A TALE OF TWO CITIES

HOW AMSTERDAM & GRENOBLE
COMBINED FORCES
ON THEIR WAY TO CARBON NEUTRALITY

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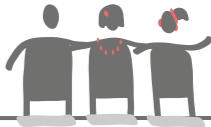
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INTRODUCTION

CITY-ZEN: TWO CITIES, ONE GOAL

Back in 2012, a group of enthusiasts submitted a project proposal to the EU. Many talks, partner proposals, and city explorations later, City-zen was granted EU-funding "to develop and demonstrate energy efficient cities and to build a methodology and tools for cities, industries and citizens to reach the 20-20-20 targets". The program, rooted in Amsterdam (NL) and Grenoble (FR), had its first official kick-off in March 2014.

In the past five years, no less than 28 partners have been working on 20 pilot projects, aiming for an annual saving of an impressive 59,000 tonnes of CO2. Academics, industries and residents have been brought together to face the cities' challenges. An integrated methodology has been developed, as have roadmaps to sustainability for Grenoble and Amsterdam.

City-zen did not shield its learning from other urban environments, either. A vehicle aptly named the 'Roadshow' sent a group of experts in the fields of sustainability, energy, and urban design to various European cities to ideate with local governments, knowledge institutions, entrepreneurs and residents.

Based on the results of workshops, field visits and serious games, municipalities have been shown feasible avenues towards sustainability. Next to Amsterdam and Grenoble, the following European cities were visited: Belfast, Izmir, Dubrovnik, Menorca, Sevilla, Roeselare, Preston, Nicosia (north and south), and Amersfoort.

It wasn't always smooth sailing. Sometimes, the time just isn't right and although the idea is great and the intention true, things do not seem to pan out just yet. In both Amsterdam and Grenoble, for example, it took nearly a year and a half to find the required m2 and the right parties willing to receive the € 3.8 mln made available for residential energy renovations by the European Commission.

In spite of the occasional hiccup, however, the City-zen program did achieve exactly what it set out to do. Innovations were showcased, targets achieved, more clarity obtained with regards to the complex playing field of energy transition. Please turn the pages and enjoy a brief glimpse of exhilarating exploration. And as you do so, ask yourself the question we have been asking ourselves repeatedly in the past five years:

Where do we go from here?

Charles-Henri Bourgois, Nathalie Moyon & Marjolein Bot

Coordinators City-zen FP7

Where do we go from here?

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THEN
2014

NOW
2019

CITY-ZEN: TWO CITIES, ONE GOAL
How Amsterdam & Grenoble combined forces on their way to carbon neutrality

How can we reach the H2020 goals?

We are willing to **fund projects that help reduce CO$_2$!**

We would like to **run pilots** that **reduce CO$_2$** in **urban areas!**

EU

AMSTERDAM

VISION FOR 2050

Circular

Fossil-free

Clean Air

Green & Blue

GRENOBLE

GOALS FOR 2030

Cross-sector

Decreased energy consumption

Smart networks

Increased RES

IMPACTS

The weight of **ten thousand elephants!**

CO$_2$
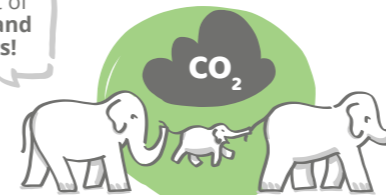
SAVING 35,000 TONS CO$_2$ PER YEAR

That's about **1,169 French apartments!**

76,000 M^2 RENOVATED RESIDENTIAL BUILDINGS

That's like connecting the **entire country of Liechtenstein!**

10,000 DWELLINGS CONNECTED TO SMART GRID

INVESTMENTS

EU

41M

METHODOLOGY
Development of Energy Master Plans that consist of energy interventions and measures plotted on a timeline.

SMART GRID
Adding technical and social flexibility, to prepare the grid for increased number of PV panels, electrical cars, all-electric households, Vehicle2Grid and Virtual Power Plants.

HEATING AND COOLING
Various project, e.g. using drinking water for pharmaceutical cooling, using river water for sustainable comfort cooling, etc.

RETROFITTING
Transforming the building stock of Amsterdam and Grenoble into NZEB: nearly zero energy buildings. Project range from house boats to apartment buildings

CITIZEN EMPOWERMENT
How does the energy transition impact citizens? How can we empower them to accelerate that transition?

LEARNINGS

CONNECT
Peer meetings lead to deeper levels even when exchanging ideas between teams from different cities is not easy

PLAN TIME
It was difficult to devote time for experience sharing and dissemination as we were fully involved in the implementation of the solutions

INVOLVE US!

EMPOWER CITIZENS
Efforts were made to involve citizens/inhabitants to put them at the heart of the solutions' implementation but we must go further

RECOMMENDATIONS

1 Plan more peer-to-peer activities upfront where there is a need for co-production by both parties

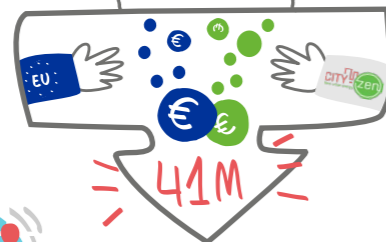**2** Involve communicators in the project team for better dissemination

3 Better integrate social and behavioural sciences into all projects

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THE ROADS TO CARBON NEUTRALITY

TWO CITIES, DIFFERENT GOALS AND VISION, ONE SHARED DESTINATION

Reducing CO_2-levels, achieving climate neutrality, realizing a sustainable metropolitan region – it is easier said than done. Crucial to any plan, especially an ambitious one like this, is setting attainable goals and working out a feasible plan on how to achieve them. Part of the City-zen project was defining Roadmaps towards Sustainability for the cities of Grenoble and Amsterdam.

In Grenoble, it was the transition to the status of "metropolis" that initiated the need to have a global vision of energy in the territory (49 municipalities – 687,985 inhabitants). Working with so many stakeholders toward a shared vision can be daunting, to say the least. Fortunately, in this case there seemed a shared desire to participate, resulting in a successful energy roadmap by 2030. To top things off, elements of the Energy Master Plan appeared in strategic approaches to urban travel, urban planning and territorial air energy climate, giving priority to energy sobriety.

For Amsterdam, the need for a roadmap led to ideation workshops and the development of a

methodology that naturally built on methods used in earlier projects (such as Energy Potential Mapping and REAP). Linking the development of the Roadmap and the City-zen Methodology to TU Delft's sustainability MSc program (SWAT Studios) turned out to be a breakthrough in the process.

Of course, there were some hiccups as well. The Dutch ran into workload distribution problems, for example. The breakthrough mentioned above? It led to an increase of time and budget when the high-level plan was worked out. Quite similar to the tension perceived in Grenoble when concretizing the desired greenhouse gas consumption reduction, actually. Sustainability

ambitions turn out to be just like any other ambition: easy to formulate in broad terms, surprisingly hard to define in concrete figures and actions – and even harder to successfully implement with the support and cooperation of the stakeholders involved.

"Don't dwell on any stage of the project too long. Appreciate it for what it is, then progress and take action."

Delphine Derobert,
Grenoble-Alpes-Métropole

In order for these plans to succeed, they require involvement and tenacity on an individual level and a lavish serving of political clout. The French notion of 'sobriety' when it comes to sustainability efforts, for example, ought to be embedded in energy master plans (even though it touches on multiple aspects of society).

The plans themselves should be common knowledge and governments should (re)introduce carbon tax in order to create a financial incentive. In other words: personal commitment from all those involved, including a well-connected person who champions the plans in a municipality and -perhaps most importantly- a team of motivated

creatives to support her. A lack of motivated people, coincidentally, truly undermines any municipality's sustainability plans.

The secret to successful implementation of these visionary yet attainable plans thus lies in assembling the right people for the job and allowing them to develop the chemistry they need to deliver first class results.

Next steps

1. Add economics experts to the team in order to cover all bases

2. Implement the plans as soon as possible to keep momentum

3. Scale up the roadshow methodology for more cities in Europe

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THE ROADS TO CARBON NEUTRALITY

Two cities, different goals and vision, one shared destination

Feasibility studies

Case studies

Local policies

DEVELOP ENERGY MASTERPLAN

- Collective consumption
- Online tools
- Citizen energy investment fund
- District heating
- PV potential

GOALS GRENOBLE

1. Reduce all energy consumption by 22%
2. Boost renewable and recovery energies by 35%
3. Reduce fossil energies by 30%
4. Greater leeway for the Metropolis in terms of energy
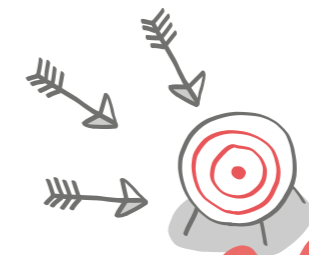
Four biomass heat networks

Renovations of over 40,000 homes and detached houses

Build a new biogas unit for food waste

Pass the metropolis waste collection buses and trucks to biogas

2030

GRENOBLE

1 2 3

1 2 3

AMSTERDAM

2050

VISION AMSTERDAM

Fossil-free

Clean Air

Circular

Green & Blue

1 2 3 4 5 6 7 8

Follow energy transition method

1. Analysis
2. Future Scenarios
3. Develop energy vision with targets & principles
4. Create roadmap with energy strategies & actions

All new buildings all-electric or **at least energy neutral**

28 hectares PV-panels

8 hectares solar collectors per year

Equivalent of 54k dwellings energy improvement towards energy neutral

14 hectares PV-Thermal collectors

Total of 100 wind turbines of 4MW

Total import of 2200 GWhe sustainable electricity from the region

20 geothermal well doublets in total (2 per year until 3,5 PJ is reached in 2030)

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MAKING SMART GRIDS SMARTER

We all know that in the foreseeable future, energy demand will surge and put the current energy network under tremendous pressure. In Grenoble and Amsterdam, various pilot programs sought to alleviate this pressure on the energy grid by introducing smartification initiatives.

In Grenoble, 3 environmental associations moved in their recently completed office building with an ideal flat roof. They contacted consortium partner Hespul to conduct a PV pre-study of the roof despite the complexity of administrative make-up of a potential project. City-zen was an ideal opportunity to start a pilot project to explore PV self-consumption in tertiary building, especially as it allowed Grenoble Energy and Climate Agency (ALEC) to lead the project's implementation.

Good collaboration between the various stakeholders, including private companies, helped to overcome complexities they encountered along the way. Structural constraints and time-consuming configuration of the battery management system are but two examples that led to discussions. Excessive insurance costs even put the feasibility of the entire project under pressure. Fortunately, the ensuing negotiations and administrative complexity were alleviated

by the fact that the installation worked exactly as planned.

Stakeholder collaboration also played a positive role in the development of Grenoble's Vivacité experiment (now Métro Énergies), a multi-energy data platform based on smart metering deployment. While the technical parties (ranging from network manager, data service manufacturer, local authorities and associations to urban planning agencies) involved were very much aware of the opportunities it presented, the actual residents lacked this knowledge and were initially quite hesitant to embrace this technological innovation. Privacy issues in particular were a major concern. Partners

Atos Worldgrid and GEG-GreenAlp decided to focus on the translation of the technique into concrete services that would be beneficial to the residents, and gave high priority to data protection in order to ensure lasting support for this innovative project.

In Amsterdam, Dutch Distribution System Operator Alliander collaborated with (a.o.) NeoSmart, EXE, NewMotion and Enervalis to run a Smart Grid pilot in Amsterdam. After a lengthy tender process, these partners concretized a three-pronged strategy into three pilot programs: Vehicle-to-Grid (V2G), Virtual Powerplant (VPP) and End-to-End Smartification (E2E). E2E would focus on the insertion of intelligent remote terminal units (RTUs) and sensors on crucial locations throughout Amsterdam's electricity network, aimed at gathering insights into current and future load balancing challenges. VPP would be confined to a selected neighborhood in one of the suburbs, while V2G would concentrate on an adjacent suburb.

Remarkably, acquiring participants and establishing a rapport with both residents and the municipality turned out to be easier than expected. On the other hand, technical difficulties grew into restrictions that ultimately held back further exploration. The reliability of the V2G charging stations, for example, distorted the operation of the experiments. (Coincidentally, a similar situation arose in Grenoble: at first there were varying constraints on the data. The initial design proved its quality when it came to the question of GRDP compatibility.

…. And it was!) Figuring out the physical set-up of E2E took three years due to the technical complexity of the experiment. Other technical issues condensed the time to acquire additional participants, which were needed to field more in-depth knowledge. This put the project under additional pressure because the importance of participants increased dramatically when it became clear that the number of participants has significant impact on smart grid design.

"Crucial to any Electric Vehicle project are motivated users. Make sure you've got plenty of those before you even start!"
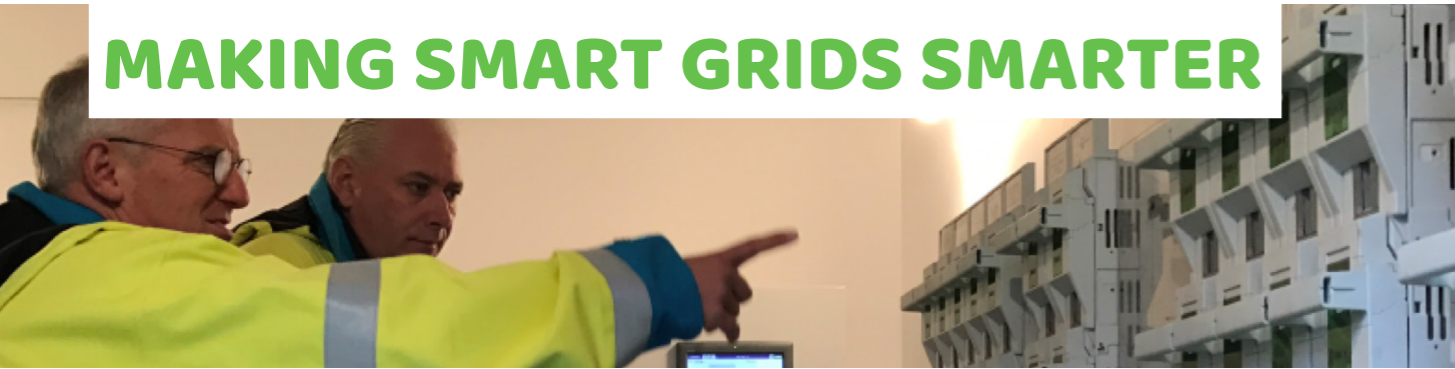
Marisca Zweistra,
Project Manager, Alliander

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MAKING SMART GRIDS SMARTER

Taking into account the multitude of determining factors, a reliable control algorithm tops the list of driving forces for success in the case of V2G programs. After all, if end-users find their vehicles not even moderately charged after a parking period this undermines motivation and will ultimately result in project failure. The number of car-sharing vehicles is a determining component as well. Car-sharing participants are accustomed to certain conditions for use (they don't mind being limited to using V2G stations, for example). Also, they are less concerned about possible battery degradation than the actual owners of the vehicle, thus lowering the threshold to participate.

Once the first projects were up and running (a milestone worth celebrating!) the attention moved from 'set-up mode' to 'maintenance mode'. This seems to be inherent to any tech-based pilot program. Another inherent trait is that, once a small-scale pilot approaches its conclusion, you will find yourself wanting to scale up within stricter boundaries. In the case of V2G, for example, the next logical step would be to scale up to from a dozen to 30+ charging stations but strictly reserved to a single node of

the network. With the learnings harvested from this experiment (see project report online), it certainly can be done.

While their Dutch counterparts learned to focus on participants and reliable infrastructure, the PV plant with storage project in Grenoble discovered the value of a very facilitating and involved company. It is safe to say that without them, the PV installation would probably not have been built! But in France, too, obstacles were easily identified but difficult to overcome. Cost ineffective storage, for example,

"This type of technical solution has no economic reality and brings little financial gain to users."

Jérôme Buffière,
ALEC

did little to encourage project owners or end-users to embrace the initiative. With a whopping 60% of additional costs, the storage system brought very little benefit to the residents.

The most logical next step in further developments would be to massify self-consumption operations but without storage. Selling the surplus on the network at a sufficient rate allows the surplus to be valued.

In Grenoble, the DSO of Grenoble had to adapt its platform due to a technological switchover on SmartMetering. Eventually they had to migrate the computer platform to be compatible with the new hardware. The lack of backwards compatibility meant a lack of data, further complicated by the GDPR requirement for explicit consent.

On a positive note: not all was lost. Because thanks to clear communication and following through on commitments a relationship of trust with the community and the inhabitants was established. Moreover, these new subjects have been able to succeed through cooperation and complementarities between actors who are moving in the same direction and target even though their individual objectives are different. And that is something that might prove to be relevant and important to the current energy context as a whole.

"Dare to fail and make it clear that failures are opportunities to learn, especially during innovation projects."

Ruben van Loon,
Project Lead, Alliander

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CAN WE USE DEMAND/RESPONSE
TO PROVIDE ENERGY FLEXIBILITY AT DISTRICT LEVEL FROM THE DESIGN STAGE?

Demand Response provides an opportunity for consumers to play a significant role in the operation of the electric grid by reducing or shifting their electricity usage during peak periods in response to time-based rates or other forms of financial incentives. In the context of flexibility evaluation on low voltage installations, an experimental project was conducted in tertiary sites aiming to evaluate and value flexibility potential at a local and national scale.

Starting up the program proved a challenge from the start: successive changes in the technical heating solution chosen (centralized heat pump then high temperature urban heating then low temperature, then finally decentralized heat pump per building) and decentralized heat pump solutions per building (adding significant complications) did not accelerate the process.

Also, it was hard to explain the system and technological needs to all the actors involved especially since they would work together while they are historically isolated (plumbers, low voltage electricians, high voltage electricians, telecom typically). Ultimately, the difficulties seemed to stem from a lack of awareness of this type of system, which is more common in the tertiary sector and less common in the residential sector.

"Thanks to close cooperation we were able to move forward even though our individual objectives were different."

Damien Fresier,
GEG-GreenAlp

Once things had been cleared, systems had been implemented and mutual understanding was achieved, things started to move surprisingly swiftly. Of course, further implementation depends on raising knowledge and clear prioritization to work beyond traditional silos. But the pilot definitely suggests further exploration of the model and technical solutions involved. More information about the demand/response pilot can be found on the City-zen website.
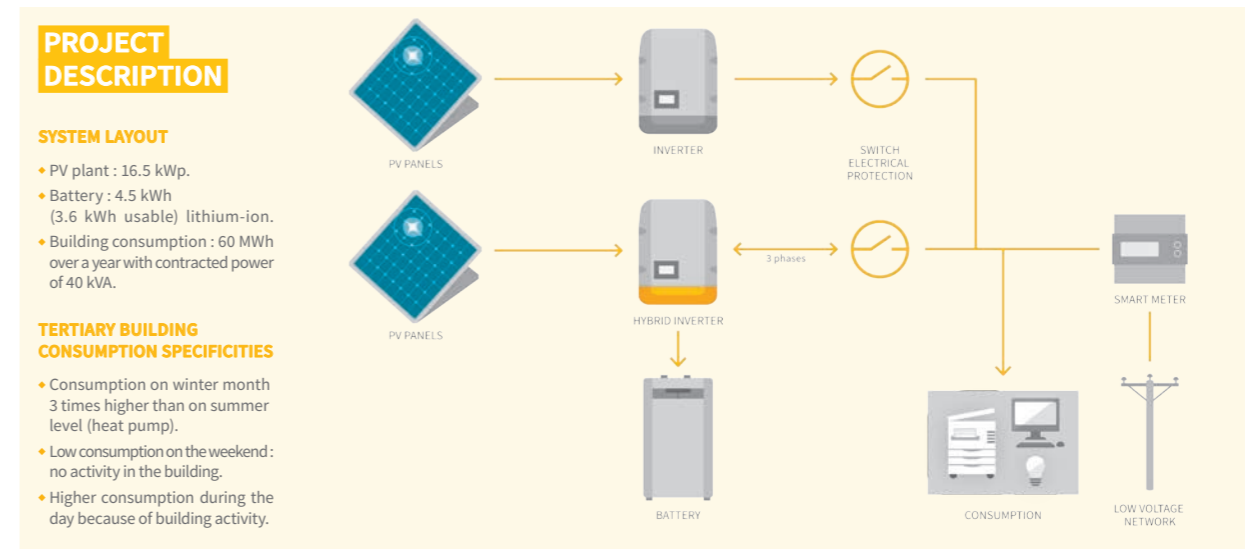
Requirements for a successful, scaled-up E2E Future

1. Dare to fail

2. Be tenacious

3. Be decisive

4. Co-operate

5. Create new business models

SMARTER GRIDS FOR SMARTER CITIES

MÉTRO ÉNERGIES

A COLLABORATIVE ENERGY DATA MANAGEMENT TOOL FOR

City planners | City officials | Building operators | City inhabitants

STEP BY STEP:

1 SMART METERS
Installed (in residential homes, public buildings,..)

2 DAILY ENERGY CONSUMPTION
data is collected with the energy smartmeters installed by grid operators

3 SOFTWARE PLATFORM
Data collected, aggregated, anonymised, processed and combined

4 EDUCATION
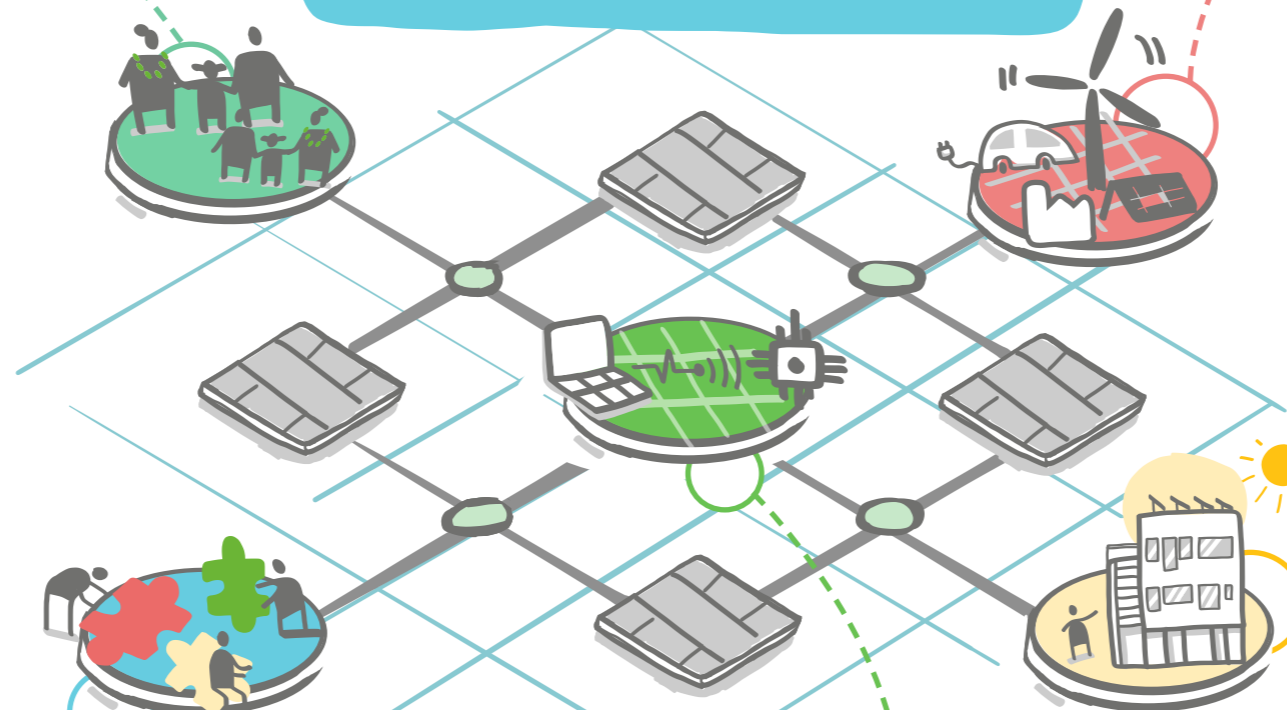Data is released with an educational purpose

DISPATCH & TRADING TOOL

Maximize the consumption of **local produced renewable energy**
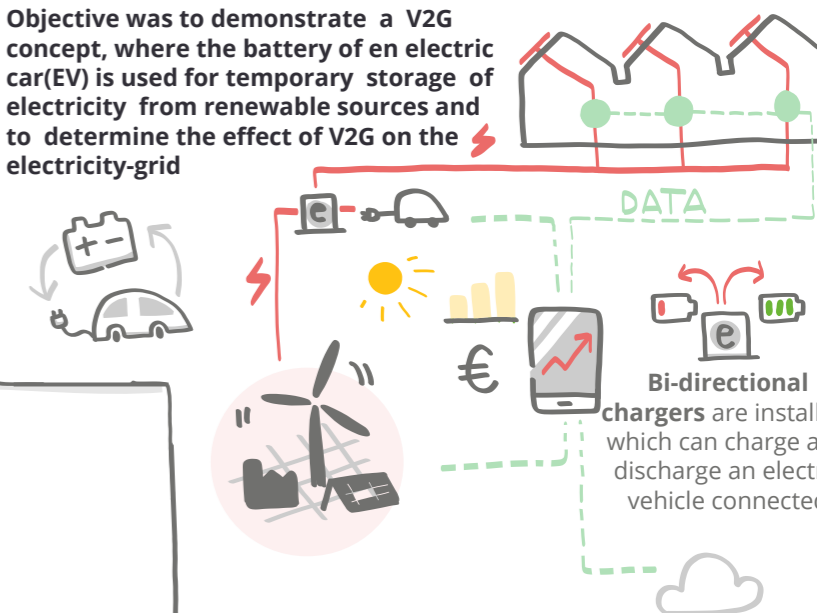
Economic efficiency improvement of the system

A model for a regional smart energy platform which balances **unpredictable energy** supply (such as wind, solar or waste power) with **flexible demand** (such as polder pumping)

VIRTUAL POWER PLANT

Integration of hardware/software in combination with social interactions

Batteries in 50 households

Connect to IT control system that determines store/use/sell options

IMPACTS

Cost benefit

Combine PV with batteries

VEHICLE2GRID

Objective was to demonstrate a V2G concept, where the battery of en electric car(EV) is used for temporary storage of electricity from renewable sources and to determine the effect of V2G on the electricity-grid

DATA

Bi-directional chargers are installed, which can charge and discharge an electric vehicle connected

END2END SMARTIFICATION

✓ **Resolve grid disruptions** better and faster

✓ **Determine more accurately** where and when to **invest in the electricity grid**

✓ **Improve** grid management

PV PLANT WITH STORAGE ON TERTIARY BUILDING

Unique self-consumption photovoltaic installation on the roof of a tertiary building including a 4.5kWh storage capacity

IMPACTS

Reduction of CO_2 emissions

Benefit from **renewable energy**

Reduction electricity bill

55 solarpanels @ 16.5 kWp

30% of building consumption covered

Want to know more? Visit www.cityzen-smartcity.eu Or scan the QR code!

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HOT OR COLD, WE ARE ALL IN IT TOGETHER

Part of the City-zen project aims to innovate on system level, such as heating and cooling. Can we think of a good use for the cold from drinking water? Can we find a solution to use ground water heat pumps in a dense area? How about using phase change material technology?

Due to the vast differences in context, Amsterdam and Grenoble explored widely differing avenues when it came to the system level issue of heating and cooling. In France, one of the interesting initiatives was a collective geothermal drainage network project. The active groundwater table of Grenoble peninsula responds perfectly well to heat and passive cooling needs. A logical follow-up to an initial project that consisted of a temperate water loop network. Another project in Grenoble sought to decrease the footprint of district heating by using lower temperature (72° instead of 120°/180°)

and lower pressure, PCM storage and high-performance solar collectors. A startling contrast with the initiatives in Amsterdam such as using river water to cool down houses or using cold from drink water infrastructure in a pharmaceutical process.

"It is essential to identify and involve all the actors concerned from the earliest stages of this type of project in order to guarantee its success."

Franck Izoard,
Innovia

As it turns out, when it comes to innovative heating and cooling solutions people are surprisingly similar even when the projects themselves are completely different. Front-runners turn out to be agile (e.g. after a change in political governance), able to pivot when needed and remarkably open to cooperation with like-minded spirits. In France it might have been positively influenced by the pre-project studies that supported the feasibility and efficiency of the proposed geothermal. And the fact that the project meets energy performance ambitions in full accordance with the territory's strategic orientations in terms of sustainable development didn't hurt, either. Be that as it may, in Amsterdam the parties involved, worked together in perfect harmony as well.

Of course, it wasn't all fun and games. In Amsterdam, one partner even threw in the towel. It happens. Sometimes the setback comes from an unexpected angle: who could have predicted that flush toilets could hinder sustainable development? Other challenges were more easily predicted, such as the regulatory aspect related to the use of geothermal energy on the scale of the peninsula area in Grenoble and the constraints it has imposed on the construction of the drainage system in order to allow its operation. Mining codes, environmental codes, all extremely relevant and valid but time-

consuming nonetheless which was especially relevant as the geothermal project required next level skills and expertise of the project management teams.

Having said that, the initiatives can all be scaled up relatively easily. Again, there is a lot of overlap when looking at the situations in Grenoble and Amsterdam. The political landscape, full political support and their influence on the economy (ranging from carbon tax to property prices and rental costs) are clearly of major influence on its possible success. Scaling sustainable innovation requires ambition, perseverance, societal awareness and the intrinsic motivation to contribute to a better environment.

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HOT OR COLD, WE ARE ALL IN IT TOGETHER

It is no surprise, therefore, that apart from the expected technical barriers (and the lack of experience familiar to any innovation project) it is mostly regulation and policy making that might prevent scaling up the pilot programs. Of course, sometimes the costs currently outweigh the (financial) rewards and programs must partner up with similar initiatives (possibly finding partners abroad) to remain financially viable. This, also, is an issue that might be solved by adjusting policies in the future.

"Partners should define a shared ambition based on a shared social business case."
Otto Reinstra,
project lead Waternet

As we learned in Grenoble, it is essential to identify and involve all the actors concerned from the earliest stages of this type of project in order to guarantee its success. The drainage network project, for example, is by nature transversal since it concerns different elements in terms of infrastructure (buildings, public spaces), phasing (network and building design, network and building operation) and actors (developer, building owners, project managers, project managers and buildings, mine operators and buildings).

The success of the project is the result of the involvement of all these actors, whose objectives can sometimes be in contradiction but which it is necessary to federate in a partnership approach. This requires an approach of awareness, information/training and sharing of issues in order to achieve a sufficient level of support and ownership of the objectives. The political support for the project and the environmental ambitions it embodies have made it possible to achieve this partnership membership of the actors.

"Sustainability is important, but we also need to efficiently meet our cooling needs and this turned out to be our best option."
Jordy Pedd,
facilities project manager at Sanquin

In Amsterdam, one of the more remarkable results was saving about 1,815 tonnes of carbon dioxide a year (approximately equivalent to the annual energy usage for up to 20 households) by extracting cold from the water of Amsterdam's two main public drinking-water lines and using this cold to lower the blood of the Sanquin blood bank to the right temperature. In the future the annual energy yield will double to 40,000 gigajoule a year. Sanquin will initially only use the extracted cold for its pharmaceutical processes but is looking into expanding the smart cooling system to more of its operations and buildings.

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SMART HEATING & COOLING
HOT OR COLD, WE ARE ALL IN IT TOGETHER

GEOTHERMAL DRAINAGE NETWORK

Allows a high density of heat pumps to provide heating and domestic hot water from groundwater with during the winter and to benefit from a passive cooling during the summer.

- Only **one geothermal borehole** (inlet) per connected building
- Groundwater pumped is collected in a dedicated **collective drainage network**
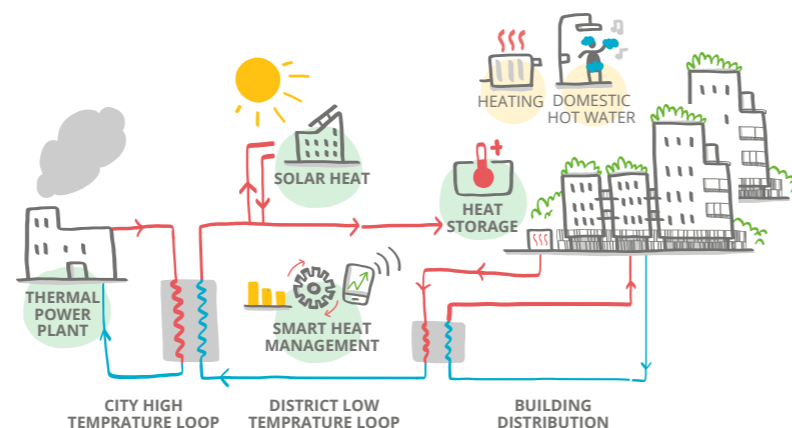- This shared network directly goes to the Isere river

Want to read all about this project, including the results? Scan the QR code or go to
www.cityzen-smartcity.eu

GRENOBLE

HEAT PUMP HEAT PUMP HEAT PUMP ISERE RIVER

WATER GOES TO THE RIVER

GROUNDWATER
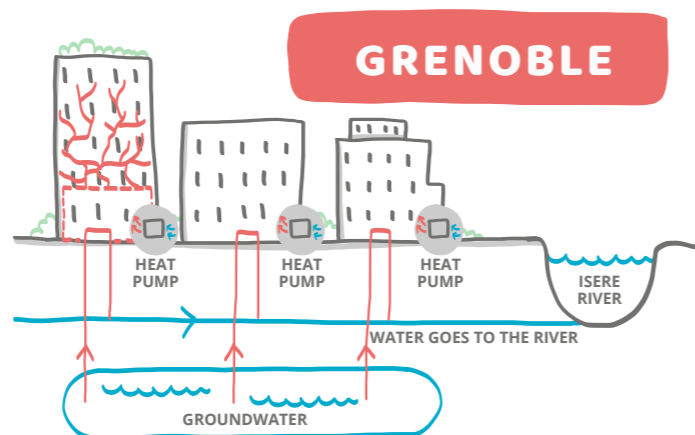
LOW CARBON HEATING NETWORK

A unique model in Europe for coupling a solar thermal field with using phase change material (PCM) storage on a substation scale, driven by innovative intelligent network management software.

- The best **solar system technology** on the market
- Decentralized solar heat: **176m²**
- Production of **100 MWh/year**
- Innovative material (paraffin) with **long heat storage**
- High density heat storage: **180kWh**

HEATING   DOMESTIC HOT WATER

SOLAR HEAT

HEAT STORAGE

THERMAL POWER PLANT

SMART HEAT MANAGEMENT

CITY HIGH TEMPRATURE LOOP   DISTRICT LOW TEMPRATURE LOOP   BUILDING DISTRIBUTION

Want to read all about this project, including the results? Scan the QR code or go to
www.cityzen-smartcity.eu

AMSTERDAM

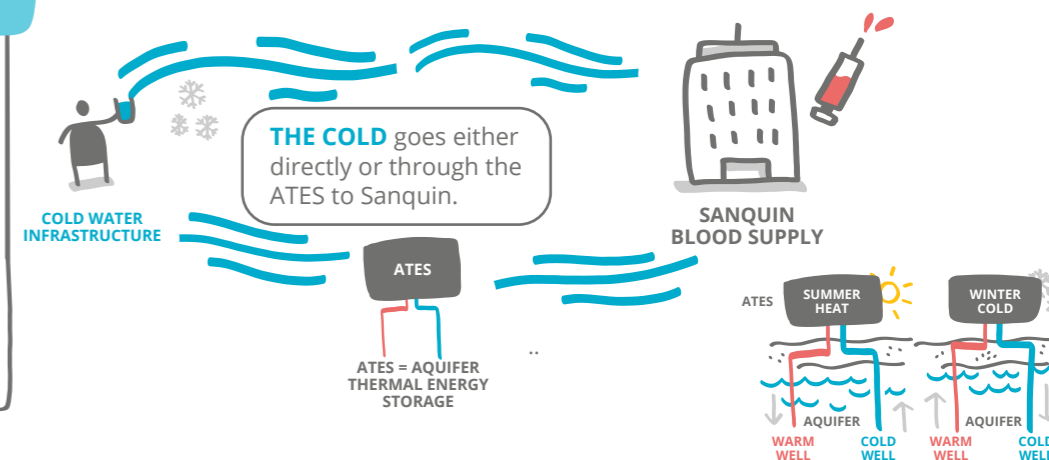### COOLING WITH DRINKING WATER

Take winter cold from drinking water infrastructure, store it in an aquifer thermal energy storage, and use it to cool Sanquin's pharmaceutical process.

COLD WATER INFRASTRUCTURE

THE COLD goes either directly or through the ATES to Sanquin.

ATES

ATES = AQUIFER THERMAL ENERGY STORAGE

SANQUIN BLOOD SUPPLY

ATES   SUMMER HEAT   WINTER COLD

AQUIFER   AQUIFER

WARM WELL   COLD WELL   WARM WELL   COLD WELL

SMART COOLING AND HEATING SYSTEMS

A plant that pumps cold water out of the river IJ in winter and storing the cold for cooling appartments during summer.

COLD WINTER WATER FROM IJ

COOLING APPARTMENTS DURING SUMMER

BIO REFINERY

A neighbourhood bio refinery is a small scale treatment unit in which raw materials (nutrients such as phosphate) and energy (biogas) can be recovered from black waste water.

RESULT

In urban environments: improved **source separation** of food waste and household waste.

Efficient recovery of **phosphate**. Recovery of nitrate and **potassium** also possible.

Improved efficiency of the **removal of pharmaceuticals** and micropollutants

30% savings of drinking water: **12,5 m3 drink / p-y**

Less transport infrastructure and pumping needed

Want to know more? Visit www. cityzen-smartcity.eu Or scan the QR code!

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RETROFITTING FOR THE FUTURE

The housing situations in mountainous Grenoble and river delta Amsterdam could not be any more different. Yet the task at hand was similar, as were some of the obstacles both cities encountered as launched pilot programs or boosted existing initiatives to boost CO$_2$ reduction.

With €2.6 mln on the table for residential energy renovations in Amsterdam, everybody expected that there would be a run on the available funds. As it turned out, quite the opposite happened, and it took nearly 18 months to find the desired retrofitting m2 (approx. 52,000 m2). Part of it was due to the credit crunch, part was due to the ambitiously low energy level (less than 70 kwh/m2/year for total net energy use) required by the European Commission. Dutch housing corporations were still working towards an earlier agreed higher average to be achieved in 2021.

Eventually, City-zen retrofitting subsidies in Amsterdam were shared among housing corporations, landlords, property developers, owner-residents, co-owners and other non-professional parties. To everyone's great surprise, the emphasis during the startup period was predominantly on communication and acquisition.

In Grenoble, the Municipality set out to find social landlords while the Metropolitan Area and ALEC focused on the private homeowners through the Mur|Mur renovation campaign. Similar to Amsterdam, it was hard to find eligible buildings at first: for the social part, finding m² to renovate with ambitious energy objectives and whose realization schedule corresponded to City-zen was the biggest challenge. Eventually the available €1.3 mln was allocated to 26,464 m² for retrofitting purposes.

In contrast, finding private homeowners was relatively easy. The City-zen subsidy coincided with the start of "Mur|Mur 2" which was a continuation of the "Mur|Mur" condominium renovation program. Many condominiums were ready to commit to the support path and the tools and methods of the first program were simply repeated and improved upon. The only real difficulty was to manage satisfactorily (acceptable in terms of waiting time for owners) a large volume of requests/projects to be supported. Quite a different story! Finding them alone was not sufficient, unfortunately, as none of the eligible condominiums could benefit of the City-zen grant directly allocated to m² because the renovation works were planned beyond the City-zen timeframe. Timing, again, worked in our disadvantage.

"Retrofitting is often interpreted as loss, not a gain. But beyond technology and early savings lie increased comfort and increased property value."

Marjolein Bot,
task lead Amsterdam

Fortunately, once the projects were found and validated, the formalization of the social landlords' commitment was quite rapid: they subscribed to the technical and social monitoring obligations without any problems. Overall, we found that participants really went out of their way to set an example. Even if the implementation does not always go as planned, we found that being given an opportunity to set an example is a hugely motivating factor.

The scale of the Grenoble renovation projects worked to our advantage as well. Despite a decrease in financial aid the interest of co-owners at the Mur|Mur program did not falter, for example.
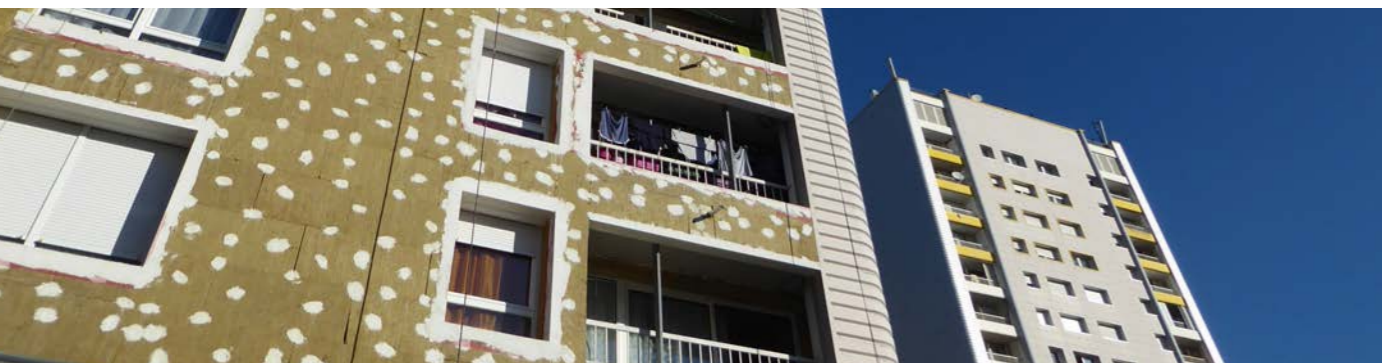
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RETROFITTING FOR THE FUTURE

"Keep in mind that most decisions are made for emotional reasons. Think of the cost of NOT doing it."

Marjolein Bot,
task lead Amsterdam

In Amsterdam, being ambitious paid off as well. Social Housing corporation Eigen Haard introduced an all-electric concept to a challenging target audience and managed to reap the rewards. Residents happily speak of increased comfort! Something we notice throughout the program: participants experience a more comfortable and a healthier (!) home. Being less dependent on natural gas adds to the enthusiasm of the program's front-runners and their willingness to share lessons learned.

Every coin has two sides, however. Retrofitting projects, in Grenoble and in Amsterdam, are demanding and require owners as well as larger organizations to be flexible and persistent. Plans are not yet practice. Planning management remains tricky when innovating in a traditional environment such as the construction sector. Sudden material shortages can play unwanted pivotal roles, for example. The lack of expertise and hands-on experience can lead to counterproductive measures (e.g. in one case pv panels were placed on a roof that had yet to be insulated) and major stumbling blocks (e.g. the Dutch struggled with filling in BEST tables).

"It is very important to find a contractor and installer who is knowledgeable and trustworthy, with a good track record and who works with specified prices."

Wigger,
received City-zen subsidy in Amsterdam

One housing corporation did not keep their end of the bargain and was taken to court by disgruntled residents. Social factors can pop up, too: The Mistral towers team in Grenoble had to deal with drug trafficking and several works broke down because of a sensitive atmosphere in the neighborhood! And of course, finance always plays a crucial role in maintaining the pace needed to achieve the set objectives.

"Residents' involvement is crucial and for this to happen we need educational actions – before, during and after the project."

Florence Vialleton,
City of Grenoble

So, what is needed to push retrofitting forward? As diverse as the projects in both cities have been and how loud the cry for context-specific measures may sound, the learnings do seem to point in similar directions. From simplifying the process and actively steering that process to making retrofitting available for all income brackets and building lasting relationships with (social) landlords: retrofitting needs a strong municipality that leads the way with policies that are consistent and up to date with current retrofitting wants and needs. Mutual trust based on clear communication is a major factor in the retrofitting process from research to advice to implementation. Finally, retrofitting needs the relentless energy of willing front-runners and experienced professionals.

Simple? Perhaps. Easy? Not quite. Context determines the ease (or difficulty) of each project. The site may be damaged, workers may be threatened, tenants may be uncooperative. Construction workers might not possess the knowledge, expertise or the desire to develop. Beyond the technical aspects it is the human factor that can influence a project's progress.

Finance is another discriminator as financial flexibility turns out to be a prerequisite for many renovation projects. In Amsterdam, for example, the higher income group tends to find its way to subsidies/pre-financing easily. Low-income households, however, are faced with the fact that the amount of subsidy available per dwelling depends on the number of square meters, the measures taken, and investment made by the homeowner.

Banks aren't exactly forthcoming either, perceiving the renovation market as small and risky. It would be interesting to see if a platform could function as a demand aggregator where applicants can bundle their requests and make them more attractive to banks because of the spread risk. Unlike Grenoble, there is no 'sustainability helpdesk' in Amsterdam and that is something missed dearly.

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RETROFITTING FOR THE FUTURE

Just like the context of the various projects, the follow-up differs per city. In Grenoble, there is a need to progress in monitoring performance over time (at least two years after the works), and to strengthen listening and the place given to tenants. This means that a significant amount of time must be allowed to inform them, co-construct actions with them, and support them in changing their habits. It is imperative to aim higher in terms of performance targeted after works, by integrating a guarantee of results, by finding partners who can propose solutions that are in line with the climate and energy challenges of the territory.

Both Amsterdam and Grenoble need to innovate and scale innovations to truly progress, taking into account the complexity of the relation with other transitions like the ones towards a circular and digital economy. Inclusive growth is currently a hot topic as are the downsides of platform economy. What is needed, is a system-based and area-specific approach with strong support from the government.

In Amsterdam, this means clarity on the energy strategy (district heating vs individual heating) as well as more incentives to establish a knowledgeable and competent retrofitting building sector. It also means making subsidies accessible to lower income brackets so people

know what to do and how to embrace new initiatives. For example, campaigns aimed at districts could work because it nudges citizens towards change. Financial institutions and housing corporations could join forces to make this happen as well. And part of the subsidy could be assigned to tech parties to help them develop the required technical solutions faster.

"French social landlords are very proactive in renovating their properties. They just need a little encouragement."

Nathalie Moyon,
City of Grenoble

At the end of the day, retrofitting invariably means improving the quality of life. In their own words:

"We are very pleased with the result, we have a net-zero house that is still 100% in traditional condition and looks historical aesthetically perfect, while we benefit from latest technology."

"No longer being dependent on gas, being more energy-efficient and creating a smaller carbon footprint is most satisfying."

"Our house CO_2 footprint is near zero. And we live in high comfort."

A WORD FROM OUR TECHNICAL DEPARTMENT

As we can see, retrofitting is heavily dependent upon behavioral change. An important tool to drive change is providing awareness, knowledge and insight. Technical monitoring aims to do just that.

"We were very pleased that the data collected in Amsterdam shows that it is indeed possible to renovate and achieve energy performances better than 70 kWh/m²."

Rudy Rooth,
DNV GL

Everything starts with defining the requirements and reporting templates. Unfortunately, for many parties involved monitoring is something that is only added three years in the project – resulting in having missed out on valuable data.

Independent service providers offered smart meter data on a monthly, hourly and even quarter-of-an-hourly basis that eliminates possible data entry mistakes by residents. However, privacy issues played a pivotal part in this process. The introduction of the GDPR increased the complexity of data collection. Even more so in France than in the Netherlands, because the French inhabitants were particularly careful when

it came to data collection and usage.

Anonymizing data can add unexpected complexities. Monitoring true usage in those case, for example, may well deliver 'real' results, but in smaller populations those results are heavily influenced by random factors such as family composition. Anonymization does not always provide room for those factors.

All in all, however, the technical monitoring revealed the results achieved by various retrofitting approaches and provided insight in their respective pros and cons.

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RETROFITTING FOR THE FUTURE

GRENOBLE

AMSTERDAM

MEASURES

- **Complete insulation of buildings**
- **Renewable energy production**
- **Awareness & support** for inhabitants & co-owners, building workers, banks and insurance companies

MEASURES

- **Improvement/replacement** of insulation, heating, glazing & ventilation
- **Connect to district heating**
- **Add PV power production**
- **Add solar hot water heating**

SOCIAL HOUSING

26,464 M²

280 houses

Max 69 kWh EP/ m²/year after renovaiton

3 Social housing companies

PRIVATE HOUSING

1000 Dwellings Retrofitted by 2020

Integrated process

Technical & administrative assistance

Financial contributions

Condominiums & Individual houses

IMPACTS

- **Lower CO$_2$ Emissions**
- Move Towards **Scale-Up Phase**
- **Ensured** Thermal & Architectureal Quality
- Contribute To **Combating Fuel Poverty**
- **Stimulate** Building Sector

IMPACTS

41,000 M²

535 Dwellings

Avg. **energy improvement: 314 kWh/m²/year**

Avg. **energy improvement: 4.7 grades** (e.g. E > A)

3,000 tonnes CO$_2$ saved

LEARNINGS

1 **RETROFITTING** is more challenging than other renovations (budget, unforeseen cirumstances, home owner involvement)

2 **INSULATION** is crucial

3 **EXPERTISE** is hard to find

4 **ENERGY RENOVATIONS** are not attainable to all income brackets

KEY DRIVER: short term financial benefits

REQUIRED: Perseverance, **perseverance,** PERSEVERANCE

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POWER TO THE PEOPLE:

CHANGE COMES FROM WITHIN

In addition to the innovations on system level, such as smart grids, City-zen also looked closely at innovation on household level. Citizen engagement and its relation to successful renovation was a key subject of the program. An interesting event during the City-zen program in this respect was the introduction of GDPR legislation, which added unforeseen obstacles to the data collection and interpretation process.

Social monitoring had a rocky start, to put it mildly. The initial monitoring method did not meet the desired objectives, which meant that a different methodology had to be set up to allow comparative analysis between Amsterdam and Grenoble. Added challenges were the lack of testers for the VivaCité (now Métro Énergies) platform in Grenoble and the late readiness of the demonstrators. Relating it to renovations meant that there was a need for side-by-side comparisons between the current situation and the situation in which the renovations would not have taken place. This was hard to do as not all the required info was readily available.

INVOLVE US!

After the rocky start, things started to come together. Residents turned out to be very accessible and willing to deliver input, even in areas where this was not expected such as Mistral in Grenoble. Also, in France, the initial lack of response by local actors dissipated completely in the 'after renovation'-phase: a change of interlocutors led to partnership work that has greatly facilitated the implementation of social monitoring in the field.

"We really need to provide more support to residents for a better understanding of their energy environment and a better use of their energy resources to move toward greater 'energy sobriety.'"

Florence Vialleton,
City of Grenoble

Legislation is a factor to be reckoned with: the introduction of the new European GDPR legislation required new consent forms, which turned out to be a long and tedious process. This, combined with the length of the social monitoring questionnaire to be filled in by residents of renovated homes and developed by researchers of TU Delft, required a review of the method of dissemination. Leaving the questionnaires in mailboxes or lobbies of buildings would have provided very few responses. In Grenoble, it was decided to employ a door-to-door collection

How did you get involved with City-zen project?

methodology in order to obtain a satisfactory rate of return allowing a relevant analysis.

Sometimes, it takes a lot more effort to reach the target audience than originally envisioned. In order to reach the Francophones, for example, it was needed to rewrite the questionnaire and make it more comprehensible and accessible for low income tenants. When expected (and needed) support of the Dutch research team remained elusive, this did very little to add cohesion to the combined effort.

In order to further citizens' empowerment, we really need to work closely with actors specialized in inhabitant mobilization and participatory methods on energy issues. A partnership with (local) actors, for example, could improve mobilization of a district's inhabitants, which is essential for social monitoring. Improved communication between all parties from municipality to residents (and including better insight in renovation measures and their advantages and disadvantages) could streamline implementation of renovations.

It is of utmost importance to provide housing corporations, home owners and residents of the various advantages and disadvantages of the various renovation options. Governments should always keep the overall energy efficiency in mind (rather than focusing on a single sustainable aspect such as eliminating natural gas). Linking technical and social monitoring more closely will greatly help integrate and alleviate common issues all stakeholders face. Most importantly, sufficient funds should be made available to further invest in gathering, developing and maintaining support for sustainability efforts.

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POWER TO THE PEOPLE:

CHANGE COMES FROM WITHIN

If you want to continue social monitoring on a European scale, you should take local context into mind and involve sociologists and academics with local knowledge on board. After all, comparative analysis between widely differing contexts (such as Amsterdam and Grenoble) is a stretch at best. At the same time, do not let the focus on locality become a barrier for the long-term goal of finding ways to make deep renovations the default approach.

Behavioral change is a consequence of increased awareness, deepened knowledge and stronger emotional appeal. Future endeavors must involve residents from the get go, from technical monitoring to the development of new monitoring methods. There is a growing need to adapt to the specific context in which projects take place and that should be a joint effort from all parties involved.
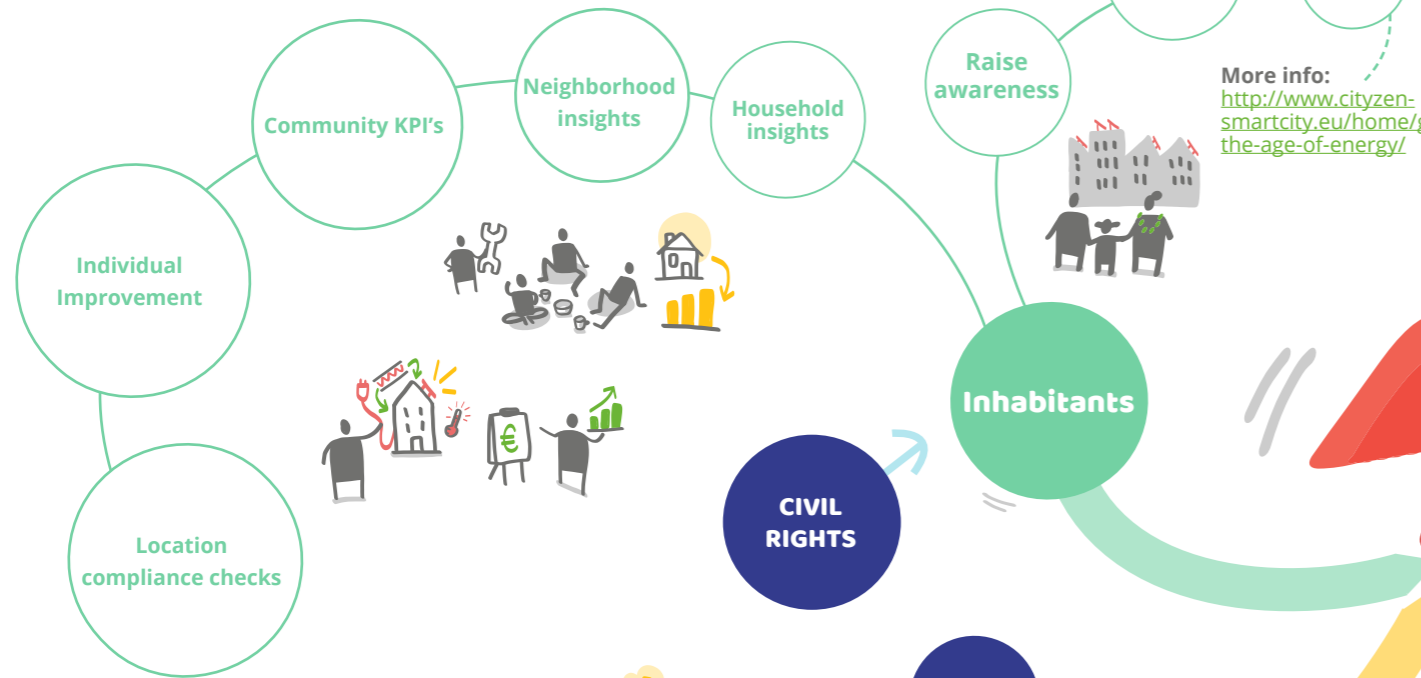

MIND

LOCAL

CONTEXT

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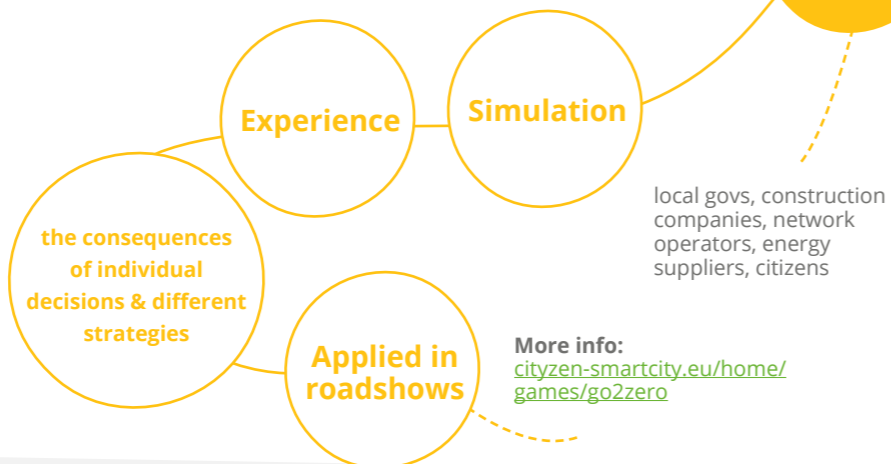**Air Energy Climate Plan**

smartphone game: the age of energy

POWER TO THE PEOPLE
HOW CITIZENS   CAN ACCELERATE THE ENERGY TRANSITION

Changing behaviour

Save energy

Raise awareness

More info:
http://www.cityzen-smartcity.eu/home/games/the-age-of-energy/

Community KPI's

Neighborhood insights

Household insights

Individual Improvement

Location compliance checks

Inhabitants

CITIZENS' EMPOWERMENT

CIVIL RIGHTS

FUNDING
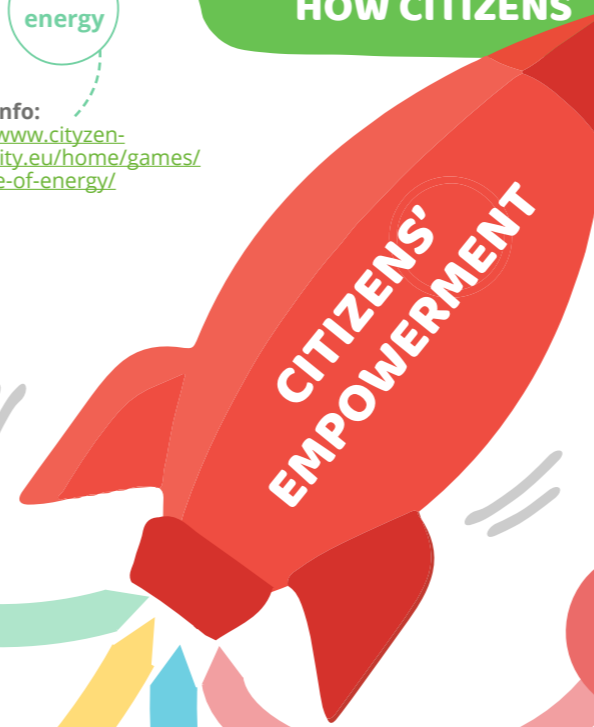
Positive energy schools challenge

More info:
http://www.cityzen-smartcity.eu/ressources/societal-issues-2/positive-energy-schools-challenge/

TEACHING

Pupils take action!

They follow consumption of energy from the school.

benefit from 4 pedagogical interventions.

They set up an action programme to reduce energy consumption (electricity and heating) of the school by **eco-gestures**.

Because of City-zen, some Grenoble schools' classrooms have a **detailed monitoring campaign** deployed by GEG, to have data at classroom scale, so pupils can **work on their own data**.

Young people

Classrooms with detailed monitoring up **900%**

Classrooms involved up **230%**

Total pupils engaged **870**

9 Classrooms

LEARNINGS

DEVELOPMENT OF NEW POLICIES is crucial

LOCAL CONDITIONS determine framework for transition

COORDINATION is needed to protet public funds

GO2Zero

Decision makers

Experience

Simulation

the consequences of individual decisions & different strategies

Applied in roadshows

local govs, construction companies, network operators, energy suppliers, citizens

More info:
cityzen-smartcity.eu/home/games/go2zero

Policies

De-centralised system is a suitable solution

Business as usual = solutions as usual

Rights of the end user equally valuable as rights of the commercial parties

The need for new policies

Energy transition coincides with the rise of citizen participation and digitisation

Tailored instruments need to be developed

'Equal' ≠ 'Just' or 'Equitable'

Needs of vulnerable end users have priority

Government must provide subsidies + tariff differentiation

The future must be "all-inclusive"

The end user should feature in all policies

More info:
http://www.cityzen-smartcity.eu/home/reporting/deliverables/

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PROOF OF THE PUDDING:
APPLYING THE CITY-ZEN METHODOLOGY TO OTHER EUROPEAN CITIES

Although the City-zen demonstration projects took place in the frontrunner smart cities of Amsterdam and Grenoble, the project's focus was sharing its knowledge and experience with other European cities. City-zen went 'Glocal': specialist global expertise combined with local stakeholder energy and knowledge of context and lifestyle on location. To this purpose a special City-zen Roadshow team – with renowned experts in the fields of energy planning and design from TU Delft, Queen's University Belfast, the University of Siena, VITO, Th!nk E and DNV GL was put together.

Since its inception in March 2014, the City-zen Roadshow has visited 10 cities with a need for expert guidance on how to become more sustainable and move towards energy neutrality. Initially, the plan was to present a set of workshops that would transcend the ideation process beyond already familiar technical/spatial aspects yielded by methods such as Energy Potential Mapping, TU Delft's REAP, etc.

Things really took a flight, however, when TU Delft's SWAT Studios were integrated in the Roadshow concept. All of a sudden, the methods conceived at an earlier stage of the City-zen project could be implemented, tested, further developed and optimized. It resulted, among

regular Roadshow reports and other things, in various remarkable publications such as a Methodology Report, a Catalogue of Measures, a Book of Inspiration and a Roadmap for the City of Amsterdam.

"It's about trust, commitment and inspiring people to embrace solutions that will bring health and happiness! At what cost? Reverse it: what's the cost of NOT doing it…?"

Craig Martin,
TU Delft

Balancing the expanding workload, however, proved to be a challenge. As the Roadshow began to take shape as a new way to disseminate our learnings, additional time and energy were required for a wide range of tasks: engaging local stakeholders, gathering the right information, arranging locations and facilities, post-reporting, et cetera. Unexpectedly, these tasks were not distributed evenly. Also, the cities' follow-up to the Roadshow strongly differed in communication and action: sometimes continued with new energy, sometimes coming to a stand-still, mostly

due to political reasons.

Perhaps the solution to the above could be to decide that a prerequisite to the Roadshow is to find a local champion within a municipality, ask for personal commitment of those involved and make

"The Roadshow shows the importance of cooperation between the various departments of urban planning, ecology, greenery. Now it is time to make this vision more specific and continue with implementation!"

Mayor Declercq of Roeselare,
Belgium

sure the right team is available. Creativity within the team in particular is of crucial importance – and the evidence of the Roadshows display just that.

The Roadshow is a perfect example of a City-zen pilot that deserves to be scaled-up. The addition of a team member with the necessary economic expertise could help best the financial challenge that lies ahead: Roadshows and Roadmaps are very demanding when it comes to resources and finance. Assembling the right Roadshow team is a challenge in itself. The intensive process requires a coherent, complementary team of people who get on well together, who are equally committed, proactive and who all add value to the final result.

The discriminating characteristic of a successful Roadshow therefore, is its team. Opportunities arose left, right and center but the team members willing to invest were the ones who enabled the Roadshow to reap the rewards. Furthering the Roadshow, therefore, is dependent upon assembling a team with complementary (technical) knowledge and (creative) skills.

"You have inspired me. We should take all this on board and dream of solutions."

Mayor Bolsius of Amersfoort,
The Netherlands

Ideally, the EU would support a pan-European roll-out of the Roadshow. This will accelerate the transition towards the Paris goals. The team would have to include the earlier mentioned economics expert and sufficient time and resources would have to be allocated towards proper preparation of local requirements.
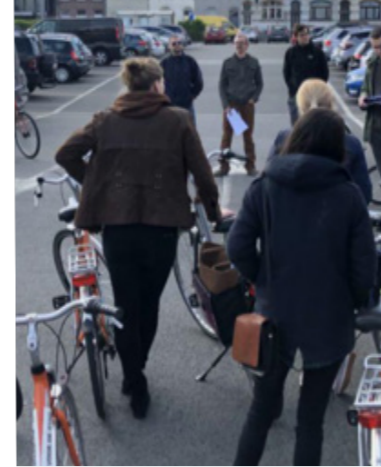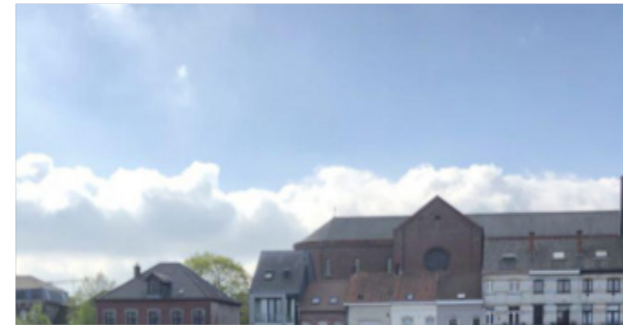
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ROADSHOWS
AT-A-GLANCE

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WE'RE FINISHED, LET'S START!

HOW CAN WE TAKE FORWARD OUR LESSONS LEARNED?

Construction can be a dynamic and messy process. It is only after the dust has settled that we truly see the result of our efforts. In the case of City-zen, it means that a very important question still needs to be answered: How can we ensure successful deployment of similar initiatives whilst taking into account our valuable lessons learned?

More than half a decade's worth of City-zen projects has yielded a mountain of results and learnings. The financial health of participating companies plays a pivotal role, as does the stability of their management team or the company's long-term strategy. The challenges faced by the City-zen consortium were great but fortunately the solutions were sometimes even greater.

Certain projects are ready for a wider audience. Take the groundwater heat pump project in Grenoble, for example. Because it was so innovative the decision to issue a certain license had to be obtained all the way from the Parisian governmental office. Now that the issue has been resolved, the project can relatively easily be replicated elsewhere – and it's already being done!

Using the cold from drinking water for pharmaceutical purposes was very successful. Sanquin and Waternet showed that a little tenacity goes a long way indeed.

The City-zen Roadshow has been quite successful as well. Applying the City-zen methodology to various European cities has proven to be a very effective way to gauge the energy and climate potential of an urban environment and communicate about it. In Roeselare, local authority staff confirmed that the roadshow helped to introduce a new way of thinking in the city administration and to break through the conventional competence silos. Visualizing what exists now and what is possible in the future, a trademark activity of the roadshow, was also deemed instrumental in helping to better understand the local energy transition challenges and opportunities.

"When others give up, you must continue. Willpower, perseverance, bullheadedness, a little bit of craziness – they certainly won't hurt."

Han Vandevyvere,
VITO

Finally, it must be said that communication seems to be an unpredictable yet determining factor in sustainability processes such as these. Language barriers need to be overcome, preferably by neutral parties with a good command of both

"Keeping the momentum going isn't easy yet crucial."
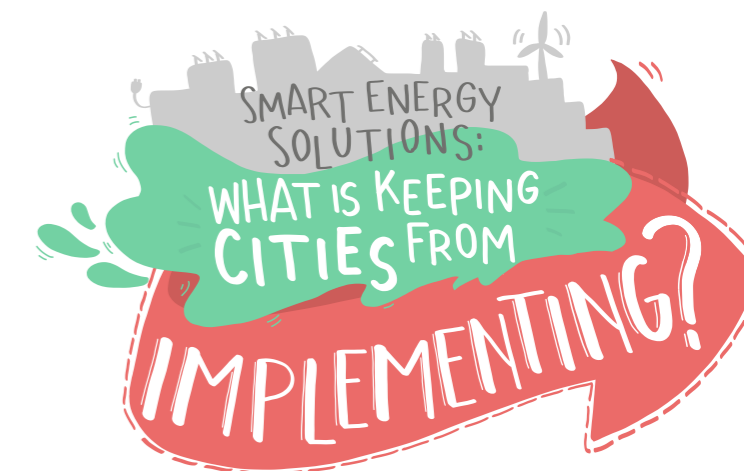
Leen Peters,
Th!nk E

participating cities' languages..

Regardless of all the visionary stubbornness in the world, however, the transition remains a financial issue at the moment. If the underlying business model does not work you will not be able to further deploy any of the City-zen ideas. Human behavior (and its attachment to finance) still need that requirement even if we all accept that innovation will not let itself be predicted.

We possess the technical expertise to battle our way through this climate crisis. Never before have

we had so much wealth and so many resources at our disposal. From an economical point of view, it makes perfect sense to invest heavily in climate action: The longer we wait, the more money it will cost. The same goes for social sustainability as well, yet everything moves at a snail's pace. Our society seems defined by its (bad) habits, practices and procedures.

At the end of the day, successful deployment of our most successful projects will depend upon the common sense that we need to be visionary and disruptive. Only then can we leave our institutionalized folly behind us, take the bundle of wisdom we gathered during five years of City-zen and shape a dramatically improved future.

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SMART ENERGY SOLUTIONS: WHAT IS KEEPING CITIES FROM IMPLEMENTING?

LET'S KEEP GROWING TOGETHER!

THANK YOU!

Want to know more? Visit www. cityzen-smartcity.eu Or scan the QR code!

WWW.CITYZEN-SMARTCITY.EU

A city operating entirely on clean energy. In theory, it's possible. But in real life?
How to integrate new solutions in existing buildings, systems and people's lives?