage its timeline, with an eye on external shocks, and adequately pace the introduction of its alternative currency. In doing that, a constant exercise will need to be undertaken in managing conflicts, monitoring results and finding opportunities to employ the newly-trained workforce into the project endeavours.

2 The policy context



2.1 The international level

Buildings are responsible for 40% of energy consumption and 36% of CO₂ emissions in the EU, with older buildings consuming at least 5 times as much as new ones, and up to 60 litres of heating oil per year¹.

Currently, about 35% of the EU's buildings are over 50 years old. By improving the energy efficiency of buildings, the EU total energy consumption could be reduced by 5-6% and CO₂ emissions could be lowered by about 5%¹.

An analysis of the evolution of energy intensity and final electricity consumption shows how, globally, buildings energy intensity has improved since 1990, but not enough to offset building sector growth². EU data seem to be aligned with this global trend³. Without assertive energy efficiency action, global building energy consumption could increase by 50% to 2050.

In Spain⁴, final energy consumption and energy intensity have been decreasing, both on overall and in the residential sector, in parallel with the increase in the share of renewables. The decrease, largely driven by the 2007 financial crisis, has overlapped those linked to the technological improvements in electric appliance equipment and to the household thermal installations.

Despite the data, however, political response to the need for and energy transition to tackle climate change has only recently reached a consensus and a commitment to coordinated action. The first global agreement on the reduction of climate change was signed, by representatives of the 196 parties, only in 2015 at the United Nations Climate Change Conference, COP 21 (the Paris agreement).

¹ EU Commission website, section dedicated to Energy Efficiency of buildings, available on: <https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings>.

² IEA Energy Efficiency Training Week, 2015, available on: https://www.iea.org/media/training/eetw2016/buildings/A.2_Energy_efficiency_potential.pdf.

³ EU Energy in figures, Statistical pocketbook, 2017, available on: https://ec.europa.eu/energy/sites/ener/files/documents/pocketbook_energy_2017_web.pdf.

⁴ Energy Efficiency Trends and Policies in Spain, IDAE, 2015, available on: <http://www.odyssee-mure.eu/publications/national-reports/energy-efficiency-spain.pdf>.

Buildings in the EU:

- 40% of energy consumption
- 36% of CO₂ emissions

Consumption reduction potential:

- 5-6% of total EU energy
- 5% of CO₂ emissions

Global building energy consumption, without action

→ +50% by 2050

First global agreement on climate change signed only in 2015 (COP 21)

The EU has been actively promoting energy efficiency (EE) and renewables (REs) since the late 1990⁵ and legislating on the energy efficiency of buildings since 2002⁶.

The **Energy Performance of Buildings Directive (EPBD)** introduces buildings energy performance certificates, inspection schemes for heating and air conditioning systems, new buildings as Net Zero Energy Buildings (NZEB) by 2020, minimum energy performance requirements for the different level of interventions, and lists of national financial measures to improve buildings energy efficiency.

The **Energy Efficiency Directive (EED)**, instead, introduces the National Energy Efficiency Action Plans (NEEAPs) containing long-term national building renovation strategies as well as targets for the public built environment.

Later, in 2016, EPBD regulations have been also updated to promote the use of smart technology in buildings and, in parallel, the Commission published the **EU Building Stock Observatory**, a database to track the energy performance of buildings across Europe.

The EU has also financed several initiatives aimed at financing buildings energy retrofits and creating expertise, namely:

- European Structural and Investment Funds (ESIF), allocating €18 billion to EE in buildings;
- Sustainable Energy Investment Forums across the EU, to boost public-private stakeholders' cooperation in the sector;
- Project Development Assistance (PDA) facilities, to help project promoters, such as ELENA (up to 90% development costs for private and public promoters of large-scale bankable sustainable energy investments) and PDA H2020 (grants for private and public promoters of small to medium sized sustainable energy projects);
- platforms such as DEEP (De-risking Energy Efficiency Platform), an open-source database of EE projects, and BUILD UP, a web portal for practitioners and professional associations, gathering Europe's collective intelligence on buildings EE.

⁵ Speaking points for the European Commission, in CSD 14: Thematic discussion 'Enhancing energy efficiency to address air pollution and atmospheric problems, combat climate change, and promote industrial development', available on: https://sustainabledevelopment.un.org/content/documents/ec_energy_02may.pdf.

⁶ Wikipedia "Directive of energy performance of buildings", available on: https://en.wikipedia.org/wiki/Directive_on_the_energy_performance_of_buildings.

Another relevant megatrend, parallel to that of the increase in domestic energy consumption, is the rise of cities.

The EU has, in recent years, been increasing its focus on urban issues, as a response to the fact that 80% of EU citizens will be living in cities by 2050, and that urban areas currently account for 60 to 80% of energy consumption and around the same share of CO₂ emissions⁷.

Sustainability of the urban dimension has been tackled at EU level through several initiatives:

- ERDF structural funds 2014-2020, 50% of which are to be invested in urban areas;
- grant framework programmes FP7 and Horizon 2020, with specific calls on buildings EE and deep renovation strategies/technologies (under the 'Tackling Societal Challenges' pillar);
- URBACT, a EU exchange and learning programme promoting sustainable urban development, and enabling joint development of solutions to major urban challenges (7 000 people, 500 cities, and 29 countries as participants);
- UDN, a Urban Development Network of more than 500 EU cities/urban areas responsible for implementing integrated actions based on Sustainable Urban Development strategies;
- EUKN, the European Urban Knowledge Network, an exchange platform of expertise around sustainable urban development;
- EU Green Capital Awards and EU Green Leaf Awards;
- other initiatives such as: the EEBPPP (Energy-Efficient Buildings Public-Private Partnership), the Smart Cities and Communities European Innovation Partnership and the European Energy Research Alliance's Joint Programme on Smart

Cities, focused on energy-efficient construction and communities, integrated interventions and the related research.

Among the initiatives financed through the ERDF, the Urban Innovative Actions (UIA) initiative finances pilot projects featuring new approaches to the challenges faced by cities. The aim is to generate knowledge around sustainable urban development solutions through a total of EUR 371M in grants over the period 2015-2020.

At the same time, several aggregations have formed to tackle sustainable urban development (e.g. Energy Cities, Eurocities, ICLEI, Local Governments for Sustainability, European Sustainable Cities Platform, Joint Programming Initiative Urban Europe...). Among these, the most significant is the **Covenant of Mayors**, a joint movement of 6000 European local and regional authorities committed to meet and exceed the EU target of 20 % CO₂ reduction by 2020 and to implement a Sustainable Energy Action Plan (SEAP) in their constituencies.

Cities in the EU:

- 80% of EU citizens living in cities by 2050
- 60- 80% of energy consumption and CO₂ emissions

Covenant of Mayors:

- 6000 EU public authorities
- 20 % CO₂ reduction by 2020

⁷ EU Commission website, section dedicated to EU Policy on the Urban Environment, available on: http://ec.europa.eu/environment/urban/index_en.htm.

From a policy and regulatory standpoint, **Spain** aligned both to EU energy efficiency directives (EPBD and EED) through its **National Action Plan on Energy Efficiency** and to the **Spanish Strategy for the Energy Rehabilitation in the Building Sector**.

Additionally, a series of measures have been introduced, to comply with the binding objective on energy savings, the main ones being the Aids Program for Energy Rehabilitation in Buildings (PAREER-CRECE), the update of the national

2.2 The local level

At the local level, the wider Barcelona area and the Viladecans Municipality (Ajuntament de Viladecans), both signatories of the Covenant of Mayors, are supporting energy transition in urban regeneration practices.

At the metropolitan level, the nearby **Barcelona** is strongly committed to EE: it has developed an **Energy, Climate Change and Air Quality Plan (PECQ)**⁹ aligned with the regional **Pacte Nacional per a la Transició Energètica de Catalunya**, it has launched a series of subsidies for EE building renovations and RE installations¹⁰ and, at an international level, it has adhered to the Compact of Mayors.

The city energy dedicated portal, **Barcelona Energia**¹¹, and the local Energy Advice points¹², provide an ever updated picture on incentives,

Technical Building Code (TBC), the Regulations on Building Heating Installations (RITE) and the introduction of a national energy certification of buildings.

Finally, a separate strategic regulatory framework has been devised to enhance the use of REs in buildings; the related initiatives, managed by IDAE, finance pilot experiences boosting a quality offer to supply hot water, and heating & cooling in buildings from different technologies based on REs through ESCOs⁸.

events and trainings focused on energy transition. The **42 energy-efficiency-focused Horizon2020 projects financed in the area**¹³, show how a knowledge base already exists on topics such as integrated residential buildings retrofits, tackling energy poverty, gamification for energy disaggregation as well as alternative decision making tools and business models for retrofitting neighbourhoods and districts.

Finally, other non-energy-focused projects financed in the area¹⁴ provide transversal expertise for specific aspects of the project.

At the local level, Viladecans has elaborated a sustainable energy action plan since 2009, a plan for climate change adaptation since 2016, it has participated in URBACT and it is a signatory of the Covenant of Mayors¹⁵.

⁸ Energy Efficiency Trends and Policies in Spain, IDAE, 2015, available on: <http://www.odyssee-mure.eu/publications/national-reports/energy-efficiency-spain.pdf>.

⁹ Pla d'energia, canvi climàtic i qualitat de l'aire de Barcelona 2011-2020, available on: http://ajuntament.barcelona.cat/ecologiaurbana/sites/default/files/PlaEnergia_CanviClimatic_QualitatAire-2011-2020.pdf.

¹⁰ Renovating to save, 2017 Subsidies, available on: <http://energia.barcelona/en/renovating-save-2017-subsidies>.

¹¹ Barcelona Energia, available on: <http://energia.barcelona/en>.

¹² On pots informar-te?, available on: <http://energia.barcelona/ca/on-pots-informar-te>.

¹³ Horizon 2020 Energy Efficiency Data Hub, available on: <https://energy.easme-web.eu/>.

¹⁴ Fernando, A. - How One City in Spain Launched a Local Currency, Shareable 08/06/2017, available on: <https://www.shareable.net/blog/how-one-city-in-spain-launched-a-local-currency>.

¹⁵ Ajuntament de Viladecans web portal, Canvi Climàtic, available on: <http://viladecans.cat/ca/canvi-climatic>.

Additionally, a series of initiatives related to energy efficiency has been put in place, namely¹⁶:

- CRRESCENDO Project - integrated strategy towards achieving an increase in the use of Res;
- an energy bank, created by the city council to manage 50% of the school savings generated within the EURONET 50/50 project (project incentivising energy savings in schools) and a time bank;
- an energy map of the municipality, to be updated into an energy transition map;
- the showcase renovation project of a school to

- passive house standards (El Garrofer School);
- the institution of a local housing office to promote renovations and inform the community;
- “the BIG Saving”, a quiz aimed at engaging citizens in reducing energy consumption.

The Vilawatt project takes inspirations from the local and metropolitan expertise, as well as from other EU project references, to develop a multidimensional integrated programme of urban renovation and energy transition to the benefit of the entire local community.

3 The Montserratina neighbourhood



Bird view of the Eixample Area.

3.1 Socio-economic context

Vilawatt scope is the “Eixample Area”, a dense and compact residential district of 8,026 dwellings and 450,000 sqm. The “Eixample Area” includes the original neighborhood of Montserratina and the other more recently urbanized areas of L’Eixample and Can Ginestar.

The Montserratina neighborhood was born isolated from Viladecans town and the other nearby areas that were built later following a more structured urban plan. Montserratina developed mainly during 1950-60, following an important immigration wave, with new

¹⁶ Viladecans project Deliverable 4.1.1 – Benchmarking Report – PPCP.

inhabitants typically self-constructing precarious homes which later on were allowed to rise up to 3 floors. Speculation led to a high density neighborhood of 500 inhabitants/ha, without school buildings, parks or green areas. In the last two decades, the Montserratina district has continued to receive new inhabitants (mainly from non-EU countries), despite the lack of free space to urbanize.

From a socio-economic point of view, the Eixample Area is a diverse but consolidated community of 20.216 inhabitants, 30% of the whole city. The typical inhabitant is 39 and born in Catalunya, has secondary studies and lives in a 4 people dwelling with a family gross income of 15,100 euros/year, 13.5% less than the Catalan average. The district also has a higher proportion of children than in the rest of the city.

“A high density neighbourhood of 500 inhabitants/ha [...] the typical inhabitant is 39 and born in Catalunya, has secondary studies and lives in a 4 people dwelling with a family gross income of 15,100 euros/year, 13,5% less than the Catalan average.”

The area has been significantly affected by the economic crisis since 2007 and this is physically reflected in the high number of unoccupied commercial premises in the buildings ground floors. According to City Council data, estimated property value is about 30% less than in the rest of the city.

The main aggregators are associations and social organisations, 196 in total according to a 2015 survey (of which 78% associations and 15.5% sports club); they configure the social network of the city. The most important community centers are the “Casal de la Montserratina”, a recent public building where social cohesion among the neighbors is promoted, and the close market, important center of social interactions.

In 2010, the Vilawatt area consumed around 56 GWh in buildings' energy, 99% of which was housing consumption. This corresponds to 75 kWh/sqm per year, against an average consumption in multi-storey buildings in the Mediterranean area of 69 kWh/sqm (-8%).

Of these, 45% was electricity and 44% was gas. CO₂ emissions reached 9,415 tCO₂ for electricity and 6,343 tCO₂ for gas, for a total of 15,758 tCO₂.

Dwellings have poor energy characteristics and household energy demand for climatization in the areas is high: in general, the energy dependency of the neighborhood has increased over the years and in some cases such demand remains unsatisfied, with some dwellings experiencing fuel poverty.

Therefore, whilst the Montserratina has been targeted for important urbanization interventions, an important need for building renovation remains unaddressed.

Montserratina

- 75 kWh/sqm per year, 8% more than Mediterranean average
- 15,758 tCO₂ per year
- increased energy dependency, fuel poverty
- important unaddressed need for building renovation

3.2 Physical context

In order to better identify the physical context and to optimize the energy transition model for the district's build environment, two key studies have been undertaken:

- a characterization of the building stock in the project area;
- energy studies on the building typologies identified, to optimize retrofit strategies.

To achieve a deep scanning of the energy needs of the existing building stock in the project area, the following methodology was developed:

- definition of most relevant building and urban indicators;
- selection and adaptation of the data treatment software (Enerhub);
- field data collection, visualization and interpretation;
- definition of building typologies according to survey results, urban legislation background and building technologies.

As a result, the building stock has been grouped into 5 typologies.

- **Typology 1: buildings built before 1955 (5% of the total)** – these buildings were constructed before the first development plan was established. Buildings from this period are mainly buildings of 1 or 2 floors, with a unique dwelling. Their floor area is about 100sqm due to the narrow urban plots. They are mainly buildings with few and/or small windows, no balconies and mortar finishing. The roofs are either flat or pitched.

- **Typology 2: buildings built between 1956 and 1970 (38% of the total)** – these buildings were constructed before the general planning regulations governing the characteristics of buildings at urban level. Buildings from this period are mainly 2 or 4 floored, with a unique dwelling per floor. Their floor area is normally under 150 sqm. These too are mainly buildings with few and/or small windows and no balconies (even if the number of buildings with medium window to wall ratio and with balconies increase). Wall finish is usually mortar and roofs are flat.



From left to right, building typologies 1 to 4.

- **Typology 3: buildings built between 1971 and 1980 (26% of the total)** – constructed before the first Spanish regulation on building insulation. Buildings from this period are mainly 4 or 5-floored, with 3 or 4 dwellings per floor. Floor area is around 300sqm and use of ground floor is non residential. These buildings have a medium window to wall ratio, balconies and flat roofs. The main exterior wall finish is bricks (54%) or plaster (40%).

- **Typology 4: buildings built between 1981 and 2010 (31% of the total)** – constructed before insulation requirements were heightened. Buildings from this period are again 4 or 5-floored, with 1 or 2 dwellings per floor. Floor area is around 150-300 sqm. Window to wall ratios are high and there are balconies, mostly continuous. Main exterior wall finish is bricks, roofs are mainly flat, mixed (33%) or pitched (19%).

- **Typology 5: buildings built after 2010** - only 2 units, irrelevant for the characterization.






Additionally, other urban indicators related to the buildings' surroundings have been transversally applied to complete the energy performance classification, resulting in the following conclusions:

- the compact and dense urban district shape generates advantages (low energy losses, **technically easy for façade renovations**) and drawbacks (low solar gains);

- whilst most buildings have low exposed surfaces and **reduced solar gain potential**, great differences appear between individual buildings, so **energy renovation strategies will need to adapt to each situation**;

- given the urban compactness, **influence of the surroundings might be more important than building parameters themselves** (i.e. buildings with similar geometry and envelope may have very different energy needs depending on the height of neighboring dwellings).

Once the building stock has been classified, **a sample of buildings for each category has undergone dynamic thermal simulation** (through DesignBuilder software) to verify the energy performance. Buildings have been simulated in comfort condition approach (i.e. according to their standard use) and real condition approach (i.e. according to their current use) and under both as-built and retrofitted conditions (identified by a set of construction and operational parameters).

BUILDING TYPOLOGY	party wall	sun radiation	Demand reduction (kWh/m2)	%	Consumption reduction (kWh/m2)	%	
B1	adiabatic	low	90.7	69.7%	174.0	93.6%	
		high	80.9	71.5%	151.4	94.0%	
B2	adiabatic	low	77.9	74.8%	140.9	94.7%	
		high	77.1	75.4%	138.6	94.9%	
	exposed (47m2)	low	85.6	73.0%	158.1	94.4%	
		high	84.8	73.7%	155.4	94.5%	
B3	adiabatic	low	100.9	73.6%	184.9	94.5%	
		high	99.3	75.9%	177.5	95.0%	
	exposed (153m2)	low	108.1	74.8%	195.6	94.7%	
		high	104.9	75.7%	187.9	94.9%	
B4	adiabatic	low	91.5	85.8%	147.8	97.0%	
		high	85.2	87.4%	135.3	97.3%	
	exposed (100m2)	low	89.2	80.4%	152.0	95.9%	
B5	adiabatic	low	59.1	75.6%	106.0	94.9%	
		high	57.1	77.6%	100.2	95.3%	
	exposed (180m2)	high	61.9	75.6%	111.0	94.9%	

Energy Simulation results. In the “party wall” column, the term “adiabatic” identifies partitions between environments without heat transfer (e.g. walls between two interior environments, walls that are not exposed to the exterior).

Energy demands and consumptions in real conditions approach were around 70% lower than those estimated in comfort conditions: this demonstrates the big influence of the user profile on final EE outcomes.

As a consequence, in the renovated scenario, annual consumption reductions are much smaller in real conditions (45.7 kWh/sqm) than in comfort ones (177.5 kWh/sqm).

Other conclusions were:

- in comfort conditions approach, envelope factors have a remarkable weight in the determination of energetic demand (buildings with greater façade or exposed party walls have higher demands);
- roof type can be substantially influent depending on number of floors;
- **buildings of Typologies 3 and 4 are those with**

the highest energy saving potential in the context of this project;

- in the renovated scenario, users would live with a much healthier range of temperatures.

An analysis of costs associated to a deep energy renovation of Typologies 3 and 4, showed again a strong difference in the amortization period between real and comfort approach conditions (87 years vs 29 years respectively), confirming the importance of user behavior in obtaining the necessary cost effectiveness.

The design deep retrofit intervention encompassed full envelope insulation, high performance windows and high efficiency heat pumps. However, in the real conditions approach, further externalized costs (health costs, environmental costs, building improvement and renovated delay costs) should be also accounted for.

Building stock:

- **5 Building Typologies**
- **easy façade renovations**
- **low solar gain potential**
- **high influence of the surroundings**
- **high influence of user profile on final consumptions and saving potential (70% difference)**
- **cost amortization strongly dependent on user profile**
- **building typologies 3 and 4 have highest energy saving potential**

4 The proposed solution

4.1 From concept to structure

The main challenge for the municipality of Viladecans is to **secure a stable energy transition process in Viladecans**, to achieve a low-carbon, socially-just and healthier community, where citizens play an active role. This broad vision also needed to align to the strategic policy context in which Viladecans is framed, that is the Pacte Nacional per a la Transició Energètica de Catalunya¹⁷, organized in 7 strategic axes:

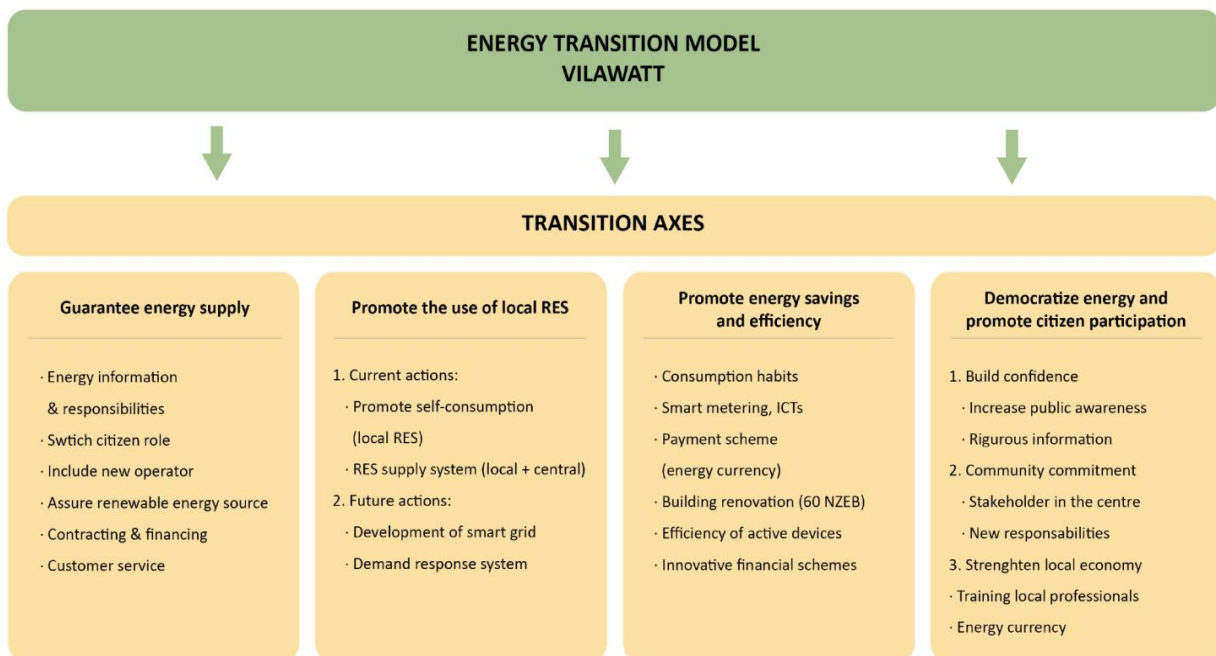
1. Guarantee energy access
2. Guarantee energy supply
3. Promote energy savings and efficiency
4. Promote use of local REs
5. Promote investigation, energy innovation

6. Democratize energy, promote participation
7. Exercise full competition within the EU.

Viladecans transition model's strategic axes have been derived from the above set, selection being made on the basis of local relevance:

1. Guarantee energy supply (electricity)
2. Promote the use of local REs
3. Promote energy savings and efficiency
4. Democratize energy and promote citizen participation

Finally, Viladecans' strategic objectives for each axis have been defined, forming the new energy transition model.



Vilawatt proposed Energy Transition Model.

¹⁷ Pacte Nacional per a la Transició Energètica de Catalunya, available on: http://icaen.gencat.cat/ca/plans_programes/transicio_energetica/.

In order to translate the above mentioned objectives into concrete actions, a benchmarking study (deliverable 4.3.1) has been undertaken which **analysed 31 different past initiatives**, on an global basis, to determine the most appropriate structural features for the project.

The initiatives have been initially identified based on their contribute to governance and executive advancements, then grouped basing on general information, governance structure, operational model, financing instrument and objectives. The grouping allowed to identify **predominant features**:

- regional or city-wide initiatives targeting the entire community, with focus on residential beneficiaries;
- a structure composed by a public authority (governance) and a public-private partnership (Project Delivery Unit), involving all stakeholders

in a unilateral or consensus-based decision making process;

- an operational model whereby the PDU acts as facilitator and aggregator, coordinating project delivery on behalf of the public authority, without intermediating contracts between the authority and third party contractors (i.e. without power of signature);
- a public or private investment fund financing at least 75% of the total investment cost;
- general objectives aligned with those of Vilawatt (i.e. energy supply optimization, RE generation, energy services, new governance and residential ESCO) and above 75% coverage of the energy target.

This analysis has allowed to establish the main features of the project, and to legitimize the chosen organizational structure as the most appropriate one.

Analysis of reference projects.

	GOVERNANCE					TECHNICAL SERVICES				
	G1. Governance structure	G2. Business model	G3. Citizen empowerment	G4. Fuel poverty	G5. Vision	A. Energy supply	B. Consultancy	C. Engineering & Investment		
								RES generation	Building renovation	Efficiency devices
1	BROOKLYN MICROGRID					X	X	X		
2	ELECTRICA DE CADIZ					X	X			
3	OPERADOR BCN					X	X	X		
4	SOM ENERGIA	X	X	X		X		X		
5	ENERCOOP					X		X		
6	BRIXTON ENERGY COOP	X	X	X		X		X		X
7	SAERBECK, CLIMATE COMMUNITY		X	X		X		X	X	
8	SMARTENCITY						X	X	X	X
9	OSER (Regional Energy Service Operator)	X	X			X		X	X	
10	ECCOO	X	X	X		X	X	X		X
11	Transition Town Totnes	X	X	X	X	X				
12	Banc d'energia	X	X		X	X				
13	Sim4Blocks			X		X	X			
14	ENERGY FUND DEN HAAG							X		X
15	ENERGIES POSITIF		X			X	X	X	X	X
16	EERFS					X				
17	SUNSHINE					X			X	X
18	WARM UP NORTH		X			X			X	
19	SPEE PICARDIE		X	X		X			X	X
20	PADOVARTI		X			X			X	
21	MESA TRANSICIÓN CADIZ	X		X	X	X				X
22	The Economic Affairs department of Amsterdam			X		X				
23	Amsterdam Energie		X	X		X				
24	ITC RURAL DEVELOPMENT TRUST	X	X	X	X	X				
25	DESILTING OF PONDS	X	X	X	X	X				
26	SUSTAINABLE SOLUTIONS FOR WATER NEEDS OF LOW-INCOME COMMUNITIES	X	X	X	X	X				
27	PPCP for impacting poor communities	X	X	X	X	X				
28	OF-THE-SHELF model					X			X	
29	CHATTANOOGA	X		X						
30	CONSEJO INSULAR DE ENERGÍA	X	X	X		X				
31	RENOVEM ELS BARRIS								X	
OTHERS										
Agrupacio de consoms per a la promocio de la gestio energetica comunitaria (Azimut 360)										
Anàlisis viabilitat comercialitzacion electrica y posibilidades (Som Energia)										
The Constructive, Destructive, and Reconstructive Power of Social Norms										
Programa d'impuls a la generació d'energia solar a Barcelona										

The structural backbone of Vilawatt is the Public Private Citizenship Partnership (PPCP), the municipal entity that will manage the entire programme.

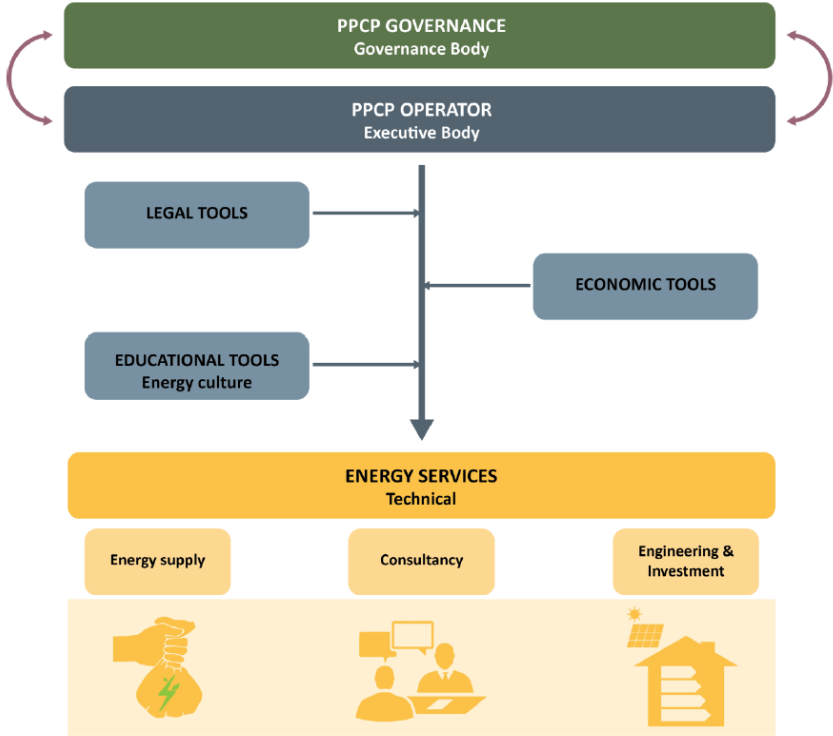
Stemming from the new energy transition model described earlier, the PPCP will be articulated in a governance body (governance structure) and in an executive body (executive structure or Project Delivery Unit).

The **PPCP governance body** will act as a steering committee, with the objectives of establishing and maintaining a common vision and a resilient business model, ensuring economic sustainability and enforcing respect of the existing regulatory frameworks (legal structure). Furthermore, the PPCP will indirectly manage (through the executive body) the program implementation and (through consultants) the capacity building and community participation mechanisms. Finally the governance body will be responsible to analyze initiatives to combat fuel poverty.

The **PPCP executive body** will instead configure as a **Local Energy Operator (LEO)**, equipped with economic, legal and educational tools and offering **Energy Services**.

Its objectives will be ensuring energy supply optimisation (by aggregating energy demand, studying different tariffs...) and a RE guarantee of origin, as well as educating citizens to a culture of energy efficiency (i.e. educating the demand). Furthermore, the LEO will be responsible to coordinate the initiatives requiring substantial prior investment, such as the new build of RE generation, the energy efficient renovation of buildings and the roll-out of domestic energy efficiency devices (smart metres, etc.).

It is intended that both RE generation and building retrofits will unlock the current immobility situation and strengthen the local economy by creating new specialized jobs and expertise in energy efficiency.



Vilawatt organisational structure.

4.2 The structure - PPCP

The PPCP governance body will have framework setting and supervising responsibilities and will therefore act according to a series of recommendations and guidelines. These have been identified through the benchmark study (4.3.1).

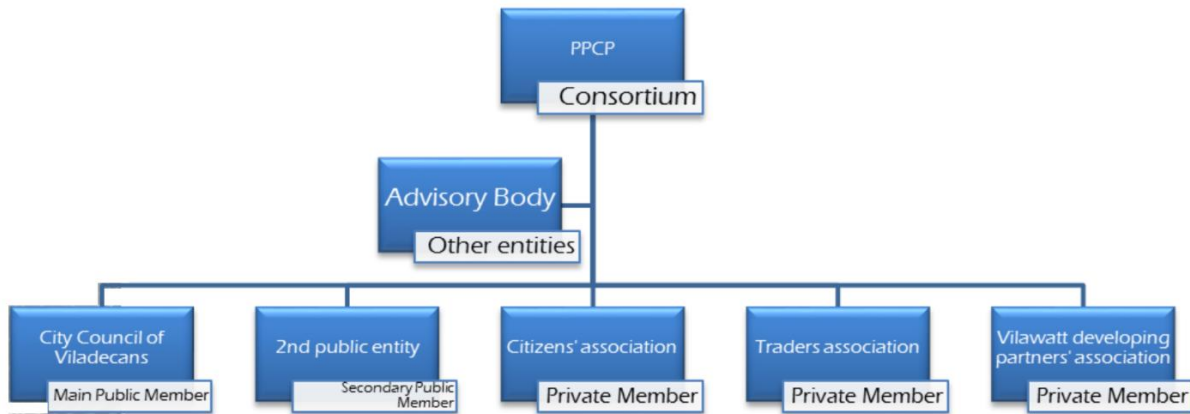
Past initiatives' predominant features, as identified in paragraph 4.1, have been singled out and their success factors, risks and replicability features have been mapped across the governance body dimensions. As a result, the following main **recommendations** have been formulated.

- **Vision and tackling of fuel poverty** – Vision should be shared, focused on clarity (especially on risks and rewards) and win-win solutions. Fuel poverty could be tackled by involving in the

PCPP an NGO subject able to channel funds to the purpose.

- **Legal entity** – The chosen legal form for the PPCP is the **consortium**, allowing for the participation of the different public and private stakeholders categories, whilst maintaining the municipality's leadership and the not for profit character of the initiative. In accordance with legal requirements, the consortium must be constituted with two public administrations or entities (e.g. City Council of Viladecans, plus another public entity which does not depend on a local administration).

Local private stakeholders should participate through an association-type entity, either for ease of management (private members and traders) or for compliance requirement (citizens).



PCPP legal structure.

- **Decision Making process** - Whilst important decisions should be taken by consensus, time and operability constraints might imply that decisions could be taken by a great majority; in any case, it will be critical to ensure presence of enough representatives from each stakeholder category, which in turn can be achieved through the establishment and periodical review of

minimum numerical thresholds; for assemblies and important meetings, an external mediator might also be summoned.

Additionally, the governance structure should include a validation mechanism (for example through ad-hoc external committees) to ensure economic, environmental and social sustainability.

- **Business Model** – Should aim at economic sustainability without targeting profits. To ensure this, a clear definition of roles and responsibilities and the implementation of appropriate monitoring systems should become key focus aspects.

- **Stakeholders role and engagement approach** – the governance body should group together representatives from the municipality, each with

its specific role as detailed in Table 1.

- **Operational model** – borrowing from a reference initiative, a guideline model has been established to accompany decision makers from the definition of the policy framework to the post-implementation monitoring. A parallel, similar prioritization structure had been devised to implement the PPCP governance body, as shown in Table 2.

Stakeholder	Role
Municipality	Facilitator and major project funder lends credibility to the project and attracts the private sector participation.
Industry-Private	Implementer, technical expertise provider and final beneficiary. Major or part project funder.
Community-Citizen	Final beneficiary and safeguard of community needs, Awareness of relevance of PPCP Ultimate beneficiary.
Local non-profit organization	Interface between community and other stakeholders Credibility Grass-root level efficacy- has the community quality of life improvement as a principle Mapping local requirements based on the needs.

As for the engagement approach, this should be aimed at building involvement and capacity from an early stage, whilst ensuring community’s central role in the PPCP.

Table 1 – Stakeholder role.

Priorities, PPCP governance body

1. PPCP policy framework and legal basis
2. Capacity building and brainstorming of all PPCP stakeholders/agents (municipality workers, local businesses, community associations, citizens)
3. PPCP management and legal structures
4. Information dissemination
5. Discussion with stakeholders
6. Call for inputs on PPCP governance
7. Evaluation of inputs on PPCP governance
8. PPCP creation and implementation
9. Monitoring & Evaluation

Priorities, implementation



Table 2 – Operational model.

4.3 The structure - LEO

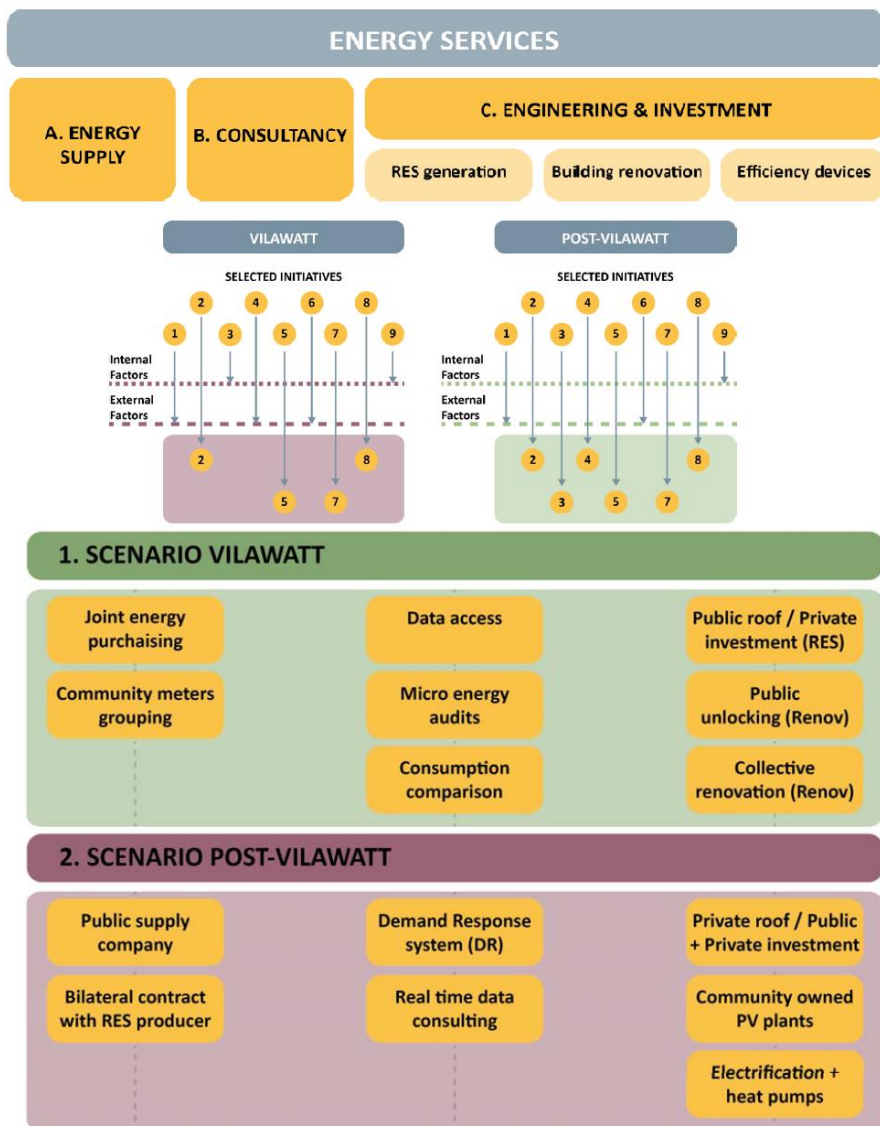
The executive body of the PPCP will act as a **Local Energy Operator (LEO)**, de-facto transforming Vilawatt's objectives into concrete actions and requirements, to fit a pre-defined roadmap. Actions constituting a draft roadmap for the LEO have been identified through a benchmark study (4.3.1).

Past initiatives with predominant features, as identified in paragraph 4.1, have been singled out and their actions analysed through a further, **two-stepped level of screening**, to ensure adaptive capacity to the Vilawatt context:

- a SWOT analysis against the LEO objectives;

- a filtering on the basis of internal and external factors characterising the scenario pre-Vilawatt (i.e. well-known context) and post-Vilawatt (i.e. unknown context, resilience required).

Resulting **actions** were adopted as either actions to be pursued by Vilawatt, or as follow-up actions for the post-project scenario. Finally, for each action, **requirements (legal, technical and social)** have been mapped, as the basis to design a **LEO Roadmap**.



LEO Roadmap definition process – actions.

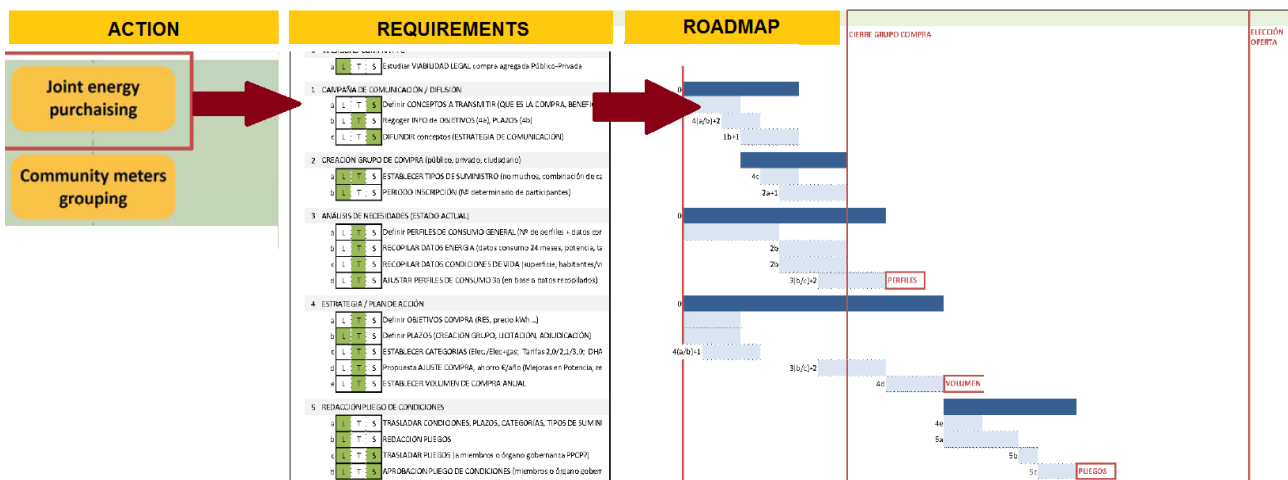
ENERGY SERVICES							
		A. ENERGY SUPPLY	B. CONSULTANCY	C. ENGINEERING & INVESTMENT			
FIELD OF ACTION	LEGAL	A5	<ul style="list-style-type: none"> Study viability of Public – Private purchase Study best system to set price Arrange starting date of contracts 	B1	<ul style="list-style-type: none"> Deployment of digital meter by DSO (before 31 Dec 2018) Obtain specific permission from consumer to give data to third parties Ensure confidentiality of the data provided 	C1	<ul style="list-style-type: none"> Study public roof to offer Study transfer of use of a public roof for a long period Realise Public-Private generation contract Study economic profit models Promote community shared investments Search different funding channels
		A6	<ul style="list-style-type: none"> Study legal viability (problem of energy resale) + consequences with DSO 	B2	<ul style="list-style-type: none"> Motivate involvement of local figure Specific training + contracting 	C5	<ul style="list-style-type: none"> Approval of local document declares Public utility a conservation area Study viability of Public intervention in private sector Establish payment scheme
	TECHNICAL	A5	<ul style="list-style-type: none"> Set an adjusted estimated plan _ annual volume of energy Study best system to set price Arrange starting date of contracts 	B1	<ul style="list-style-type: none"> Deployment of digital meter by DSO (before 31 Dec 2018) 	C1	<ul style="list-style-type: none"> Study public roof to offer Study economic profit models
		A6	<ul style="list-style-type: none"> Optimise new consumption point Prepare technical reports (new CIE, tariff change...) 	B2	<ul style="list-style-type: none"> Specific training + contracting 	C5	<ul style="list-style-type: none"> Approval of local document declares Public utility a conservation area
		A5	<ul style="list-style-type: none"> Assemble greatest volume of energy 	B3	<ul style="list-style-type: none"> Assemble great amount of consumption data Establish various consumption profiles Determine communication channel 	C6	<ul style="list-style-type: none"> Promote community shared investments
	SOCIAL	A5	<ul style="list-style-type: none"> Assemble greatest volume of energy 	B1	<ul style="list-style-type: none"> Obtain specific permission from consumer to give data to third parties 	C1	<ul style="list-style-type: none"> Promote community shared investments
A6		<ul style="list-style-type: none"> Reach Community consensus 	B2	<ul style="list-style-type: none"> Motivate involvement of community in energy matters Motivate involvement of local figure 	C5	<ul style="list-style-type: none"> Mediate among the community 	
A6		<ul style="list-style-type: none"> Reach Community consensus 	B3	<ul style="list-style-type: none"> Assemble great amount of consumption data Determine communication channel 	C6	<ul style="list-style-type: none"> Mediate among the community 	

A5: Joint energy purchasing
A6: Community meters grouping

B1: Data access
B2: Micro energy audits
B3: Consumption comparison

C1: Public roof / private investment
C5: Public unlocking
C6: Collective renovation

LEO Roadmap definition process – requirements.



LEO Roadmap definition process – roadmap.

4.4 The tools – Energy Contracting Model

One key aspect of Vilawatt is the capitalization of energy efficiency savings. To reach that, the most common business model involves utilising an ESCO (Energy Service Company).

Energy Service Companies (ESCOs) deliver energy services and/or other EE improvement measures in a user's facility or premises, and accepts some degree of financial risk in so doing. Payment for the services delivered is based (either wholly or in part) on the achievement of EE improvements and on the meeting of other agreed performance criteria. Depending on the type of contract, different energy services are included (e.g. the supply and installation of energy-efficient equipment, the supply of energy, building refurbishment, maintenance and operation, Measurement and Verification of savings).

To identify the best energy efficiency contracting model, a benchmark study has been undertaken (deliverable 4.4.1) which compared strengths and weaknesses of 6 different contract structures:

- **EPC Plus or EPC Basic** – Energy Performance Contract with or without comprehensive refurbishment (guaranteed savings);
- **EPC Light** - Energy Performance Contract for the sole energy management (guaranteed savings);
- **Green EPC** - Energy Performance Contract for the sole renewable energy installation (guaranteed electricity production);
- **ESC/Delivery Contract (DC)** - Energy Supply Contract for the sole supply of electricity and heat solutions (no guaranteed savings);
- **IEC** - Integrated Energy Contract for the supply of energy and the implementation of energy

efficiency measures (no guaranteed savings, occasional quality assurance).

Among these, EPC Plus, EPC Basic or IEC (if energy supply is to be included in the contract) are the three contract typologies best suited to achieve significant energy savings. Final choice should depend on baseload consumptions and type of retrofit intervention. In particular, EPC Plus contracts could be adequate in case of envelope thermal retrofits (i.e. insulation, windows...).

Following the analysis, a series of **recommendations** have also been drafted.

- Selection of a contract model should be informed by the results of a preliminary energy audit of the buildings to retrofit, in order to define baseline consumption, saving potential, required energy conservation measures and their cost of implementation. This data will provide valuable information to assess technical and economic feasibility and optimise both contract structure and counterparts selection.
- Subsidies will be needed to implement one of the three energy contracting models proposed above with the aim to reduce the average payback period of the interventions, and as a consequence to reduce the length of the ESCO contract.
- Part of the funds for the implementation of the energy efficiency measures and/or renewable energies (e.g. Photovoltaic system, solar thermal system ...) could be obtained through crowdfunding mechanisms (e.g. Ecrowd), allowing citizens from Viladecans to contribute in financing some of the measures.

- Green EPC (Photovoltaic or solar thermal systems) and/or EPC Lights formats can be good alternatives whereby only little or no investment in technical solution is possible, or whereby a deep energy retrofit cannot/doesn't need to be achieved.
- A simplified Measurement and Verification

(M&V) process is proposed as a monitoring solution for residential buildings, for which a full M&V could be too expensive in relation to the saving potentials. It is proposed to conduct.

A preliminary M&V Plan should be defined by an energy consultant expert (e.g. CMVP expert).

4.5 The tools – Alternative Currency: the Vilawatt

In order to translate the energy efficiency initiative into a benefit for the local economy, the programme incorporates the creation and diffusion of a local currency (the 'Vilawatt') which converts energy savings into local purchasing power.

Whilst main national and international currencies (like the Euro) have legal status, a local currency is referred as a "common tender currency", meaning its acceptance as means of payment is based on voluntary acceptance by their users. They are also called "complementary currencies" as they complement, but not substitute, official conventional money.

Three reference initiatives have been utilised as a reference for the Vilawatt alternative currency system:

- the Frankfurt spar strom
- the Brixton Pound
- the Grama of Santa Coloma the Gramanet.

Complementary currencies as a microfinance product underpinning incentive schemes to encourage specific behaviors are a known solution. In the case of Vilawatt, a tailor-made currency design will be conceived, mainly targeting the Local Energy Operator users (individuals and businesses), the local economy, the municipality and citizenship in general.

	Frankfurt saves energy	Brixton Pound & Energy Coop	Santa Coloma de Gramanet - Grama
Name of system	Frankfurt saves energy - Frankfurt spart strom	Brixton Pound local currency	Grama moneda local
Organisation	City Hall - Energy Agency (Energiefereferat)	Brixton Pound CIC	City Hall - Department of Commerce
Type of organisation	Public body	Non-Government Organisation	Public body
URL	http://www.frankfurt-spart-strom.de	www.brixtonpound.org	www.grama.cat
Country	Germany	United Kingdom	Spain
Region	Hessen	Greater London	Catalunya
City	Frankfurt	Lamberth	Santa Coloma de Gramanet
Year the system started	2008	2009	2017
Type of community currency	Commodity-based system	Sterling-backed	Euro-backed
Medium of exchange	Accounts	Accounts + vouchers + APP + SMS	Accounts + APP + SMS
Unit of value	Kwh reduced	Units of national currency equivalent	Units of national currency equivalent
Valuation	Convertible for national currency (discount on energy bill)	Convertible for national currency + payment of municipal taxes	Convertible for national currency
Cost-recovery mechanism	No charge	1,5% fee for electronic transactions, paid by the recipient business	5% conversion fee, paid by the business cashing-out
Source of funding	Publicly-funded service	User fee + seigniorage of outdated vouchers	Publicly-funded service
Purpose for establishing the system	Reward energy savings	Local economic promotion and support of Transition Towns movement	Local economic promotion and support of Transition Towns movement
Size of membership (approx.)	4.000 households	250 businesses + 1.200 individuals approx.	130 businesses + 30 NGOs
Population of Area (approx.)	732.000	325.000	118.000
Yearly volume of trade	Participants saved 24% electricity on average in one year and were given a premium of approximately 70 Euros.	Volume unpublished for e-currency. Volume of vouchers unknown because of anonymity and non-traceability.	300.000€/year (expected given extrapolation from first semester in operation)
Main goods and services traded	Electricity only	Day-to-day goods and services	Day-to-day goods and services

Alternative currencies comparative study, results.

Vilawatt currency's main goal will be to encourage energy efficiency investments and energy saving behaviours of participating families and businesses. This will be done by measuring the energy savings of the participating dwellings, and rewarding the participants with an energy currency or incentive scheme for their behavioral change.

The secondary goal will be to stimulate the local economy and employment by encouraging consumer loyalty to local businesses and, in particular, environmentally-friendly local shops. Therefore, not only the currency could be used to pay the Local Energy Operator's energy bill, but also for purchases in a network of local businesses.

Thirdly, the currency will also represent an environmental marketing tool for awareness-rising on energy saving actions for families. Launch of the currency and launch of the Local Energy Operator will be therefore aligned, and by connecting specific actions to a specific level of currency rewards, participants will learn what should be their behavioural change priorities.

When establishing an alternative currency, aside from scope and objectives, some key aspects also need to be defined:

- choice of money format (e-money vs non-e-money), benchmark unit of monetary value and legal framework
- money flows, means/channels of payment
- agents involved
- payment infrastructure technology and security

In order to ensure efficiency, security and traceability of the initiative, the Vilawatt has been established first and foremost as an electronic currency. Its legal framework,

therefore, is the one regulating electronic money in Spain (Law 21/2011).

According to that framework, e-money is real legal tender money conditioned within a semi-closed payment system, whereby monetary value is represented by a credit payable to its issuer. **E-money units are the digital representation (on an electronic platform) of deposits stored in a ring-fenced bank account, so they are 100% backed and guaranteed credits.** Such credits are issued upon receipt of funds in an amount equal to monetary value and accepted as means of payment by companies other than the issuer.

For simplicity, the Vilawatt has been benchmarked to the Euro, with a 1-to-1 conversion rate (i.e. 1 Vilawatt = 1 Euro). The e-money format requires the formal participation into the system of a Bank of Spain-licensed electronic money entity (EME) which manages the means of payment. Since this is not immediately implementable, **a parallel non-e-money solution of physical vouchers has also been introduced.**

Money will flow in a circular structure whereby the City hall (main issuer) hands out grants in e-money and individuals can buy e-money units in exchange of cash or bank deposits. Transactions will occur as "payments and charges" and "debits and credits", among system participants. Finally, the municipality will re-collect the Vilawatt (and close the money circle) by allowing payment of municipal fees and public services with the energy currency.

Transactions will utilize different **channels:**

- **internet** - Accessing the digital payment platform website using the user code and password from the own computer, mobile phone or tablet.

- **mobile phone (APP)** - Downloading the project APP and accessing it through user code and password from the own mobile phone or tablet. The APP enables payments only (no cash-out functionality).

- **physical vouchers** - physical vouchers available through EDE-backed Change Points, equipped with both euros and vouchers.

Operation flows for the **Change Point** will be:

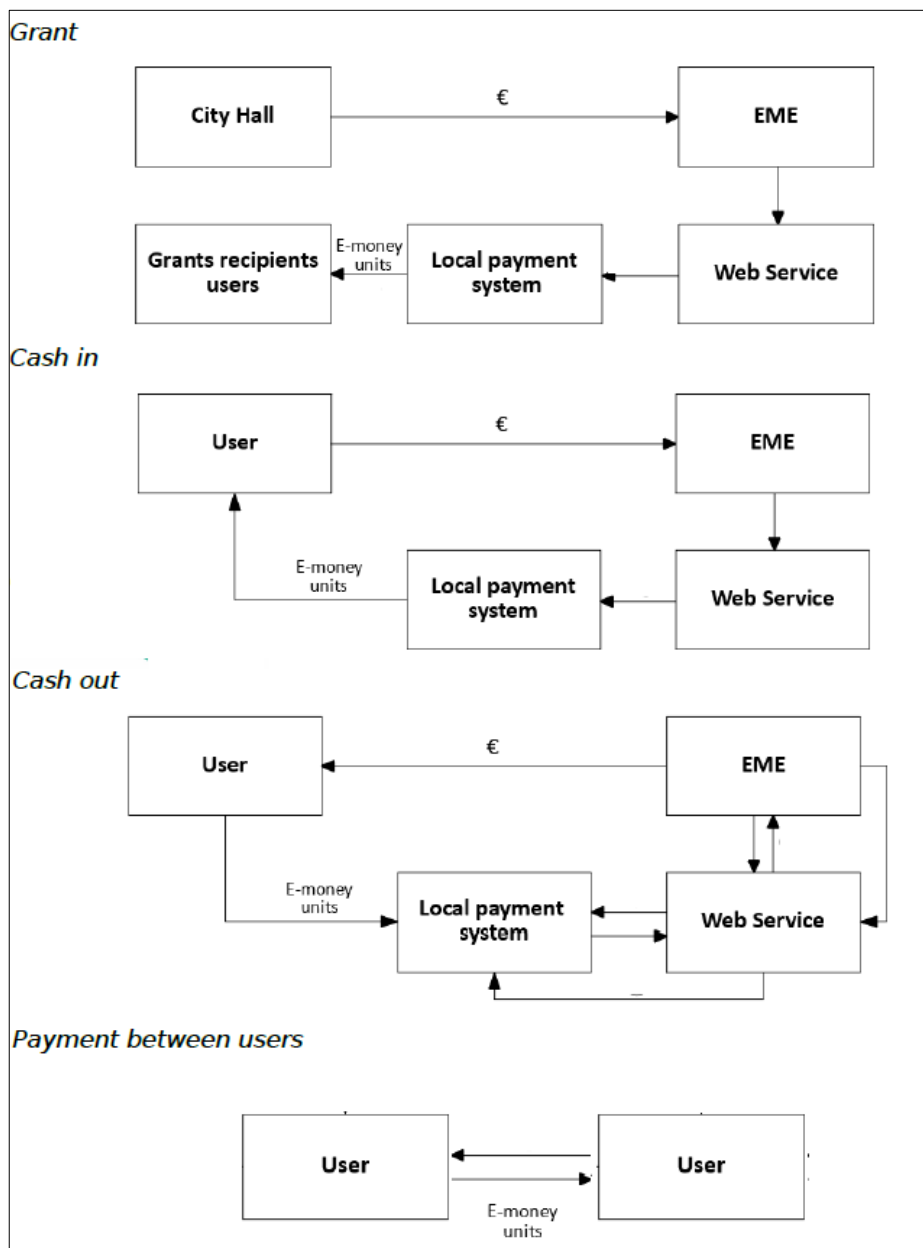
- Delivery of euros / vouchers (from City Hall administrator to Change Points).

- Purchase of vouchers with euros / with e-money (user performed)

- Conversion of vouchers to euros / to e-money (user performed)

- Business closing procedure (from the Change Points to City Hall).

Optionally, a devaluation rate system can be configured, which either forbids the currency exchange to Euros until a minimum circulation days threshold is reached, or impose a cash-out fee to all exchanges before such threshold.



Vilawatt currency transactions.

The implementation of such system requires a certain number of **agents**:

- **City Hall administrator (treasurer)**: through the City Hall budget, the administrator allocates funds to back e-money issuance, usually through a bank transfer to the EDE. In addition, the administrator provides the EDE a list of grants beneficiaries for the e-money to be issued through the payment system. Finally, the City Hall administrator manages the Change Points (EUR and vouchers supply).

- **Brokering Agents**: City Hall workers or external delegates with functions of intermediation (between the City Hall and system users), promotion, user support, feedback collection, supervision of supply and demand levels and management of the . Change Points.

- **Electronic Money Entity (EME)**: Financial institution licensed and regulated by the Bank of Spain to issue, manage and euro-back electronic money, monitor all transactions and manage users' information and cash-ins.

- **Payment system administrator**: according to the e-money legislation, this will be consortium member acting as agent of the licensed Electronic Money Entity (EME). It will be in charge of the deployment and operation of the energy currency scheme.

- **Users**: physical or legal persons authorized to carry out transactions (private citizens, grants recipients, companies, employees, etc.).

When choosing the payment infrastructure configuration, particular attention has been devoted to the key aspects of safety and privacy. Transactions will be enabled by a real time electronic payments network, where real money circulates within a semi closed circuit of

registered members. The system will be 100% transparent because it systematically and automatically records movements, granting traceability of all operations.

The payment system administrator, a company with experience in developing and deploying authoring centers and other SaaS (Software as a Service) payment services, uses a **specific IT platform to create virtual environments for software execution**. The underlying computing infrastructure to put into service consists of a single web server (nonelastic configuration) and a single database server, hosted by the IT platform.

Upon this IT infrastructure, two environments will be set up: a production environment, intended for the publicly accessible instance of the payments software, and a staging environment, intended for testing configurations before they are deployed. The **payment software**, Cyclos (by Social Trade Organization, STRO) is already widely used by local banks, multilateral financial institutions, barbers, community currencies and time banks. The software offers a range of banking and payment options, a complete ecommerce system and mobile access channels; additionally, it allow organizations to 'build' a dedicated payment system from scratch just by changing the configuration (i.e. without coding) and it also allows connection with other internet payment systems.

Users will be able to either self-register on the software platform, or to have a Brokering Agent doing it on their behalf, however, registration will be finalized only following submission of an ID document to the City Hall e-mail. Brokering Agents accounts will be created by the City Hall Administrator, they will have permissions to visualize only the registered users' general

information and info on the payment system's transactions.

Confidentiality, integrity and authenticity are guaranteed by security checks in combination with HTTP secure (https); password levels are hashed and all identifiers are ciphered when sending to client (browser) and the use of cookies limited to user session. Administrators are notified of every attempted breach or malfunctioning through security alerts.

In the deploying process of complete payment services, the Payment system Administrator underwent a security audit (December 2016) certifying compliance with the necessary security measures and requested guarantees.

As for **continuity of service**, the IT platform underpinning the service is headquartered in different European cities, complies with the European data protection framework and offers servers that meet the highest PCI/DSS standards of means of payment for critical security solutions. The IT and software configuration has also been optimized to ensure load balancing (in case of high internet traffic), data persistence (with the creation of permanent databases), stand-alone running (i.e. the software Cyclos running autonomously from other currency systems) and resistance to attacks (i.e. XSS, CSRF, SQL injections).

“Transactions will be enabled by a real time electronic payments network, where real money circulates within a semi closed circuit of registered members. The system will be 100% transparent because it systematically and automatically records movements, granting traceability of all operations.”

The Vilawatt:

- first and foremost electronic currency
- 100% backed and guaranteed credits
- 1 Vilawatt = 1 Euro
- parallel physical vouchers and Change Points infrastructure
- circular money flow mechanism
- several payment channels: internet, mobile, vouchers
- self-registration or via Brokering Agents
- transparency and security: recording of operations, breach alerts
- IT platform + payment software infrastructure
- continuity of service guarantee: redundancy configuration, load balancing, data persistence, stand-alone running

4.6 The tools – Stakeholder Engagement and Capacity Building

Another innovative aspect of the Vilawatt project is the participatory approach sought throughout the entire project, from its design to its implementation. In reality, for a multi-dimensional project of this kind, impacting the physical, economic and social fabric of 30% of the municipality population, engaging with citizens and with local traders is indispensable to effectively implement the program and to prevent potential resistance (traction and consensus).

To reach this goal, two main objectives have been pursued:

- stakeholder engagement
- capacity building

- **Stakeholder engagement**

Engagement with stakeholders, particularly with citizens, is important for the following reasons:

- proactive citizens make faster changes
- energy demand is people-driven
- democratic and equitable transition process
- bottom-up transition process.

To optimize the stakeholder engagement plan, the project started from the socio-economic characterization of the Montserratina district to determine the average stakeholder profile and to map the citizens' aggregators (associations) by level of influence and sentiment. It then cross-referenced the results with the physical locations of the aggregators and of the main pedestrian streets, isolating areas with higher concentration of public. An additional SWOT analysis of the social dimension of the Vilawatt project completed the study.

As a result, three main stakeholder engagement initiatives have been defined:

- an exchange forum, as part of the citizen forum association internal to the PPCP
- a 50/50 communities initiative
- a series of awareness raising workshops (RENOLAB, site visits to demo-buildings...)

THE EXCHANGE FORUM

The Forum activation is a key part of the services offered by the PPCP. Its main goals are:

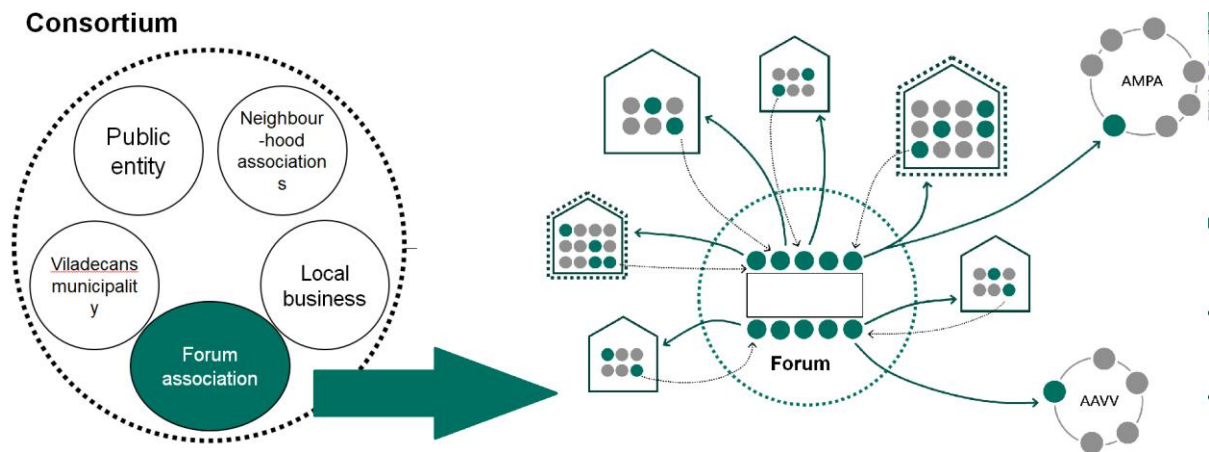
- to reduce energy consumption – through specific action-oriented activities
- to improve energy culture – generating a common knowledge through experience sharing and training
- to achieve a proactive citizens role in the long-term development of the initiative – by centralizing such activities
- to promote behavioral change.

Participation to the Forum will be undertaken through a diverse group of community representatives responsible of transferring the knowledge to the community (peer-to-peer transfer). In this way, citizens will be encouraged to form an Energy Team within each building. The team could potentially also involve master students from the nearby University (MISMEC Master, UPC) in the role of expertise providers.

Homeowners and tenants' subject to the energy retrofit of their buildings (demo-renovations) will be required to participate and

all the neighborhoods homeowners and tenants' associations in the Vilawatt area with an interest in the project will be invited. The Forum and its activities will privilege holistic approach (i.e. conveying the bigger picture),

peer-to-peer learning, collective work, participatory research and middle-out approach (i.e. utilizing professionals as change agents).



Exchange Forum schematics.

Forum activities will be structured in three main phases:

- initiation / capturing process (Jan-Sep 2018)
- activation / forum start (Sep 2018 -Jun 2019)
- continuity / forum with demo-renovated communities (Jun 2019)

The **initiation phase** will involve some research and information gathering (i.e. diagnosis) aimed at identifying the starting point in terms of community knowledge and interest. Firstly, group interviews will be held with local organized stakeholders and homeowners and tenants associations, to select homeowners and tenants for the renovations (i.e. the interest group). Then, an open meeting will be held to present the interest group and the Forum, to showcase results of the diagnosis, to introduce to the comprehensive action plan and invite the participants to help define it. A final workshop will then finalize core group, availabilities, action plan scenarios and rewards.

The **activation phase** will have two dimensions: co-management actions related to the operations preliminary to the renovations (i.e. auditing, funding) and training plan (i.e. participating in site visits and other awareness-raising initiatives, learning and practicing from the PPCP consortium services).

A kick-off meeting will validate the comprehensive action plan, prioritize its components and discuss the co-management actions.

This will be followed by blocks of awareness-raising initiatives, each devoted to a specific aspect of the Vilawatt program (i.e. energy management, comfort, currency) and by a series of 6 workshops, including the 50/50 initiative, the RENOLABs, demo-renovation explanations and site visits to demo-buildings.

To reach conclusions and allow **continuity** of the project, **impacts of the Forum (in terms of**

consumption, comfort and perceptions) will be monitored by control groups differentiated by level of involvement in the project (e.g. engaged in demo-renovation, self-sponsoring renovation, participating in the Forum, participating indirectly through an association). Conclusions will assess the proposed solutions in the light of the results on different dimensions of the constituency (i.e. academic, institutional, economic and social); this will be followed by a debate among Forum stakeholders on the next steps to be taken, and by a final public presentation of the consolidated feedback.

The Forum:

- **key part of the consortium**
- **all stakeholders invited, participation through representatives**
- **demo-renovations subjects required to participate**
- **privileged methods: holistic approach, peer-to-peer learning, collective work, participatory research, middle-out approach**
- **three main phases: initiation (Jan-Sep 2018) , activation (Sep 2018 -Jun 2019), continuity (Jun 2019)**
- **impacts will be monitored by differentiated control groups**

THE 50/50 COMMUNITIES

The 50/50 communities initiative is a workshop internal to the Exchange Forum focused on social aspects of energy consumptions (i.e. social norms, routines, beliefs...) and promoting a communitarian approach to the topics.

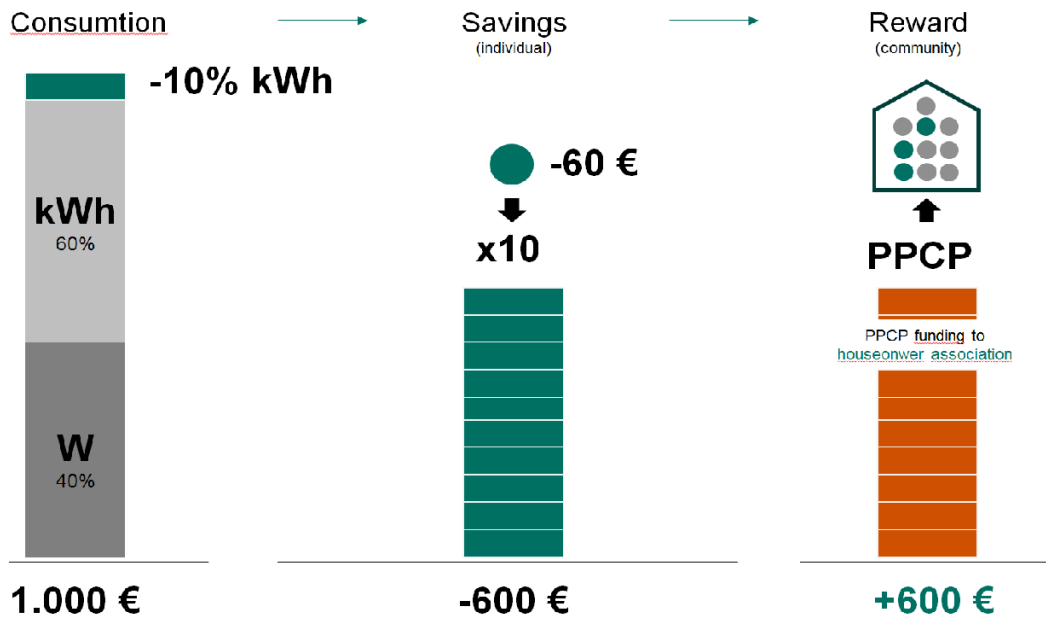
The 50/50 methodology is a 9-step methodology aiming at the achievement of energy and financial savings in a building.

It actively involves buildings' users in the process of energy management and teaches them environmentally friendly behavior through a series of practical actions.

Since the Forum initiation, enrolled associations will have one year to apply the trainings in their dwellings, whilst consumption data and feedback on behavior and learning will be collected and analyzed.

After a year, the PPCP will reward homeowners and associations with the sum of the individual reductions they achieved.

The initiative runs in parallel with the awareness-raising workshops and the RENOLABs, where energy saving opportunities and behaviors are taught, in a collaborative training format.



50/50 communities, incentive mechanism.

AWARENESS RAISING WORKSHOPS AND RENOLABS

Awareness raising workshops are action-oriented educational programs, co-designed with the participants, to reduce energy dependency in households. They aim at triggering changes in energy consumption habits and giving feedback on the resulting effects (e.g. minimal energy consumption that is socially accepted). This is obtained with a diverse gamma of group dynamics, such as knowledge exchange exercises, cognitive maps, collages, observation walks and development of proposal.

As part of these workshops, **RENOLABS are laboratories for interaction about energy renovations, where inhabitants meet students and professionals directly involved in building design** and participate themselves in the creation of portions of the renovation projects.

- **Capacity Building**

An essential resource in developing energy renovation projects in buildings is the

involvement and training of professionals who are currently providing services and products to businesses and homes, as they serve as advisors and technical references when it comes to take actions.

Two initiatives are proposed to enhance the competitiveness of the local construction industry: first, a capacity building plan and, second, the creation of a group of companies (cluster) working toward energy efficiency.

CAPACITY BUILDING PLAN

The professional construction industry in Viladecans is a heterogeneous industry made up of companies, self-employed workers and unemployed workers. The capacity building plan seeks to accompany local workers in developing the skills necessary to respond to the expected new demand for building renovations. Moreover, the plan includes training pathways for people not currently performing these professional activities who are interested in learning the skills required to do so (i.e. unemployed or career shifters).

In order to structure the training, several aspects have been analysed, namely:

- success and risk factors for the local construction industry;
- age of buildings in Catalonia and Viladecans
- offer of training related to energy efficiency retrofits in the province of Barcelona;
- success and risk factors of implementing a training plan;
- identification of training needs and skills to be developed.

Following this analysis, a set of training objectives has been developed, across the two dimensions of **passive systems** (e.g. envelope solutions) and **active systems** (e.g. HVAC components and renewables), distinguishing between **general concepts, specific concepts and know-how**.

The final structure features different training pathways organized in **6 modules** (M0 to M5), for a maximum of 25 students in theory classes and of 20 students in practical classes. Modules account for different level of student expertise, with module 0 (the longest one) intended for people who are unfamiliar with the field of energy.

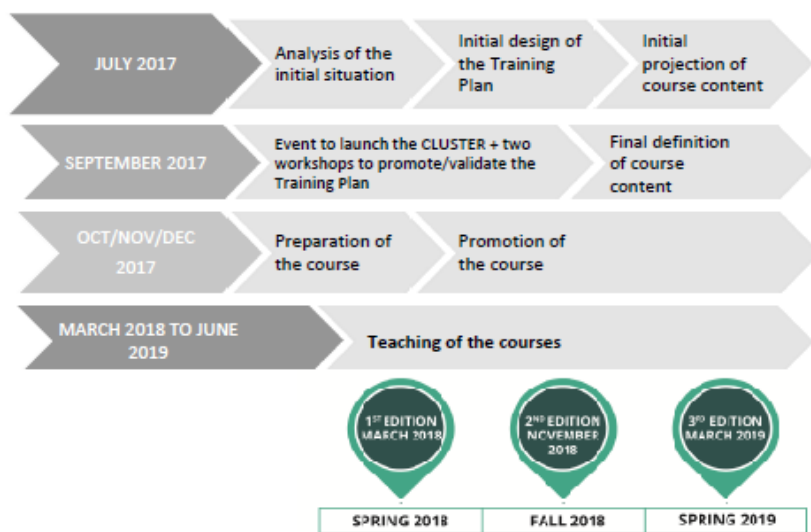
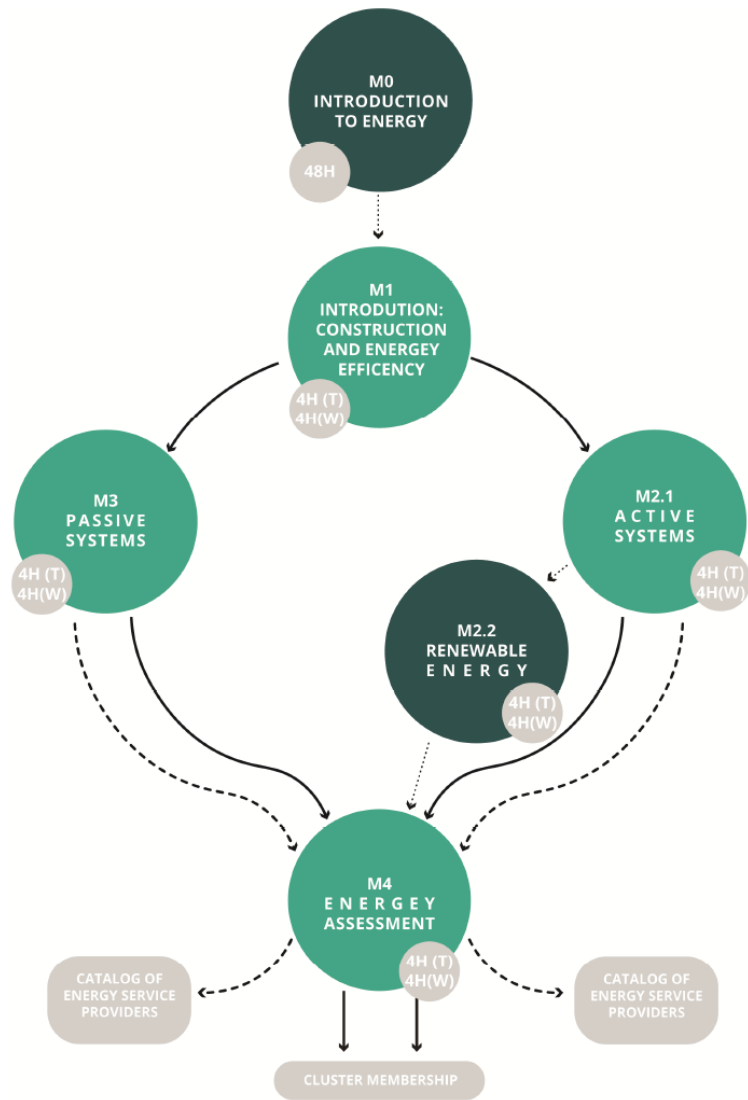
Participants must have an academic level of secondary vocational training or possess

equivalent knowledge. **Viladecans residents and students applying for a complete pathway will have priority.** Participants can enroll through the website www.viladecans.cat.

To obtain an attendance certificate, a person must take at least 3 and up to 5 modules. Class attendance will be monitored, and students will be required to attend at least 80% of classes to obtain an attendance certificate. Knowledge will be evaluated through practical workshops and feedback from participants will be collected, in a spirit of continuous improvement. Self-employed workers (183 people) will be allowed to attend individual sessions.

The goal in terms of number of participants is a total of around 200 during the implementation stage of the between March 2018 and June 2019, in three editions.

“The capacity building plan seeks to accompany local workers in developing the skills necessary to respond to the expected new demand for building renovations. Moreover, the plan includes training pathways for people not currently performing these professional activities who are interested in learning the skills required to do so (i.e. unemployed or career shifters).”



Exchange Forum schematics and timeline.

THE ENERGY CLUSTER

To achieve full engagement, the training plan will be complemented by two other actions in the Vilawatt project: an aggregation of professionals will form part of the management body of the new Local Energy Operator (LEO); and a catalogue of services will advertise products and services available to Viladecans residents. **Participation in the capacity building plan would allow free joining of the industry cluster and inclusion in the catalogue of energy services.**

The final goal is to create an industry cluster aimed at promoting sustainable and efficient construction. Such local companies will be then able to participate in the development and execution of the Vilawatt Project and to address the expected increase in renovation demand following the initiative.

The industry cluster will perform two blocks of activities:

- **group dynamics, to generate opportunities** with participating companies;

4.7 The partners involved

Hereunder, a brief description of each partner involved in the project is done.

Viladecans Municipality (PP1)

The Municipality is responsible for developing housing policies and actions at local level. Viladecans City Council will start a new renovation plan within the Montserratina district, starting 2018. The council has already implemented an energy management system and a local Energy Bank for schools, which capitalize energy savings from public buildings.

In this project, the Municipality participates in the definition of the strategical elements of the

- **organisations of technology-specific training** for business managers, to help them positioning their business in the sustainability and energy efficiency industry.

Technology-specific training will run in parallel with another programme reserved to participants to the PPCP and to LEO personnel, as every component will have to know and promote all the services offered, know how to process the contracts and carry out an exhaustive control.

The training plan will be structured in 14 modules subdivided in 3 macro groups: electricity sector, gas sector and energy efficiency. For each macro group, the modules will give an overview of the sector, training on the types of contracts and products as well, on related measurement and calculation methods and on consumption habits.

“The final goal is to create an industry cluster aimed at promoting sustainable and efficient construction.”

program (i.e. energy supply negotiation, renovations, contracting, management), generates money supply for the alternative currency and designs the relative reward system.

Urban Ecology Agency of Barcelona (PP2)

BCNecologia - the Urban Ecology Agency of Barcelona, is a public consortium comprising the Municipality of Barcelona, the Municipal Council, the Metropolitan Area of Barcelona and the Barcelona Provincial Council. The Agency's aim is to rethink cities in terms of sustainability, involving the social dimension, which is

fundamental in the definition and implementation of the new PPCP governance structure. Moreover, their energy market knowledge is employed in the definition of the Local Energy Operator (LEO).

UBIQUAT TECHNOLOGIES S.L. (PP3)

UBIQUAT is a company leader in the development of reward points and local currency systems in Spain, including one of the examples utilized as a reference for the Vilawatt currency (Santa Coloma de Gramanet). It has also expertise in digital payment systems and provides the relative consultancy services, including on security, methodological and legal issues. Ubiqat acts as an agent of the e-money provider and manages the digital and voucher payment scheme. It is also in charge of the technical and legal implementation of the energy currency reward systems, as well as of the relative training and monitoring activities, including the set-up of a help-desk service at the Local Energy Operator's premises.

ICAEN-Catalan Institute for Energy (PP4)

ICAEN has been involved since 2009 in the development of the Energy Performance Contracting model for the Catalan public buildings. ICAEN is in charge of defining the most appropriate contract models for the renovations, as well as the process, methodology and metering solutions to monitor and assess energy savings over time.

LIMA Association (PP5)

LIMA is a multidisciplinary team of experts in sustainable building design and construction processes, and in the formulation of practice related, future demand oriented energy efficiency programs in building and urban areas. LIMA's activity is focused on Mediterranean climates, encompassing Building Energy

Strategies, Renovation and Dissemination. LIMA provides advice and support in all technical aspects connected with the building renovations and the installations of renewables, it is also in charge of the audits, the identification of the energy saving potential, the renovations roadmap and the RENOLABS.

CERCLE GESPROMAT S.L. (PP6)

GESPROMAT is a consultancy specialized in legal, financial and technical issues related to neighborhood communities, as well as on social mediation in building blocks and small districts renovation plans. GESPROMAT provides expertise in the energy auctions and aggregated energy purchases, leads the renovation investment process and advises on legal and financing matters across all programme phases.

EGM ENERGY EFFICIENCY (PP7)

EGM is an engineering company within the energy sector, specialized in solutions for energy efficiency. In this project EGM tackles the challenges of creating an Energy Information System of the area, collecting energy-related data from the field, creating an energy model, running simulations and comparing results between model and reality.

VIGEM - VILADECANS GRUP D'EMPRESSES MUNICIPALS, S.L. (PP8)

VIGEM provides technical assistance in legal, finance and human resources to the municipal private companies, such as VIMED. VIGEM has experience in the field of Construction Management (Studies, Project design and Direction of works, Project Management, Execution) and in Infrastructure (Telecommunications and Energy). It is in charge of consulting on energy efficiency matters, installing and operating renewables and acting as an Energy Service Company.

VIMED - VILADECANS MEDITERRÀNIA S.L. (PP9)

VIMED has experience in giving services in the field of constructions (functional studies, project design, direction of works, project management and execution) and infrastructure (telecom and energy). It is in charge of the NZEB renovations (project design, suppliers contracting and project management) including the legal and financial aspects.

in planning and community mediation in the built environment (architecture, urbanism and landscape). It is in charge of all the stakeholder management and training initiatives and acts as a facilitator in the moments of stakeholder introduction/attraction, monitoring of results, aggregations (e.g. formation of steering committees, associations or groups).

CÍCLICA (PP10)

Cíclica is a cooperative society studio specialized

Partners' involvement has been mapped across the target stakeholders and project functionalities.

			STAKEHOLDERS		
			PUBLIC**	PRIVATE	CITIZEN
			1	2	3
ENERGY OPERATOR	Energy Supplier	A	PP1, PP2, PP5*	PP1, PP2, PP6	PP1, PP2
	PV installation	B	NO	PP1, PP2, PP6, PP7, PP9	PP1, PP2, PP6, PP7, PP9
	Smart Metering + ICTs	C	PP1, PP2, PP4, PP5*, PP7	PP1, PP2, PP4, PP7	PP1, PP2, PP4, PP7
	Renovation investment	D	NO	PP1, PP2, PP5, PP6, PP7, PP9	PP1, PP2, PP5, PP6, PP7, PP9
	Contracting + Savings evaluation	E	PP1, PP2, PP4, PP5*, PP6	PP1, PP2, PP4, PP6	PP1, PP2, PP4, PP6
ENERGY CURRENCY	Payment scheme management	F	PP1, PP3, PP5*	PP1, PP3	PP1, PP3
	Reward scheme	G	PP1, PP2, PP5*	PP1, PP2	PP1, PP2
	Marketing and broking	H	PP1, PP3	PP1, PP3	PP1, PP3
ENERGY CULTURE	Building confidence	I	PP1, PP7	PP6, PP7	PP2, PP6, PP10
	Building commitment	J	PP2, PP5, PP10	PP1, PP2, PP5, PP10	PP1, PP2, PP5, PP6, PP7, PP10
	Strengthen local economy	K	-	-	PP10

PP1	Viladecans Municipality	PP6	CERCLE GESPROMAT SL
PP2	Urban Ecology of Barcelona	PP7	EGM Energy efficiency
PP3	UBIQUAT TECHNOLOGIES SL	PP8	VIGEM
PP4	ICAEN	PP9	VIMED
PP5	LIMA Association	PP10	CÍCLICA

Stakeholders and project functionalities.

4.8 Innovative aspects

Vilawatt takes inspiration from several successful streams of initiatives rotating around the urban renovation and energy transition nexuses. Nevertheless, the following innovative aspects define the programme as innovative in the EU:

- **Multidimensionality** – The project is innovative since its scope encompasses the entire complexity of the urban fabric; in this respect it's perfectly aligned with the most recent definitions of sustainable urban development¹⁸. Vilawatt's impacts on the energy characterization of the neighborhood are converted into an economic benefit for the local community, both in the short term (through the Vilawatt currency) and in the long term (through capacity building); in parallel, the initiative is utilized as an opportunity to trigger a social shift in the way a key aspect of the district life is administered (through the PPCP and its citizens Forum); the creation of new forms of aggregations is also leveraged upon to create a cultural shift in stakeholders approach to energy matters, whilst building a form of community knowledge. Additionally, not only such approach increases long term survival chances for Vilawatt, but most importantly it's transferable:

its PPCP structure, social engagement strategies and incentivizing currency, for example, can be repropose to promote other strategic initiatives of the Ajuntament.

- **Public Private Citizenship Partnership (PPCP)** – Public Private Partnerships are a tool of recognized and increasing importance in complex interventions such as urban regenerations and infrastructural projects^{19,20,21,22}. In parallel, other studies^{23,24,25} demonstrate the need and will to find tools and organizational configurations to allow citizens' participation to such projects, as this is widely recognized as a key factor of success. The PPCP has very few antecedents in Europe and its innovative character stands in its being a basis for truly participated (i.e. democratic) governance.

“The project is innovative since its scope encompasses the entire complexity of the urban fabric.”

“The PPCP has very few antecedents in Europe and its innovative character stands in its being a basis for truly participated (i.e. democratic) governance.”

¹⁸ URBACT capitalization, Sustainable regeneration in urban areas, April 2015, available on: http://urbact.eu/sites/default/files/04_sustreg-web.pdf.

¹⁹ Impact of the energy efficient buildings public-private partnership, EC workshop report, 2014, available on: http://www.streamer-project.eu/Downloads/Interview_PPP_Impact_Workshop_Report.pdf.

²⁰ EE-10-2016 - Supporting accelerated and cost-effective deep renovation of buildings through Public Private Partnership (EeB PPP), available on: http://cordis.europa.eu/programme/rcn/700243_it.html.

²¹ Akintoye, A. et al., Public Private Partnerships: A Global Review, Routledge, 2016

²² H-2020 project NewTREND, 2017, available on: <http://newtrend-project.eu/>.

²³ FP7 project FASUDIR, 2015, available on: <http://fasudir.eu/>.

²⁴ Quelle intégration territoriale des énergies renouvelables participatives ?, ADEME, 2016, available on:

<http://www.ademe.fr/sites/default/files/assets/documents/quelle-integration-territoriale-enr-participatives-2016-rapport.pdf>.

²⁵ H-2020 EU-GUGLE project , presentation at the Scisconference 2017, available on: http://www.smartcities-infosystem.eu/sites/default/files/document/eu-gugle_project_sustainable_renovation_pilot_for_smart_districts.pdf.

- **Local Energy Operator (LEO)** – the role of municipalities as energy aggregators is innovative in its alignment to a world where energy generators are multiplying²⁶, renewables are gradually becoming mainstream and power purchase agreements are increasingly utilized by public and private energy intensive subjects²⁷; to an extent, the LEO represent the evolution of community energy projects²⁸. Whilst EE projects tend to be successful when the municipality acts as aggregator of individual interests²⁹, there are no or few antecedents where this approach is utilized for decentralized energy supply negotiations.

- **Utilization of an alternative currency to capitalize energy savings to the benefit of the local economy** – alternative currencies are a well-known mean to promote a local economy especially in or after times of crisis^{30,31}. In parallel, virtual currencies, particular blockchain technologies, have already been identified as a game changer enabling the trading of renewable electricity generation on a global basis, with experiments currently underway^{32,33,34}. Vilawatt is innovative as it combines the benefits of alternative currencies to that of energy efficiency savings, and it is potentially long term

commutable into a blockchain based mechanism, making it potentially profitable even outside the borders of the individual initiative.

- **Innovative stakeholders engagement strategies** – another innovative aspect is the gamification³⁵, competition and peer-to-peer knowledge building³⁶ dynamics leveraged to obtain stakeholder engagement: the communication is targeted to specific stakeholders depending on their level of expertise, their role in society, and the specific project stage. In parallel, the existing aggregating social structures (associations) are leveraged upon through incentives (i.e. through the 50/50 initiative) to gain traction whilst maintaining cohesion.

“The role of municipalities as energy aggregators is innovative in its alignment to a world where energy generators are multiplying”

“Vilawatt [...] combines the benefits of alternative currencies to that of energy efficiency savings, and it is potentially long term commutable into a blockchain based mechanism”

²⁶ Lindt, A. et al., Renewable Energy and Liberalization of Energy Markets: The European Experience with Third Party Access to the Grid, 2013, available on: https://www.researchgate.net/publication/309293239_Renewable_Energy_and_Liberalisation_of_Energy_Markets_The_European_Experience_with_Third_Party_Access_to_the_Grid.

²⁷ Wright, M., Pathways to 100% renewable: how are companies reaching this goal?, The Guardian, 05/05/2017, available on: <https://www.theguardian.com/rethinking-business-with-ing/2017/may/05/pathways-to-100-renewable-how-are-companies-reaching-this-goal>.

²⁸ Bauwens, T., What Roles for Energy Cooperatives in the Diffusion of Distributed Generation Technologies?, 2014, available on: https://www.researchgate.net/publication/260421342_What_Roles_for_Energy_Cooperatives_in_the_Diffusion_of_Distributed_Generation_Technologies.

²⁹ Lupkin, L., How clean energy aggregation empowers neighborhoods, Greenbiz, 19/10/2015, available on: <https://www.greenbiz.com/article/how-clean-energy-aggregation-empowers-neighborhoods>.

³⁰ The history of alternative currencies, FXCM, 2016, available on: <https://www.fxcm.com/insights/the-history-of-alternative-currencies/>.

³¹ Deighton, B., Alternative currencies in rapid growth phase – researchers, Horizon, 24/01/2017, available on: https://horizon-magazine.eu/article/alternative-currencies-rapid-growth-phase-researchers_en.html

³² Collins, B., Blockchain to Disrupt Utilities as Customers Trade Power, BNEF, 26/08/2017, available on: <https://web.powerledger.io/blockchain-disrupt-utilities-customers-trade-power-bnef/>.

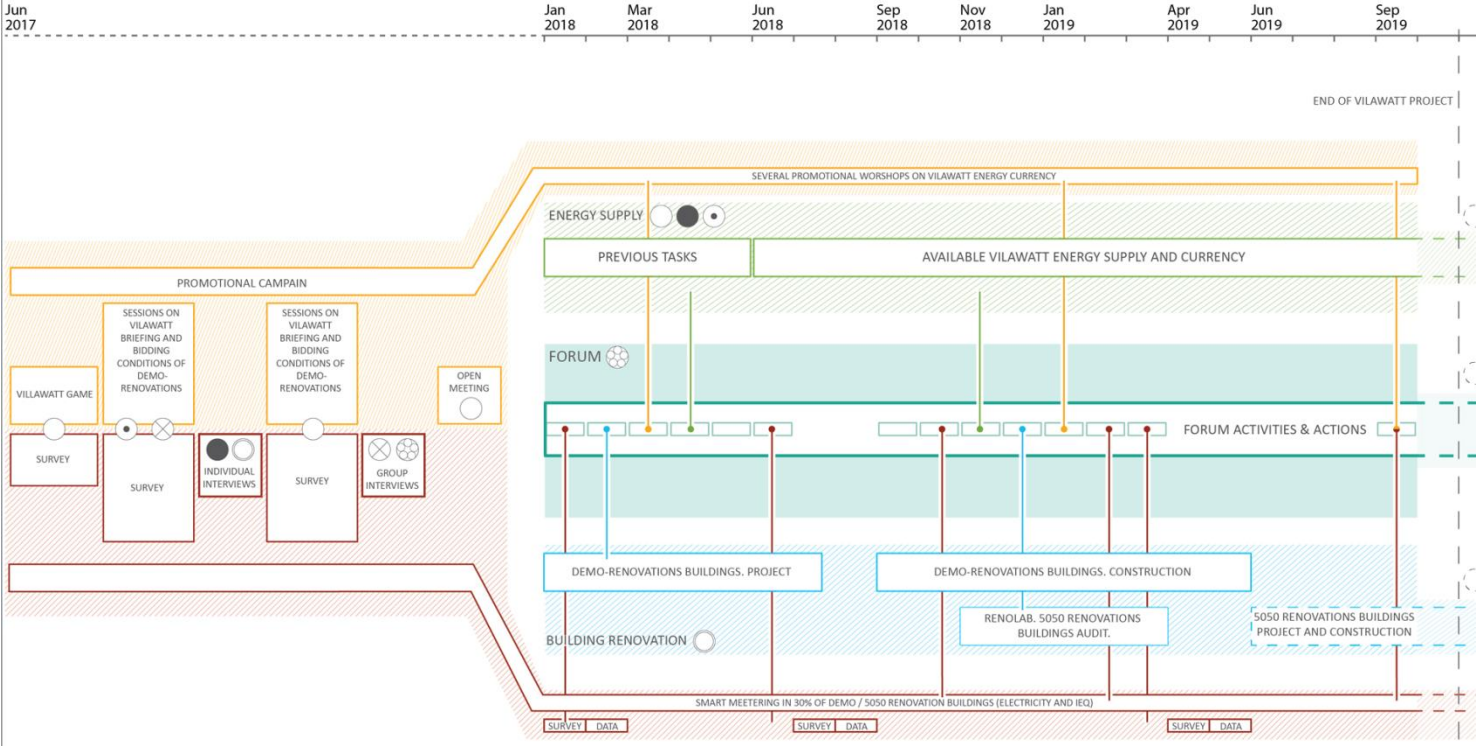
³³ Blockchain Applications to Solar Panel Energy: Landscape Analysis, MIT, 2017, available on: http://dci.mit.edu/assets/papers/15.998_solar.pdf.

³⁴ Vorrath, S., Blockchain-Based Peer-To-Peer Solar Energy Trading To Be Tried In Perth, Cleantechica, 13/06/2016, available on: <https://cleantechica.com/2016/08/13/blockchain-based-peer-peer-solar-energy-trading-tried-perth/>.

³⁵ Masser, K. et al., Citizens' Participation and Gamification – Lessons Learnt from Previous and Recent Participation Boosts in Germany, IMODEV vol.3, 2016, available on: <http://ojs.imodev.org/index.php/RIGO/article/view/46/123>

³⁶ Andrews, M. et al., A Guide to Peer-to-Peer Learning, Effective Institutions Platform, 2016, available on: https://www.effectiveinstitutions.org/media/The_EIP_P_to_P_Learning_Guide.pdf.

5 Implementation status



Project timeline.

Vilawatt timeline coordinates the four main project dimensions:

- stakeholders engagement/capacity building
- building retrofit implementations
- organizational management (PCPP and LEO)
- energy currency deployment and diffusion.

The program is divided in two macro moments:

- **Jun 2017 to Jan 2018, the observation** – in this initial period, the majority of studies are drafted and most of the preparatory stakeholder engagement actions are undertaken (i.e. promotional campaign). This period is utilized to map the situation “as-is” and to establish in detail the legal and technical terms of reference for the organizational structures underpinning the project dimensions, including a definition of

the building renovations and of the smart metering solutions to measure the results.

- **Jan 2018 to Sep 2019, the implementation** – in this period, the organizational structure management (PCPP and LEO) has been set up, including the Forum, and start functioning. The building demo-renovations are firstly designed (Jan-Jun 2018), then implemented (Sep 2018-Apr 2019) while consumptions are monitored through smart metering. The Forum integrates feedback from the consumption measurement with the awareness-raising and capacity building initiatives, contributing to the knowledge update and transfer, strengthening the participants’ engagement. In parallel, new energy supply contracts are negotiated, through the LEO (Jan-Jun 2018), to create a Vilawatt optimized energy supply, after which the energy

currency will be introduced, allowing to capitalize initially from the savings generated by the new contracts and then from those generated from the reduction of consumptions and the demo-renovations.

Although the project is supposed to end by October 2019, a **continuity is forecasted** for the main organizational structures (i.e. the PPCP and the Forum), as well as for the energy currency, the smart metering and the building renovations.

In terms of deliverables, **Vilawatt is structured in milestones, signaled by the delivery of reports** (Benchmark/Roadmap, Master Plan/Deployment and Final Progress reports) on each of the main project dimensions (retrofits implementation, PPCP and LEO, energy currency, stakeholder engagement and capacity building) as well as on key transversal aspects (energy savings capitalization and contracting models, solidarity funding).

In the last quarter of 2017, Vilawatt is concluding its observation period and transitioning into the implementation one.

A brief analysis of the status suggests the project is almost on track: most of the Benchmark studies have been finalized (pending the one on the solidarity funding scheme), the promotional campaign has been successfully deployed and surveys and interviews are being completed. At the same time, the Montserratina

quarter has been characterized, built environment conditions “as-is” have been assessed and terms of reference for the renovations have been derived.

In terms of **achievements**, the program is proving to be quite successful:

- the building renovations have received applications from 3 different communities, for a total of 60 dwellings. Furthermore, as of October 2017, 3 additional external communities are in the process of preparing the required documents to participate to the scheme;

- the definition of the PCPP legal entity is underway: the Ajuntament is engaging with the Metropolitan Area of Barcelona to include it as a third public entity within the PPCP, as the Spanish law requires at least 2 public entities for the formation of public consortia. The consortium is to be instituted in October and within 3 months (i.e. in time for the PPCP start of operations) will have to publish a legal memory on its statutes and regulations

- the Ajuntament is studying the economic viability of extending the consortia after the project close for other three years.

“In the last quarter of 2017, Vilawatt is concluding its observation period and transitioning into the implementation one. [...] The project is almost on track.”

6 Challenges and Focus Aspects

6.1 Implementation challenges

In its transitioning from study into implementation, Vilawatt has already overcome a few hurdles. **The current phase, however, remains delicate** as it's from now on that the major implementation challenges will start materializing, testing at the same time robustness of the studies and project management skills of the consortium.

As UIA projects of the first Calls for Proposals work on a variety of topics, seven challenges to the implementation of the projects have been identified that are common to all projects. These are listed below, presenting Vilawatt's approach to them.

Leadership for Implementation.

In order to manage the multidimensionality often characterizing innovative projects in a circumscribed geographical scope, leadership needs to evolve from a single point of contact to a matrix configuration; as a minimum, a double level of leadership is needed: an horizontal leadership to coordinate the political and engagement aspects (aggregating), as well as to pace and monitor the programme in its entirety (steering), and a vertical leadership, to implement individual parts of the programme by "working down all the chains of levels" (actioning) and to guide stakeholders through the process (influencing). In the framework, connection and stability of the two leadership levels become therefore key success factors.

In the Vilawatt project, the aggregating (horizontal) leadership is embodied by the PPCP and the specialised (vertical) leadership by the delivery partners. Political stability is granted as

the project duration fits within the mandate of the current Ajuntament, whilst the connection between the two leadership layers (horizontal and vertical) is guaranteed through the delivery partners' consortium being integral part of the PPCP.

Secondly, an additional value added of Vilawatt in terms of leadership and governance is its capacity to actively shape a model of participative leadership through the PPCP institution through its Citizenship Forum: including the general population in the governance system through representatives not only facilitates maintenance of the consensus but also the delivery of communications and engagement initiatives to the wider community; in fact the Forum acts as a coordinator of all activities involving citizens. In this framework, including representatives of the citizenship as co-leaders of projects whilst keeping executive decisions under majority rule ensures a good balance between participation and effectiveness of the decision making process; additionally, including delivery partners in the Forum ensures their accountability and helps shaping consensus (i.e. partners are responsible in front of the community and at the same time can provide their expertise to inform-build consensus), strengthening the connection between steering and implementation.

During implementation, the cooperation across the range of different stakeholders' organisations within the PPCP, will be granted through its stable legal structure of a single individual entity, a clear majority/consensus decisional governance (strategic decisions by consensus and executive decisions by qualified

majority), and a change management plan, devised at pre-implementation stage, assigning a specific sets of actions to each delivery partner / change agent: this will limit the power of dissents, whilst enabling the Municipality to monitor it, impressing corrective actions to the programme, should dissent reach critical levels.

Smart public procurement: methodology specification levels and openness to a diverse set of players.

Public procurement could be a dead hand on innovation by over specifying methods by which results should be achieved and by the domination of the large market players. The challenge is twofold: first of all to specify terms of reference in such a way to leave freedom for innovation in the mode of delivery and secondly to ensure local benefits within the commissioning and procurement processes.

In the case of Vilawatt, the challenge is resolved, again, structurally: the inclusion of most delivery partners as partners of the project (i.e. recipients of the UIA grant) minimises the number of outsourced (i.e. tendered) services.

In this way, the most relevant tenders to be published will be that for the energy provision (i.e. for an external energy retailer) and that for the buildings' renovations (i.e. engineering, procurement and construction company). These are also the most capital intensive endeavours in the project: whilst minimising the number of outsourced services, Vilawatt also manages to attract external players from the energy and construction industries.

For both these key aspects, Terms of Reference are underpinned by expert studies and benchmark studies performed by either an experienced third party or a delivery partner. In

this way, relevance and appropriateness of terms of reference is ensured as much as measurability and precision of the requirements.

Energy contract requirements will be informed by an analysis of energy bills and consumption data derived from energy audits to the three consumer categories of citizens, commerce and municipal services. Parameters identified are average energy price, average power price, consumption of energy, contracted power; corresponding internal targets for the LEO are energy price/margin improvement, increased energy savings, power reductions, tariff time discrimination and green energy share increase (i.e. green energy offer will be positively assessed).

Renovations have been preceded by a series of specialised studies: a social survey to select focus areas and a building survey to determine "as-is" conditions and to underpin retrofit programme design and optimisation (e.g. most cost-effective interventions, savings expected, indoor comfort aspects...). For the resulting tender, a white list of installable active and passive devices as well as implementable interventions is specified, alongside related physical performance parameters (i.e. acceptance criteria) and targets for the savings expected.

Ensuring local benefits (i.e. social inclusion, local employment, environment!).

As for ensuring local benefits Vilawatt has already responded structurally by choosing its specialised delivery partners as close as possible to the local dimension and by introducing a virtual currency to reinsert energy savings capitalised in the local economy. This philosophy is also reaffirmed through the very structure of

the PPCP (including the citizenship) and in programme initiatives such as the RENOLABS (where students of the local university are involved) or the promotion of a reuse/repair shop for electrical appliances (which is to be managed by the citizens).

Most importantly, the entire programme is focused on a neighbourhood already identified as a socially problematic area (i.e. characterised by unemployment, lower than average income, energy poverty...) and the buildings to retrofit have been chosen, among the shortlisted ones, as those in which social services had identified families at risk of social exclusion.

As for commissioning and procurement processes, Vilawatt seeks to inform present and future private procurement decisions through the formation of an industry cluster and the following release of a catalogue advertising the entire local offer in terms of energy-efficiency-related products and services, the demand for which will be enhanced as an effect of the programme (due to the increased awareness and the imitation effect).

Finally, Vilawatt includes a capacity building plan targeting not only citizens and employers but also students and unemployed individuals, with the target of inserting them in the developing industry cluster by helping them develop first hands-on experiences. Related trainings are compatible with normal working schedules and have been timed around the implementation process so that benefits can be directly applied and employment opportunities generated. Viladecans students and residents will be given priority access.

Organisational arrangements to ensure delivery and coordination with existing actions.

Within the urban authority, a Project Management Office (PMO) has been created which coordinates the Group of Municipal Enterprises part of the project (Grupo Impresas Municipal). The PMO also includes one assigned team member for each critical project dimension (communication, implementation, finance), able to connect to senior officers of the Ajuntament. The Head of this “internal partnership”, or Head Project Manager, is also the main point of contact with the UIA institutions.

This structure allows the Group of Municipal Enterprises to act as a single macro-partner, whilst ensuring effective internal and external coordination and maintaining the focus on key project dimensions. The presence of additional team members also enables the PMO to summon cross-sectoral expertise through the entire Ajuntament without weighting on other departments’ resources. As for coordination with the existing sustainable urban regeneration context and initiatives, Vilawatt already extracts, through its benchmark studies (particularly 4.3.1), the most suitable set of actions for the programme.

At a regional level, Vilawatt is aligned with the Catalan Strategy to Energy Renovation and incorporates previous local initiatives related to energy efficiency, gathering and further developing them under the same umbrella (i.e. increased coordination). For example, the 50/50 initiative is re-proposed within the programme, scopes of the CRESCENDO and of the URBACT initiatives are included within that of Vilawatt, the existing Energy Map for the municipality is transformed into an Energy Transition Map, the BIG Saving quiz is adapted into the Vilawatt game as part of the communication and engagement strategy.

Similarly, in developing the capacity building strategy there's an attention not to overlap training courses already available at the local university, but instead to involve students and academics in the initiative (e.g. in the RENOLABS and/or in advising the PPCP).

At a daily implementation level Vilawatt exploits, logistically and timing-wise, existing social events and structures (e.g. local fairs, existing aggregation places and moments) to enact dissemination and engagement building initiatives. Similarly, previous energy efficiency retrofits, such as the El Garrofer School, are utilised in Vilawatt as demonstration sites.

Participative approach and stakeholder engagement.

With a programme of such complexity, one key implementation challenge is to secure continuous engagement of all delivery partners and stakeholders. Vilawatt tackles this challenge both structurally (i.e. through contractual and organisational features) and programmatically (i.e. through apposite strategies).

The inclusion of most delivery partners as partners of the project (i.e. recipients of the UIA grant) ensures the right amount of "skin in the game" to grant commitment; additionally, the PPCP will not be a counterpart in any contract, but delivery partners and additional subcontractors will each have a direct contract with the Municipality, which should minimise accountability gaps (i.e. clear identification of two standardised contractual subjects). There's even an outlook to finance parts of the initiative through crowdfunding (e.g. through Ecrowd), which would turn citizenship stakeholders into true shareholders.

To ensure the widest possible participation, the

PPCP includes representatives from delivery partners, local professional associations, local and regional institutions (university and regional authority); more importantly, the PPCP also includes the entire citizenship through the Citizenship Forum (or Exchange Forum). All these parties participate to the design process and have equal weight in defining priorities (for capacity building and implementation). Furthermore, every key initiative of Vilawatt (from the LEO, to the trainings, to the virtual currency) is officially launched well before its final definition, for stakeholders' feedback to determine the final optimisation.

Continuous engagement is maintained through several initiatives; the general strategy is to combine cooperation, virtuous competition and behavioural rewards (i.e. incentives).

For example, the Citizenship Forum organisation, through representatives, promotes internal neighbourhood organisation; its participation mechanisms privilege hands-on collective work (e.g. participatory research, citizens' led surveys, RENOLABS...) creating a sort of peer-to-peer learning experience and a shared knowledge-base; within the Forum, frequent meetings are programmed to enhance group dynamics, these meetings also include representatives from delivery partners to allow cross-stakeholder confrontation (i.e. moments whereby citizens provide feedback and delivery partners offer expertise). Similarly, participation to the industry cluster entails several meetings aimed at generating discussions, shared opportunities and partnerships.

Finally, each initiative within Vilawatt is also combined with some sort of incentive: the energy savings are rewarded in virtual currency, the 50/50 initiative generates a form of virtuous

competition among participants towards a final money prize, participation to the Citizenship Forum is rewarded with additional financing for the committed associations, free joining to the industry cluster and inclusion in the cluster's catalogue is only guaranteed upon successful completion of the training courses.

Monitoring the real added value of the project, ensuring continuous learning.

Whilst measuring physical outputs, even in complex projects such as this one, measuring the real total added value of the project (i.e. compared with a "no-project" situation) and ensuring continuous improvement throughout implementation could be far more challenging.

In Vilawatt, every aspect of the project is measured and compared to a specialised study (i.e. a benchmark study) of the initial "no-project" context: the ROI for the renegotiation of energy contracts by the Local Energy Operator (LEO) is calculated upon an initial bills and consumption study, the effectiveness of renovations is measured in terms of reduction of the initial demand/consumption at same or improved levels of indoor comfort, success of the Vilawatt virtual currency can be measured through metrics such as total currency circulating and the ratio between it and currency directly introduced by the Municipality.

Other initiatives of less technical nature are also assessed (against a "no-project" situation) through suitable non-quantitative metrics: communication effectiveness is tested through internet fluxes and through surveys, attendance to trainings is monitored, phone surveys to participants 6 months after course completion are used to measure derived increase in employment, achievements related to organisational aspects (e.g. the constitution of

the PPCP) are conditional to specific deliverables being produced (e.g. a legal entity and a statute).

Whilst Vilawatt hasn't yet planned to distil these metrics in a unique "social ROI" figure, an overall multicriteria evaluation with a weighted matrix of such metrics could be devised, to this end. The matrix weighting could be derived from an extensive post-implementation stakeholder survey, to probe perception of social benefits, and the final result could be qualitatively validated by repeating the urban and social characterisation studies post-implementation and comparing values of the same indicators.

Continuous improvement in Vilawatt is obtained by coupling repeated monitoring with repeated occurrences of the initiatives throughout implementation. Lessons learnt from each communication initiative are reported, feedback and learnings are collected from site-visits, meetings of the PPCP and of the industry cluster, embedded advisory services and training programs; in parallel, each initiative features at least two complete sessions throughout the entire duration of Vilawatt. In this way, corrective actions can be implemented and marginal improvements measured. The very change management plan underpinning the entire programme includes two moments of self-reflection, one pre-implementation (i.e. readiness and reluctance assessment) and one post-implementation (i.e. resistance assessment), before scaling-up to the final model.

Communication with target beneficiaries.

A multi-channel and multi-stakeholder communication campaign has been designed to

promote Vilawatt throughout all its phases and its currently being implemented.

The campaign started well before implementation (6-12 months before), in what was conceived as an awareness-raising phase, informing the community about all those initiatives in which it would have been directly involved (i.e. the Citizenship Forum, the Local Energy Operator, the building renovations, the virtual currency).

Content and channel of the communication is tailored on the receiving stakeholder and on the context where the action takes place. For the sectoral association, where the aim is to create an economic fabric, communication privileges bilateral meetings and site visits to operating demo-projects (i.e. physical visualisation of end results, specialised narrative).

For the citizenship, communication privileges experiential formats (e.g. gamification, visualisation) and word-of-mouth, with the aim of creating a redundancy effect: the Vilawatt game and the RENOLABS allow citizens to engage directly in Vilawatt energy efficiency thematic, for an effective behaviour and consensus building; interactive online platforms include dedicated training resources and video storytelling, facilitating remote access; word-of-mouth communication is promoted by social networks (Facebook, Twitter, YouTube and LinkedIn), by the Citizenship Forum (whose representatives commit to 13 communication meetings), and through each infrastructural component of Vilawatt (i.e. PPCP, LEO and the virtual currency) advising the general population via a series of appropriately trained personnel.

In any case, communication is conceived as a two-way process: a narrative is conveyed and at the same time a feedback is recorded. Finally,

communication initiatives have been strategically located and timed so as to leverage on existing aggregation moments and points (e.g. the Vilawatt game positioned in the associations' centre and displayed in the local summer school, launches of infrastructural components taking place during local fairs...).

Another aspect of the communication is that of dissemination. In this respect, Vilawatt will capitalise on its delivery partners' participation to international and regional events as well as on related EU level events, looking to create international partnership whilst sharing knowledge. At a local level instead, since the aim is to create an economic fabric related to energy efficiency, dissemination will be done by means of advertising related products and services through a catalogue distributed to Viladecans residents.

Upscaling

Vilawatt focuses on a specific neighbourhood for a definite amount of time; however in the long term the municipality will have to ensure the approach could continue and be extended to a wider area. For this reason, all benchmarking studies produced within the programme include an "how to upscale" section: for example, the operational plan features a continuity starting 2019 and the virtual currency forecast an extension in scope via the incorporation of the Blockchain technology.

Upstream, in terms of knowledge transfer and organisational structures, delivery partners have been chosen also in terms of their capabilities to apply lessons learnt on a wider scale/community; additionally, the presence in the PPCP consortium of regional and metropolitan authorities (i.e. the Metropolitan

area of Barcelona) ensures administrative support in a prospected enlargement of territorial focus.

Whilst capacities might be adequate, an upscaling could also generate additional complications: in this respect, infact, a choice should be performed whether to upscale sequentially (i.e. to upscale only one aspect of Vilawatt, such as the renovations or the LEO) or organically (i.e. to upscale the entire programme to a wider area). Upscaling organically would be quicker but more demanding: the administrative complexity would require some form of

automatization, imbalances with the virtual currency might verify during the expansion process and a shift in the communication process privileging internet based forms should occur. For this reason, any upscale/continuation would be subject to the results of the initial project being consolidated (i.e. success obtained and bottlenecks resolved).

Finally, an upscale would imply availability of a series of conditions such as local and regional political stability (for a three-years-period), the forecast of an adequate ROI and the mobilisation of additional financing.

6.2 Lessons learnt

Legal entity – since the PPCP is an innovative entity, a series of studies have been produced to latch its intended structure and capabilities with a suitable legal form. The exercise, which is successfully coming to an end at the time of this report, has been more time consuming than expected and required the support of an external legal consultant as well as considerable investment in dialogue and partners' coordination.

Traction – one of the potential challenges was to gain enough traction early on. In this respect, the initial stakeholder-specific engagement with citizenship through gamification, surveys and peer-to-peer communications, proved successful, given the number of subscriptions and contracts signed. Additionally, two main planning strategies have been instrumental in obtaining the positive result: firstly, the change management plan included an assessment of the reluctances/barriers with prioritized

corrective actions, which in turn informed the engagement campaign; secondly, communication strategy mapped and leveraged on the most influential aggregators (i.e. associations), incentivizing them to act as change agents.

Change management – the project entails not only the creation of new municipal actors (namely the PPCP and the LEO), but also a transition in the energy governance of the entire municipality. In this respect, whilst the transition is imagined as a bottom-up participated process, the transition axes and the initial and final energy models (in their production, fluxes and consumption characteristics) have been identified early on in the change management plan, stemming from the more general objectives of the Pacte Nacional per a la Transició Energètica de Catalunya.

6.3 Focus Aspects

Going forward to the implementation phase, some aspects will need heightened attention:

- **Managing conflicts** – with ten different partners to the initiative, additional stakeholders as part of the PPCP and a decision making process willing to privilege consensus wherever possible, conflict management will become a success factor in the implementation phase. To this end, the partner CICLICA, expert in social mediation, will act as a facilitator in all PPCP meetings.

- **Timeline Coordination** - being Vilawatt a multi-dimensional program, it will be important to coordinate the various sub-components across the project timeline. Even if project planning efficiently coordinates dimensional interactions, a risk remains that, given the high level of inter-dependency, a delay in one critical aspect might prejudice the entire success of the operation: for example, if capacity building initiatives fail to provide enough expertise, demo-renovations might proceed too slowly (for the lack of resources) or might lack quality; in turn, energy savings might fail to materialize or to be measured effectively/timely which would make the entire currency exercise pointless and the short-term impact on the local economy nihil. A close supervision will need to be enforced if implementation schedule is to be respected. In this framework, a risk assessment report identifying and mitigating critical paths would help to pre-emptively address the worst case scenarios .

- **Currency circulation** – Vilawatt’s alternative currency will be introduced in 2018, after the demo-renovations will have started and the energy supply contracts renegotiated. Whilst IT infrastructural features and circulation

mechanisms have been adequately defined by the benchmark study, a scenario analysis will be needed to correctly dimension two critical aspects.

The first one is the total amount of currency in circulation at the various stages: the amount of currency needs to be from time to time adequate, substantial enough to allow a meaningful spending activity by its target users (i.e. to generate the necessary traction), diffused to create a liquid-enough market, and scarce enough to avoid commoditization and perceived loss of value (which would probably trigger a rush to re-conversion into legal currency) .

The second one is the ratio between currency circulating and currency retained: in the current framework, avenues to expand the market (i.e. generate Vilawatts, through energy savings and municipal grants) are more than the avenues to contract it (i.e. withdraw Vilawatts, through the payment of municipal taxes), a scenario analysis – again – would help to address potential risks related to liquidity and payment capacity at various project stages, under these conditions.

- **Monitoring results** – currently a monitoring plan description is still to be finalized. On the other side, energy savings will be directly converted into currency and results of the awareness-raising initiatives, in terms of responsible energy consumption, will translate into incentives for the participant stakeholders’ associations. Therefore, it will be important for clear measurement strategies, of both technical and social outcomes, to be already defined by the beginning of the implementation phase. Finally, even after all internal project risks have been identified, economic political and social

shocks (e.g.. a political upheaval, an economic downturn...) might bring the project to a halt or to an end. Planners should include stakeholders' reactions to the external context in the periodic assessment of Vilawatt's resilience.

- Building expertise on time and re-inserting it in the socio-economic fabric – professional training opportunities are to be spread throughout the project lifetime, with incentives for local companies to participate, a successful outcome of the capacity building dimension could be ensured by actively monitoring the

integration of the newly-professionalized subjects in the local economic fabric or, even better, by having the Local Energy Operator facilitating the process, either enhancing their visibility or creating opportunities (even on a voluntary basis) to apply the learnt skills to one of the demo-projects en-course.

“The current phase [...] remains delicate as it's from now on that the major implementation challenges will start materialising, testing at the same time robustness of the studies and project management skills of the consortium. ”

7 Conclusions

The present journal has presented a recollection of Vilawatt main features and progress. The project so far has matched its innovative character with a successful organisational definition; it has also managed to gain the necessary traction but now it needs to focus on execution and monitoring: the next set of deliverables will be intermediate reports and they will need to provide evidence that the devised structures are performing as planned.

The following journals will therefore focus on implementation aspects and impact evaluation

methodologies, with additional ad-hoc zooms on innovative project features such as the governance structure, the alternative currency and the stakeholder engagement strategy.

At the same time, the first monitoring results will be available, and they will be utilised to reinforce successful practices and suggest alternatives to overcome bottlenecks.

As the first demo-renovations will be completed and energy savings will start materialising, Vilawatt will prove its true, multidimensional, value.

Urban Innovative Actions (UIA) is an Initiative of the European Union that provides urban areas throughout Europe with resources to test new and unproven solutions to address urban challenges. Based on article 8 of ERDF, the Initiative has a total ERDF budget of EUR 372 million for 2014-2020.

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