NEW URBAN ENERGY

WP2 – Project Initiation
Key Innovation Form

RETROFITTING IN GRENOBLE

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PROJECT INFORMATION

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MAIN COORDINATOR

Name	Sarah BOGAERT
Organization	VITO
Address	Boeretang 200
	2400 Mol (Belgium)
Phone	+32 14 33 58 68
E-mail	sarah.bogaert@vito.be

CONSORTIUM PARTNERS

N° DoW	Organization	Acronym	Country
1	VITO	VITO	BE
2	Stichting Amsterdamse Economic Board	AIM	NL
3	Universiteit van Amsterdam	UVA	NL
4	Westpoort Warmte B.V.	WPW	NL
5	Alliander	LIAN	NL
6	HESPUL Association	HESP	FR
7	The Queens University of Belfast	QUB	UK
8	Th!nk E	THNK	BE
9	KEMA Nederland BV	KEMA	NL
10	Technische Universiteit Delft	TUD	NL
11	Stichting Waternet	WAT	NL
12	Mastervolt International B.V.	MAST	NL
13	SOLCALOR	SOLC	NL
14	AEB	AEB	NL
15	Daikin Airconditioning Netherlands B.V.	DAIK	NL
16	Siemens Nederland NV	SIEM	NL
17	Universita'degli Studi di Siena	UNIS	IT
18	Ville de Grenoble	MUNG	FR
19	Commissariat a l'Energie Atomique et aux Energies Alternatives	CEA	FR
20	Compagnie de Chauffage Intercommunale de l' Agglomeration Grenobloise	CCIA	FR
21	Gaz Electricite de Grenoble	GEG	FR
22	SAS ATOS Worldgrid	ATOS	FR
23	Clicks and Links Ltd&L	C&L	UK

DELIVERABLE INFORMATION

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Lead organization	Hespul
Main author(s)	MUNG
Contributors	Perrine FLOURET / David-Albert BILLIOTTE
Reviewers	Benjamin GIRON (HESP)
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ABSTRACT

Knowledge in the areas of energy efficiency and smartification is rapidly evolving. It is important to incorporate the knowledge on the latest state of the art in each of the 3 areas (buildings, district heating/cooling and smart grids) with special attention to the synergy between those.

The objectives of Work-Package 2 are:

- To incorporate the knowledge on the latest state of the art in each of the 3 areas;
- To indicate which of the collected technologies are relevant for City-zen
- To serve as input for the following Work Packages:
  - > Technology/integration (WP3)
  - > Processes/stakeholders/regulation (WP4)
  - > The demonstration activities (WP5 & 6)
  - > The City-Zen & Deployment: WP8 (serious game) & WP9 (social issue)

The State of the Art analysis task (task 2.1) answers the following questions:

- What has been the experience and outcome of recently finished projects, with special focus on demonstration projects?
- What are the experiences in ongoing projects at different scale?
- What are the latest industrial innovations in this area?
- What are recent outcomes from research programs in this and closely related domains?
- What have been successful approaches for valorising the products and services of innovative companies?

This State of Art Analysis will mainly focus on:

- **Technologies that show a large potential for the European context,**
- **Innovations that are focusing on the interoperability between networks (electricity, gas and heating & cooling)**
- **Process wise: which are the existing methodologies of approach for transition processes?**

This work will deeply rely on the outputs of recent European projects (TRANSFORM, ZENn, LINEAR, Next-Buildings) as well as on the Smart City Stakeholder Platform. Databases such as BuildUp, OpenLivingLabs, Smart cities and Communities platform and SETIS.

The State of Art Analysis information will be stored in the information exchange website developed under WP9[1]. The information will be publicly accessible. The website section developed within WP2 will further take shape throughout the project with the outputs of other WPs (cfr. task 2 of WP2).

[1] The project website (task 9.5) will be on line by end of M6 (end of August 2014)

RETROFITTING IN GRENOBLE

1. DESCRIPTION OF THE INNOVATION AND RATIONALE FOR THE SELECTION

In this section, regarding the innovations list in the appendix, each the partner describes the innovation he is in charge of to allow other partners and the public to have a better understanding about what will be demonstrated in City-zen project.

***Please justify why this is an** Innovation compared to existing technologies/practices. You can develop argumentation with the following criteria:*

- *Performance*
- *Simplicity*
- *Affordability/Replicability*
- *Technology integration*
- *Potential impact*
- *Etc..*

Building retrofitting strategy in Grenoble is focussing on 4 main items:

- **Public targets:** The legal context of co-ownerships retrofitting is very complex in France. In the meantime its sector has the highest energy saving potential. Development of retrofitting work-programs is long (2/3 years) and expensive (20-30 k€/dwelling to reach 96 kWh/m^2/year). In City-Zen project, the municipality of Grenoble aims to systematize refurbishment programs for co-ownership buildings dated from 1945 to 1975 involved in façade renovation works.
- **Engineering & advisory services:** Previous experiences conducted by the municipality of Grenoble, demonstrated the increasing need of a high-level technical supports in design and retrofitting social acceptance in co-ownerships. This support work should be based on:
    - Systematization of the dynamic thermal simulation (DTS) tool to optimize the cost efficiency of work programs
    - Reinforced process management support all along the decision-making-process
- **Technical solutions and performance:** Prefabricated façade solution should be relevant in case of an important upstream design phase is requested. Engineering quality will be necessary to guarantee a performance under 96 kWh/m^2/year.
- **Project funding**: City-Zen project should develop new additional financial helps to support co-ownerships retrofitting projects, and deploys the Eco-loan zero by strengthening partnership with the banking system. Others helps, as matching contribution works for voluntary co-ownerships is now under considerations.

The city-zen retrofitting adresses two retrofitting projects : social dwellings, private co-ownerships. The first one will be developed with social housing association (mainly Actis, owned at more than 50% by the city of Grenoble). The innovation will consist to ask them to retrofit with more ambitious energy target than the 96 kwh/m².y for heating, cooling, DHW, ventilation and lighting (French label BBC renovation). At the proposal stage, 230 social dwellings have been identified.

The second one is the retrofitting of private co-ownership; around 300 dwellings have been identified at the proposal stage. It has been proved that this is not sufficient and that to reach the m² put in the contract, a larger area for retrofitting must be studied. A new potentiality study will be launched this summer. For this type of buildings, the innovation is on the process. This project will be developed on the Mur/Mur frame as describe below.

MUR/MUR RETROFITTING CAMPAIGN

At the crossroads of the local climate plan signed in 2004 and its habitat policy, the metropolitan area launched in 2010 with its partners the insulation campaign Mur/Mur with the objectives of save energy, fight against global warming and reduce energy poverty for poorest households.
The insulation campaign Mur/Mur was programmed over a period of 4 years, thanks to the return on experience of previous programs, such as the OPATB of the Grands Boulevards in Grenoble (belonging to the Concerto project in Grenoble).

Potential impact:

The existing building stock offers a massive potential to reduce energy consumption. But some interventions are more difficult and with a cost that reduce the potential impacts in terms of numbers of retrofitting buildings.

The mur/mur campaign aims to encourage private owners from co-ownerships from the years 1945-1975 to rehabilitate their dwellings. It has been indeed analysed that it will be more rewarding in terms of energy saving and technical system to make works on that typology of buildings, which were constructed after WW2 period without any thermal specifications. The target was to reach nearly 150 condominiums, about 5000 dwellings.

Affordability/replicability and simplification

In this refurbishment program, the innovation has not been pushed forward on technical aspects but on the processes and on accompanying measures developed. The replicability is the core of the process, and everything was made to develop simply solutions.

This incentive scheme for retrofitting of private condominiums proposes a choice among 3 offers of works :

1) complete thermal renovation (insulation of roof, walls, groundfloor and ventilation system as option)
2) exemplary thermal renovation (complete renovation, improvement of ventilation system, replacement of windows)
3) progressive thermal renovation (walls insulation)

Of course, the subsidies are different from one to another solution chosen.

A single contact point has been created to be able to give answer on technical questions and make administrative and financial process.It gather several parners who distribute subsidies with different targets. The technical and administrative support given to condominium is given for free throughout the project, run by professionals ALEC and the Pact of Isère.

City-zen retrofitting campaign will be linked with the mur/mur 2 campaign to be launched in 2015, with a focus on energy saving (only exemplary thermal regulation will be accepted).

2. LEVEL OF DEVELOPMENT

The objective of City-Zen project, as for any lighthouse projects of the Smart City and Communities (SCC) call, is to demonstrate replicable SCC concepts in city context where existing technologies or very near to market technologies (TRL 7 and more, see below) are integrated in an innovative way.
The European Commission has defined a scale of 9 technology readiness levels (TRL):

- *TRL 1: basic principles observed*

- *TRL 2: technology concept formulated*
- *TRL 3: experimental proof of concept*
- *TRL 4: technology validated in lab*
- *TRL 5: technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)*
- *TRL 6: technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)*
- *TRL 7: system prototype demonstration in operational environment*
- *TRL 8: system complete and qualified*
- *TRL 9: actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)*

Please indicated the TRL of your innovation and argue (10/15 lines max) what is the actual level of deployment (e.g. existing system prototype demonstrated in operational environment).

TRL8: Every aspect of the level of deployment has been already lifted. The refurbishment process has been successfully developed and tested to reach the energy performance of City-Zen. To ensure its implementation, the following items are requested:

- To define a relevant Smart Urban Labs in Grenoble
- To formalize financial commitments between partners concerned by City-Zen: French Government & services, the Rhone-Alpes region, the Grenoble-Alpes-Métropole greater metro area municipality of Grenoble
- To draw a methodological guideline to frame the support needed by co-ownerships in a multidisciplinary advisory team, from the first steps to the energy-retrofitting works programs, including their assessments.

The results of mur/mur retrofitting campaign showing the level of development
- 174 condominiums (about 9.500 units) have received support of ALEC (local Climate, Energy and Air Agency)
- 52 condominiums (or 2.900 units) have voted work
- 41 condominiums (or 2.200 units) are preparing to vote work (before June 30, 2014)

3. WHAT ARE THE MOST RELEVANT DEMONSTRATION PROJECTS?

In this section, for the innovation/solution proposed will be indicated:
- *The experience and outcome of recently finished projects that have been demonstrating this innovation,*
- *The most relevant reference of the integration of this key innovation in operational environment in national, EU or international project,*
- *The links where to find presentation or/and analysis about the related projects (ex.: TRANSFORM, ZENn, LINEAR, Next-Buildings, etc.) as well as on the Smart City Stakeholder Platform and databases (ex.: BuildUp, OpenLivingLabs, Smart cities and Communities platform and SETIS).*

The municipality of Grenoble will capitalize its experience from 3 significant energy-retrofitting programs to help City-Zen project implementation:

- **"OPATB Grands Boulevards"**: It is an experimental refurbishment program dedicated to co-ownership buildings located along the main boulevards, dated from 1945 to 1975 (working-class housing estate target) and involved in façade renovation works. Grenoble and the Environmental National Agency (ADEME) supported 40 voluntary co-ownerships to carry out energy audits. Finally, 21 co-ownerships realized those works, financially & technically supported by the municipality services, ADEME and Improved Habitat National Program (ANAH). That experimentation helped to define a local working & supporting method. It also provided a work guidance document dedicated to concrete postwar buildings.

http://concerto.eu/concerto/concerto-sites-a-projects/sites-con-projects/sites-con-projects-search-by-name/sesac.html[2]

- **"MUR/MUR" insulation campaign**: Following the previous experimentation, Grenoble-Alpes-Métropole developed an incentive energy-refurbishment work programs for the whole Grenoble urban district. The program is based on the followings principles: an one-stop shop principle for information and assistance, the OPATB guidance complying with *Effinergie Label*, a range of work-programs to match with co-ownerships objectives in terms of energy performance, investments and financial supports. The municipality of Grenoble actively participates to support technically and financially implementation of this program, in its territory.

- **Zen-N project:** In the context of the Villeneuve district urban renewal plan, the municipality of Grenoble applied for the *Smart Cities* European Program to develop a high-level energy performance refurbishment program dedicated to postwar social housing estate. Financial commitments from EC were gained to achieve the following innovative goals:
  - An important R&D design upstream work to optimize financial investments and energy performance gain,
  - Prefabricated façade solution to ease the works realization in an occupied site,
  - A particular care should be taken to thermal bridge treatment, airtightness testing and air regulation with the help of a dynamic thermal simulation tool
  - Renewable energy production with biomasse heating, a 170 kWc PV units on parking silo's roof attached to the renovated dwellings

  http://zenn-fp7.eu/demonstrationsites/arlequinfrance.4.3d71f8313d6a4ffc79324c.html

4. Expected Impacts of the innovation

This section presents the information on impacts supplied in the innovation/ solution proposal as well as the expert assessment by the relevant working group members. If the solution proposal does not present this information, the provider of the solution has to be contacted to assist in the provision of this information. Where possible, the drafting of the KIs, should involve the stakeholder that submitted the proposed solution.

4.1. Impact on Energy (supply or savings) & greenhouse gas reduction expected

In this section, will be explained how the innovation/solution proposed participates to:
- *The RES production,*
- *Energy savings,*

Feedbacks from OPATB's experience put into relief a 30% average reduction in energy consumption after works, about a 600 tonnes of CO_2 yearly gain for 800 dwellings.

City-Zen Project objective has a more ambitious energy performance: to reach 1.000 tonnes of CO_2 yearly gain for 500 dwellings.

[2] Deliverable could be send upon request

The technical guidance provided by Mur/Mur campaign has been design to reach the French BBC renovation level, which is of 96 kWh PE/m² shon/y (for heating, cooling, DHW, ventilation and lighting) when a complete renovation is done.

Insulation of roof, wall and floor lead to a consumption after work of 150 kWh/m²/y.

Depending on the consumption level before works, the gain could reach 60% of energy savings.
No RES production is forecast in technical guidance.

CO_2 saving will be calculated once decision to making work will be taken.

4.2. Wider potential benefits for cities

In this section, will be exposed how the innovation/solution proposed contributes to the potential benefits on jobs creation, economy, safety, health, etc. for the city.

After the experience developed by the city of Grenoble and Echirolles on single OPATB (Building thermal improvement program), the Mur/Mur program has been launched on the whole metropolitan area.

The impact in terms of jobs creation and economy are real, but not evaluated. ALEC provided special training session for local building enterprises.

4.3. Other impacts

In this section, will be developed the other impacts of the innovation/solution proposed participates, in terms of urban sustainability, smart citizens, governance, urban mobility, transport flow, mobility efficiency, shift to more sustainable modes, etc.

City-Zen should foster the acculturation of local stakeholders involved in the energy savings for existing private housing. Incentives disposal are complicated to implement, even more with the environmental constraint. However, Grenoble area has a high level of experimentation to foster a common culture shared by stakeholders involved: the economic players of the construction, the public sphere, the engineering and project development, the co-ownership management, architects and designers, the banking sector, …

That common culture a precious source for the Grenoble living area with an ambition to broad dissemination at national and European levels.

5. TECHNICAL FEASIBILITY AND SOCIO-ECONOMIC VIABILITY

In this section for the innovation/solution proposed, will be explained:
- *The technical requirements (ex: data sharing for the territorial monitoring system)*
- *And the socio-economic viability (ex: obligation versus incentives for property owners or developers to connect a thermal loop or thermal retrofitting)*

Technical feasibility is not a big problem for the typology of building when external insulation is possible.

Socio-economic viability depend on decision in co-ownership, must be taken at the decision of majority. It needs a lot of work to convince people to accept to make insulation works.

6. INTEGRATED MEASURES

6.1. Integrated measures combining multiple of the domains: buildings, smart grids and district heating and cooling

In this section for the innovation/solution proposed, will be explained:
- *What the combination of domains actually is*
- *What examples are available*
- *Which stakeholders were involved in the roll out*

Once the co-ownerships involved in retrofitting program will be known, smart meters connected to the smart grid will be installed to monitor the energy consumption of the district and meter the energy savings.

The link with smart grid is very interesting: enable to have consumption in real time and allow people to act on it. 500 box have been forecast by smart grid system.

Only when condominium will have decided work, we can be able to measure their real energy consumption, thanks to the installation of a box (link to the smart grid system).

6.2. Which other stakeholders would need to be involved in the implementation of the key innovation?

In this section for the innovation/solution proposed, will be indicated how to imply stakeholders and which can be the potential challenges to do it. When relevant, indicate how the implication of citizen can be enhanced.
Stakeholders:

City-Zen stakeholders should be extended to the engineering area. The mains feedbacks from previous experimentation tested in Grenoble proofed the key element of the energy refurbishment process was the co-ownerships decision to start the works. The key decision factors are: high-level consulting requirement, objectives recommendations, strategically targeting to increase the financial/energetically efficiency of the works programs, etc. Those key elements will help the co-ownership assembly to assess the interest of these works investments. It requires a multidisciplinary engineering assistance focussing the following skills:

- R&D design for thermal studies (DTS, 3D modelling, etc),
- Real estate legal counselling for co-ownerships,
- Setting-up complex financial operation (certificate of energy savings, fund application process, banking partnership, …),
- Coordination and management of complex and various projects

It is necessary to create a public actor to combine all those skills, linked with the public local authorities (town, district area, region, public investment bank, …). It would probably be a semi-public company dedicated to the private co-ownerships for energy-refurbishment programs

Metropolitan local government, who will develop Mur/Mur 2 campaign and will have the responsibility for retrofitting works in Metropolitan area.

ALEC : Local Climate and Air Energy Agency, which was the single contact point for Mur/Mur campaign.

7. Challenges to be addressed by City- Zen

In this section, will be explained what are the main difficulties that would need to be addressed by City-Zen to ensure the successful demonstration of the innovation. This can be technical barriers as well as financial, legal or societal challenges.
Ex: Requirements for wide deployment. Indicate any potential barriers or risks facing wide deployment or replication elsewhere (governance,, regulation, stakeholders to involve, ….

The main issues to achieve the City-Zen end result are:

- **Technical:** During the long engineering design stage, an assistance mission is requested to bring a high-level of technical expertise with material (DTS) and human (engineers). The assistant will supervise the designers to develop the energy-retrofitting work programs. He will in particular monitor the City-Zen energy performance commitments.

- **Financial:** The main challenge is to ensure a convergent application between energy savings financial disposals. These financial resources depend on multi-criteria conditions, with different performance expectations, which should be grouped in one convention. That objective is a big challenge.

- **Legal**: In Co-ownerships rules individual property prevails over common interest. Recent legislation is altering that disposal for the energy-saving work programs. The strategy is to make the co-ownership assembly vote for individuals works programs with a common interest (ventilation, windows, …). But it requires obtaining the approval of the real property managers, which is challenging decision to get.

- **Sociological:** The social acceptability of energy-savings works program, combined with more sustainable behaviour in a smart dwelling are 2 mains challenges of retrofitting. City-Zen project will focus those subjects with the help of the meter monitoring, to clearly analyse residents' behaviour and adapt the recommendations and practice guidance.