NEW URBAN ENERGY

Social Monitoring Plan

DELIVERABLE D8.1

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 608702.

PROJECT INFORMATION

Project Acronym	City-zen
Project Full Title	City-zen, a balanced approach to the city of the future
Call Identifier	FP7-ENERGY-SMARTCITIES-2013
Grant Agreement	n° 608702
Funding Scheme	Collaborative Project
Project Duration	60 months
Starting Date	01/03/2014

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6	HESPUL Association	HESP	FR
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DELIVERABLE INFORMATION

Number	D 8.1
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Nature	R – Report
Dissemination level	PU – Public;
Delivery Date	M18 (31/08/2015)

VERSION HISTORY

Version	Date	Author/Reviewer	Description
0.1	09/06/2015	Boots/Overtoom; Giron	First draft
1.0	24/08/2015	Boots/Araghi	Final version
2.0	09/05/2016	Boots/Rooth	Final version with data protocol

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CHAPTER 1 – Introduction

The main objective of the social monitoring plan (SMP)[1] is to provide a common basis for socio-economic monitoring of the City-zen projects in the category 'buildings', enabling comparison between, and replication of, the projects.

Ultimately, the objectives of the socio-economic monitoring are:

- To determine the socio-economic impact of City-zen and thereby provide recommendations for policy development, efficient dissemination of project achievements to other communities nearby or other places in Europe.
- To motivate and empower the citizens of the demonstration communities of Amsterdam and Grenoble for a long-term energy saving.

The success and acceptance of the City-zen projects (partly) depends on the human factor. Socio-economic monitoring will provide insight into citizens' attitudes and beliefs, experience, engagement or adverse response to the changes that they will face in their life as a result of the City-zen project. The changes that citizens encounter are either tangible/technical such as refurbishment of houses and specific measures like installation of energy boxes, solar photovoltaic panels (PVs) or connection to district heating or less tangible/process related activities such as providing information and initiating awareness campaigns on benefits of retrofitting.

As such, the primary target group in this monitoring plan are the citizens. Here we essentially focus on those who are tenants and owners-occupiers of the residential buildings that are subject to one of the project activities in Amsterdam and Grenoble. Note that this excludes, for example, employees working in and using office buildings in the City-zen areas.

While the technical monitoring is left to WP7, there will be coordination between project partners on the interaction between WP8 and WP7. For example, deliverable 7.1 already provides an overview of data required for the user behaviour analysis on electricity consumption (WP7 task 4.1). It includes both technical and socio-demographic data and mentions that the socio-demographic data should come from WP8 surveys.

This SMP starts with a short description of measures taken in the City-zen project in Amsterdam and Grenoble in chapter 2. Then, in chapter 3, tasks 2, 3 and 4 of WP8 are briefly described, since the work to be carried out in those tasks determines the socio-economic data to be collected. Then, chapter 4 discusses the monitoring methodology, including monitoring criteria and indicators, which build on the earlier CONCERTO methodology. Finally, in chapter 5, an exemplary outline of the questions in the questionnaires is given.

[1] Equivalent to project evaluation plan (PEP).

CHAPTER 2 – City-zen demonstrations

2.1. AMSTERDAM

The main objective of the 'retrofitting to zero energy buildings' task in Amsterdam is to improve the existing building stock considerably to ensure affordable costs for tenants, while establishing better comfort in the dwellings. The target is to improve energy efficiency performance by 80%, on average, compared to the existing situation (30% when compared to new build). This is equivalent to annual savings of 15.4 GWh for the mentioned buildings. The CO_2 reduction target is 5000 tonnes per year.

The retrofitting projects are primarily located in the western part of Amsterdam, which are locally called: West, Nieuw West and Westpoort. The main focus buildings are the social housing stocks of various housing corporations, while a minor part focusses on energy retrofitting by private home-owners.

The main activities in Amsterdam include[2]:

- Improving the energy efficiency of a large number of buildings (> (equivalent to more than 50 000 m^2) through insulation, enhanced ventilation and integration of renewable energy sources. Note that dwellings in the City-zen project may not be connected to the district heating system.
- Testing and demonstrating new innovative technologies, materials and processes (from WP3) as well as innovations from non-City-zen partners, in a small number of buildings/dwellings, which are known as "LIVING LABS".
- Involvement and coaching of inhabitants.

2.2. GRENOBLE

The city developed several retrofitting programs dedicated to post-second World War dwellings. The initial objective was to focus the entire City-zen demonstration project on the same eco-district. However, some preliminary studies showed that this objective was technically impossible. Then, the municipality chose to extend the project perimeter to the whole city. For the retrofitting part of City-zen, the municipality and the metropolitan area, Grenoble Alpes Metropole, aim to strengthen the retrofitting programs with two target groups:

- For social dwellings: the social housing companies will select the buildings to be included in the project, depending on their own priorities. The municipality will then validate their choice following several criteria (e.g. area, typology of building, efficiency of the energy works).
- For the private dwelling: the metropolitan area will launch an informative campaign (called Mur-Mur) aimed at providing technical advice, incentives, monitoring, etc. for retrofitting the dwellings. Technical and financial advice will be given in a centralized area. Only co-owners who chose the most energy efficient level after the reworks and who are located in the Grenoble city area will be part of the City-zen project.

[2] In parallel to the City-zen project (but not as part of the project), the municipality of Amsterdam has set up a refurbishment fund worth € 20 million, from which the municipality is prepared to subsidise the renovation of some 50,000 m^2 of residential areas, equivalent to 700 to 900 dwellings.

The retrofitting works (insulation of envelop, heating system, ventilation, efficient lighting, etc.) target a high level of energy efficiency. The retrofitted buildings will reach at least the BBC Effinergie[3] renovation standard, which is 96 kWh/m²/yr of energy consumption. Depending on the energy consumption before renovation, some buildings could develop exemplary retrofitting works in order to reach a consumption of 60 -70 kWh/m²/yr , which is the standard RT 2012 consumption level for new buildings.

The main activities of the city-zen project in Grenoble include:

- Extensive awareness raising, advising and training programs to convince the citizens (co-owners and social housing).
- Provide supporting actions to ensure the achievement of co-ownership retrofitting (non–technical drivers).
- Develop technical solution for buildings erected before 1945 with architectural specificities (technical drivers).
- Involvement of end-users, consumer focused renovation to enhance the energy efficiency of their dwelling, to increase comfort and health, and control energy expenses.

2.3. RETROFITTING BUILDINGS DEMONSTRATIONS (WP5 TASK 2; WP6 TASK 2)

The following table provides an overview of the housing projects in the two cities that are currently considered in the City-zen project. The selection of retrofitting projects together with the housing corporations proves to be difficult causing delays in the projects. The projects identified up til now are shown in the table and are organized per city and per housing corporation.

Table 1 City-zen retrofitting projects

	No. dwellings	Start	Measures	Remarks
AMSTERDAM				
Ymere				The Ymere projects do not reach the City-zen standard of 70 kWh/m²/yr (in WP5) but are included as 'extra' in the social monitoring, mainly for WP8 task 4.
Merkelbach	206	2016	Renovation	
Bloom IV	287	2017	Insulation roof, wall and groundfloor, HR++ glazing, HR-boiler, Mechanical ventilation	
Stadsdeel West				
Borstblok Woutertje Pietersestraat	78		Renovation (insulation, installations, rental PV)	With HuurDeZon
Rochdale				
L.v. Deijsselbuurt	50	2017	Renovation (exact measures to be decided)	First high level retrofit by this corporation which might lead to more ambitious renovations in this area.
Eigen Haard				

[3] A French system for energy efficient buildings, see also www.effinergie.org.

Nieuw West	157	2015	Zero Energy (on the Meter) renovation	Is part of Stroomversnelling, a nationwide innovation approach to enable high level retrofitting of dwellings and homes.
Other	300		To be decided	
Private houses	100		Renovation	Pauline Westendorp
GRENOBLE				
Actis				
Tours Mistral	200	2016	Renovation	Tours Mistral
Private houses	300	2017		Part of Mur-Mur

2.4. OTHER DEMONSTRATIONS

Although the socio-economic monitoring is focused on the retrofitting demonstrations in the two cities, there will also be other demonstrations – in the category of 'smart grids' – where monitoring of social aspects for citizens play a role. Potentially these are:

	Measure/demonstration	**Partner**	**Type**
WP5	**Amsterdam**		
Task 8	Smartification at building level	MAST	SG
Task 9	Smartification at neighbourhood level	LIAN	SG
Task 11	Integration of EV and V2G	LIAN	SG
WP6	**Grenoble**		
Task 4.1	Make buildings smarter	GEG	SG

CHAPTER 3 – Social monitoring activities

Based on the Description of Work (DoW - dated 31 August 2014), a summarized list of monitoring activities is provided below, together with the associated deliverables and the parties involved. The socio-economic monitoring activities to which this document applies are those in WP8 task 2, task 3 and task 4.

Task	Description	Partner	Deliverable
2.1	Social monitoring in Amsterdam West	AIM	8.2
2.2	Social monitoring in Grenoble	MUNG	8.3
3	Socio-economic impact of City-zen compared to base case	KEMA	8.4
4	Exploration of societal aspects of innovation	TUD	8.5

Each of these tasks will be further explained in the next sections, which lead to specific considerations and requirements for the social monitoring plan.

The actual social monitoring will differ between Amsterdam and Grenoble and between the various projects due to differences in (type of) projects (e.g. houses, households, goals, technologies) and objectives. We strive to have a broad common basis and a base questionnaire, however, when relevant these differences will be accounted for with an extra set of questions depending on the exact project.

Common themes and differences between Amsterdam and Grenoble are identified in the DoW p8/9.

To put these activities into perspective of the CONCERTO framework of socio-economic activities, we note that the City-zen activities in WP8 mainly relate to 'surveys and studies' and 'activities to change energy behaviour'. We will also address activities in the field of 'information' and 'stakeholder involvement' whilst 'training and counselling' is disregarded completely.

3.1. Social monitoring in Amsterdam West (task 2.1)

In Amsterdam, user (or focus) groups will be organized in a way that they represent the citizens together with the stakeholders that either serve the citizens or view them as customers, including e.g. representatives of energy supply companies and the municipality. Participants in the user groups will be asked for input via physical meetings, online community tools and questionnaires. Preferably, each retrofit project will have one user group. The user groups cannot be identified and organized before the precise neighbourhoods and projects are fixed. The main topics of the user groups will be the implementation of technologies and how to communicate and facilitate the citizen, with a focus both on qualitative and quantitative results.

The main goal for Amsterdam is to get insights in success and failure factors of energy retrofit and actual energy reduction, as well as establishing (local) policies that will lead to maximum energy reduction. Insights relate to:

- The decision making process of all stakeholders.
- How information on energy retrofit can be efficiently shared with residents and stakeholders.

- The link between attitude and action of all parties involved.
- The link between technical measures and projected versus actual reduction of energy and behaviour.

3.2. SOCIAL MONITORING IN GRENOBLE (TASK 2.2)

The monitoring strategy in Grenoble will be based on the results of the previous European project, EMPOWERING[4], which raised the importance of considering the energy profile of the users. Four profiles were identified and can be summarized by a question:

- Economic rationale: Are you concerned about your energy bills?
- Economic/ecologic: Are you concerned about both your energy bills and the environment?
- Energetic: Are you concerned about understanding and being able to better control your energy consumption?
- Ecologic: Are you concerned about energy savings to reduce your environmental footprint?

To determine the behaviour and relationships involved among different parties such as: users, co-owners, social housing, public services. The municipality of Grenoble has decided to focus on the empowerment of stakeholders with the SPIRAL methodology. SPIRAL is developed at the European level[5] and aims to determine indicators for progress and well-being of citizens and communities. The SPIRAL methodology was tested in 2014 with the inhabitants of the Mistral district, in a social cohesion project. The municipality of Grenoble wants to use this bottom-up approach in the same area to empower stakeholders of the 200 retrofitted dwellings from ACTIS. The 8-steps methodology of SPIRAL is illustrated below.

In addition to SPIRAL, some 100 families/households of the retrofitted dwellings will be actively involved in the social monitoring campaign. Some of them will benefit from specific assistance of:

[4] http://iee-empowering.eu/en/
[5] http://spiral.cws.coe.int/tiki-index.php

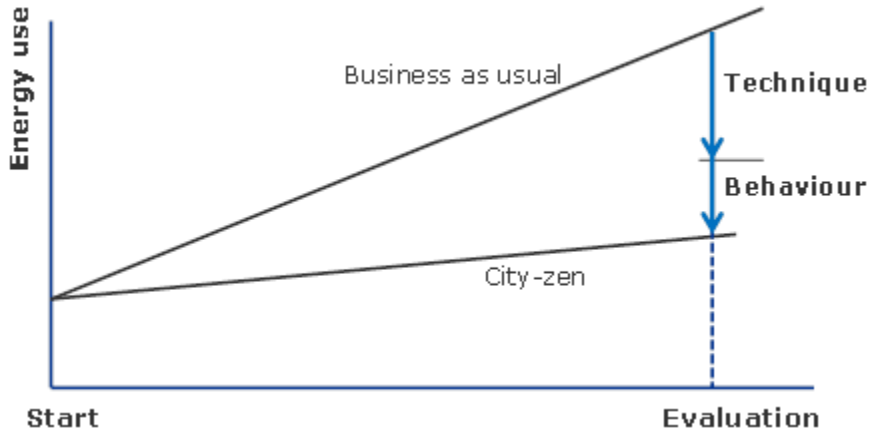
- The Energy Positive Family Campaign, a saving energy contest organized for groups of 5 people (family, company, school, friends – i.e. a group of people living together or sharing the same space) after a public call for candidacy. After the 6 months campaign (during the heating season), the team with the biggest energy saving progress is declared the winner. The campaign will be led by the Grenoble Local Energy & Climate Agency (ALEC).
- The multi-energy box will display the consumption flows (heat, electricity, water, gas) and price indicators, with the objective to impact family behaviour. GEG will install the boxes in 50 dwellings.

The objective of this social monitoring campaign is to evaluate the impact of these approaches (SPIRAL, Energy Positive Campaign, Multi-box) on different target group selected for the City-zen project.

3.3. IMPACT COMPARED TO BUSINESS AS USUAL (TASK 3)

To understand the real socio-economic effects, the results of tasks 2.1 and 2.2 have to be evaluated and compared with a business as usual scenario. Essentially, the analyses performed in Amsterdam (task 2.1) and Grenoble (task 2.2) by their respective task leaders will be brought together for a cross-section analysis by DNV GL in task 3. The analysis will focus on energy consumption and financial implications for end-users, with attention to specific improvements and the synergy created by the improvements on the three aspects (buildings, smart grid and district heating/cooling network). DNV GL's analysis will be based on the situation before renovation and statistical data on retrofitting and installation activity and also on behavioural aspects for each of the two demonstration cities. Clearly, here there is a strong link to the technical monitoring in WP7 as well. In addition to this rather technical angle, we are also interested in the impacts of the projects on peoples' well-being, satisfaction with measures, and quality of life compared to business as usual.

For the business as usual scenario we will take a reference group of tenants and owner-occupants (with similar characteristics as citizens) whose houses are not retrofitted. This reference group will then be subject to similar questionnaires, although perhaps on a less frequent basis. We think it will be difficult to identify and select a reference group for each neighbourhood/project, due to the lack of interest with City-zens not involved in the retrofitting. However, we strive to have at least one reference group in each city that is representative. The sociological and energy profiles may help to identify reference groups.



Our estimation is that, due to the retrofitting and specific technology and assistance measures of City-zen (building and smart grid, e.g. insulation, pv and energy box), as well as due to citizens'

change in behaviour, energy consumption will decrease[6] while comfort and wellbeing may increase relative to business as usual, i.e. relative to the reference group without retrofitted houses.

3.4. SOCIAL ASPECTS OF INNOVATION (TASK 4)

The social aspects of the City-zen measures will be addressed by looking for parameters that determine the acceptability of society to embrace technological and process innovation. The innovations are sustainable, or at least they increase sustainable living for the citizens. The hypothesis for the research team is that enhancing sustainable behaviour not only relates to technological innovations, but also in behavioural change itself; technology is seen as an addition to the required change, not as the solution.

The purpose is to zoom in on behaviour; therefore, a closer look at the factors that influence behaviour is required. The following interrelated factors are distinguished:

- Personal factors, such as motivation, values, beliefs, control over the behaviour, attachment to the home/city, etc.
- Spatial factors (the physical environment), such as type of housing, neighbourhood characteristics, accessibility (on foot, bike, car, public transport), green areas, etc.
- Social factors, such as social networks, identification with social groups, categorisation of social groups, etc.

Inclusion of the social factor is important because people/citizens are influenced by the people in their social network. We function as individuals in various groups. For example, if one person in a flat starts with growing vegetables on the balcony, the neighbours might adopt the behaviour if they feel they want to be like that person, either because they are in the same social group (category) or they want to be like that person (identification).

Ultimately, this task ideally answers the following questions:

- What are stimulating environments (social and physical) for embracing new technology / innovations and for energy efficient and sustainable behaviour?
- What are the fundamental parameters that determine the success and failure of behavioural change in different social groups?
- Which motivation techniques must be applied/developed?

This analysis is related to transition management and engagement of different user groups. TUD and VITO will perform this evaluation. They will define answers that can serve as input to industry, public bodies and educational and societal organisations to create innovation-stimulating environments necessary to boost a greener economy.

Anticipated indicators that are important for this task, relate to citizens' sustainable behaviour change, attachment to the neighbourhood and social groups.

- Sustainable behaviour change is about motivations and how to motivate people to change their behaviour in a more sustainable way. In addition to technological changes and innovations, behaviour change can increase (or decrease) the intended effect. What motivates people, what they think is a good and achievable goal is therefore important.
- Attachment to the house and neighbourhood has an effect on how much people care for and are willing to invest in their environment, and how (sustainable) they perceive their living environment.

[6] Research shows however that people may increase the use of appliances because they think their total bill or use will still be lower or greener (rebound effect).

- Social identity is related to the social environment of a person and how this is judged. Ideas and behaviours spread more easily if others see or hear about the behaviour and perceive it as a desirable example. What different groups value and who belongs to them could provide information on what is the best way to approach them and to motivate them.

CHAPTER 4 – Methodology for monitoring

Basically, two forms of monitoring will be employed[7].

- Monitoring of demographic, housing and contextual data. This refers to characteristics of household, house/building and neighbourhood e.g. education level, income, household size, age, (un)employment, nationality[8], ownership, type of house/building, etc. In addition, energy consumption and cost data is important (also for technical monitoring in WP7), based on annual electricity and heating fuel utility bills. This data needs to be captured on a per-household or per-person level and therefore may be treated as part of individual monitoring (see following point).
- Monitoring of individual people affected by and related to the City-zen project (primarily citizens). Ideally all citizens affected by the City-zen project should be monitored, though that is difficult to achieve (due to response rates). This type of monitoring is the main subject of this plan. For example, this includes personal attitudes, acceptance and satisfaction towards energy use, comfort, housing, retrofitting, etc.

We will use the socio-economic evaluation framework as developed in the CONCERTO (plus and premium) project as the basic methodology[9] implemented in this project. Basically this framework consists of criteria and indicators structured in three dimensions – Society and Households (representing 'people'), Environment ('planet') and Economic ('profit').

Table 2 Categorization of criteria

PEOPLE – Social and household dimension		**Relevance to WP8**
1	Degree of satisfaction / acceptance by inhabitants	✓✓
2	Level of information, knowledge & direct participation	✓✓
3	Active / proactive householders' behaviour	✓✓
PLANET – Environmental dimension		
4	Improvement of district environment and internal comfort level	✓✓
PROFIT – Economic dimension		
5	Economic-ecologic cost effectiveness	✓
6	Increase in local control of energy supply / local energy production	✘✘
7	Stimulation of local economy	✘
8	Payback period (investor side)	✘✘

The symbols in the last column give an indication of the relevance of the criteria for City-zen WP8. The prime focus in the WP8 part of City-zen project will be on the social and household dimension. In the environmental and economic dimensions only emissions, costs and wellbeing directly related to energy use are relevant to WP8. Therefore, in the remainder of this document points 6, 7 and 8 will be ignored.

[7] See p.3 CONCERTO Social Monitoring Guide, 31 January 2012.
[8] There may be cultural differences in energy use, perception, etc.
[9] CONCERTO Premium is continued as the Smart Cities Information System (SCIS). For more information on social monitoring see CONCERTO Social Monitoring Guide, 31 January 2012 and CONCERTO Socio-economic Impact Assessment Report, 2010.

To evaluate the most striking differences and similarities between Amsterdam and Grenoble, key indicators for the most important criteria will be assessed in both cities. The key socio-economic indicators are to be assessed in surveys, for which we make a set of basic questions to be used in both cities. However, before going into the indicators, the following section first provides a preliminary set of relevant criteria. This set is based on the long list of criteria described in Annex A. Subsequently, in section 4.2 relevant indicators per criterion and per city are given. This list of criteria creates the basis for the questionnaires.

4.1. SELECTED CRITERIA

The shortlist of criteria that will be evaluated within the City-zen project is given in the table below. The identifying numbers between brackets in the first column correspond to those in the Annex A, but for our purpose they are renumbered.

Table 3 Selected criteria

	PEOPLE - Social and household dimension
1	**Degree of satisfaction / acceptance by inhabitants**
1a (A1 D2)	**Degree of satisfaction and acceptance of the City-zen measure(s)** How satisfied are citizens with the measures implemented. Primarily, this refers to the retrofit of their home, including e.g. the application of a solar heating system, the implementation of district heating, smart meter display, energy checks, dissemination, etc.
1b (A2 D1)	**Degree of satisfaction and acceptance with the area / local involvement / social cohesion** How satisfied are citizens with the area as a place to live. To what degree do citizens identify themselves with their local community, are they proud to live (and work) there, what is the image of the districts and are they considering leaving their community.
1c (A3 D8)	**Degree of local involvement / citizens organised in local organisations** How active are citizens, are they engaged in organisations, participate in community decision-making processes, try to take part in the project by changing certain habits, etc. Information is collected on the number or percentage of citizens that are part of a local organisation that is concerned with local problems and issues. It shows how many actively take part in decision-making processes or are engaged in making their district a better place to live.
2	**Level of information, knowledge & direct participation**
2a (D3)	**Information to and direct participation of citizens before, during and after retrofit** If and to what extend were citizens informed or involved about the retrofits and installation of new technologies. Level of satisfaction with City-zen related information provision and with involvement in relevant decision-making process.
2b (D5)	**Citizens seeking energy advice or information** The number of households who requested information or advice on their own accord. It is an indicator of the level of pro-activeness of the citizens.
3	**Active / proactive householders' behaviour**
3a (D6)	**Participation in feedback-systems; Understanding / using information and control systems** Whether and how citizens are / have been using feedback information. Use of metering equipment, displays and interfaces with the aim to change energy consumption behaviour and attitude. (link with WP6, task 4) Information of citizens taking part in any sort of feedback-system on their energy consumption is collected (e.g. diaries, regular questionnaires on energy consumption, internet

	surveys, collecting energy bills, control instruments, etc.). This criterion helps to assess whether citizens make use of (the results of) the feedback-systems and for example change their consumption behaviour. It also reviews whether citizens understand technical control instruments. This also involves the results of energy savings campaigns based on competition between households.
3b (D7)	**Citizens investing in energy efficiency measures** Whether citizens spend money on insulation, energy efficient equipment such as energy-saving appliances, or take further retrofitting measures in their homes, etc. It looks at proactive behaviour and indicates whether the project actions have had an impact on people's attitude.
	PLANET - Environmental dimension
4	**Improvement of district environment and internal comfort level**
4a (B2)	**Improvement of indoor climate quality, health and comfort (personal quality of life)** Whether the indoor conditions have been improved. It can refer to the space available to each person, the air quality, the amount of fresh air, materials used, the acoustic quality and the amount of daylight available, the temperature, draught, moist and mold. For City-zen the improvement according to the thermal retrofit of buildings and the allocation of hot water, heating and electricity with more sustainable systems is vital.
	PROFIT - Economic dimension
5	**Economic-ecologic cost effectiveness**
5a (C3)	**Reduction of fuel costs and consumption** Whether the measures to refurbish older buildings and the measures to increase the awareness had any effect on the energy bills of the citizens. Both lower consumption as well as lower fuel costs result in lower energy bills, which in turn creates satisfied customers. It also links to the advantage of production of renewables and the energy compensation fee for the zero-energy projects.

4.2. SELECTED INDICATORS

Each city (AIM and MUNG) selected a set of indicators, based on the selected criteria (above), that addresses the city-specific measures and objectives in City-zen. Some of the indicators will be determined by measurements in WP7, for instance the actual electricity consumption, some by calculations, for instance the CO_2 reduction and some will be based upon other databases, for instance the market attractiveness of the dwellings (€/m^2). Most indicators however, will be determined in surveys. The table below focusses on the indicators that will be determined in surveys.

Table 4 Selected indicators

	PEOPLE	Amsterdam	Grenoble
1	**Degree of satisfaction / acceptance by inhabitants**		
1a	**Degree of satisfaction and acceptance of the City-zen measure(s)**		
	Satisfaction with retrofitting measures: ▪ Glazing / Insulation ▪ Ventilation ▪ Connection to DH / Heating system ▪ PV ▪ Solar thermal ▪ Lighting	 ✓ ✓ ✓ ✓ ✓ -	 ✓ ✓ ✓ - - ✓

	Satisfaction with refurbished home in general	✓	✓
	Satisfaction with the smart meter	✓	✓
	Satisfaction with the energy box	-	✓
	Satisfaction with smartification at building level	✓	✓
1b	**Degree of satisfaction and acceptance with the area / local involvement / social cohesion**		
	Satisfaction with the refurbished area / building	✓	✓
	Satisfaction with comfort and security in the city and district	✓	✓
	Attachment to place	✓	✓
1c	**Degree of local involvement / citizens organised in local organisations**		
	Satisfaction with own local contacts/networks; Satisfaction with local facilities	✓	✓
2	**Level of information, knowledge & direct participation**		
2a	**Information to and direct participation of citizens before, during and after retrofit**		
	Satisfaction with information received on City-zen measures. Are households well informed about retrofitted house and specific measures? Information amount, clearness and timing of information and the way it is given (mail, online, app, home display, etc.)	✓	✓
	Are households well informed about renewable energy	-	-
	Are households well informed about energy savings	✓	✓
2b	**Citizens seeking energy advice or information**		
	Do households seek information on their own accord	-	-
3	**Active / proactive householders' behaviour**		
3a	**Participation in feedback-systems; Understanding / using information and control systems**		
	Preference for certain feedback service (costs vs sustainability)?	?	?
	Do households actively use feedback info	✓	✓
	Preference for type of controlled energy use (automatic, smart, manual)	?	?
3b	**Citizens investing in energy efficiency measures**		
	Changes in purchase behaviour towards energy efficient appliances (other than those offered within the retrofit project) or willingness to invest	✓	✓
	Switches in energy supplier	-	✓
	PLANET		
4	**Improvement of district environment and internal comfort level**		
4a	**Improvement of indoor climate quality, health and comfort (personal quality of life)**		
	Satisfaction with indoor quality of life	✓	✓
	Satisfaction with thermal comfort	✓	✓
	PROFIT		
5	**Economic-ecologic cost effectiveness**		
5a	**Reduction of fuel costs and consumption**		
	Electricity consumption and price/cost	✓	✓
	Heat consumption and price/cost	✓	✓
	Natural gas consumption and price/cost	✓	✓

4.3. DATA COLLECTION METHODS

For quantitative evaluations, the indicators described will be assessed by citizens by means of the surveys (questionnaires). Furthermore, a subset of citizens will be asked to participate in a user

group (Amsterdam) or team (for the Energy Positive Family Campaign in Grenoble). Those participants will be interviewed as well.

In addition, other stakeholders such as the city administration, housing corporations, energy suppliers and grid operators, will be asked to provide both quantitative and qualitative input for the socio-economic evaluation. For example, we would like to know from municipal policy makers to what extent they use instruments like cost-benefit and SWOT analysis in their decision making.

4.3.1. Questionnaire-based surveys

To collect information, attitudes, values or demographic data, we suggest designing questionnaires for self-completion in electronic form (e-mail, dedicated internet platform etc.) and/or 'paper-and-pen' form (delivered by post, handed out in person).

We will be mainly using closed form questions in the surveys, to allow scoring regardless of language barriers and to enable quantification and objective comparison of answers. The 5-point Likert scale will be used as much as possible.

A well know disadvantage of questionnaires is the low rate of response in general. From earlier experience we expect a response rate of 20 to 30 percent (assuming several reminders to be sent out). All citizens in the implementation area will be addressed and asked to complete the questionnaires, i.e. we will not define a sample beforehand. We should also think about the central question that our target citizens would ask themselves: "what is in it for me?" There are a number of tools/measures to incentivize the completion and return rate of questionnaires, among which we consider:

- Award a present (e.g. an ipad) amongst the returned (and complete) questionnaires (only those who returned S1, S2 and S3). Or as an alternative, all citizens who completed and returned all surveys may get some small present.
- Hand-out in person a paper version of the questionnaire to those not responding to electronic form or without internet/email.
- Sending reminders to fill out and return the questionnaire.
- Keep the length of questionnaires limited.
- A letter of recommendation from the housing corporation (in several languages), or getting the support of local social workers, etc. may help to increase the response rate.
- Special attention need to be paid to citizens with different ethnical backgrounds who are not receptive to our request or don't understand it.

The respective municipalities will develop a strategy that accounts for these issues.

Frequency and timing of surveys

Basically, citizens will be asked to fill out a questionnaire three times during the project:

- S1: Survey before the start of the retrofit, when nothing has changed yet as a result of the project. The major aim is to determine the households' situation before the retrofit of their home and their expectations for their retrofitted home. Also, the characteristics of the households will be determined (demographic, housing and contextual data). Furthermore it will be important to know if they read and understand the information received about the refurbishment and energy measures. This also will determine their expectations.
- S2: Survey during the refurbishment. It is expected that in general the occupants will stay in their homes while the renovation of their house takes place. Presumably this has an impact on the citizens' wellbeing and attitude towards the project.

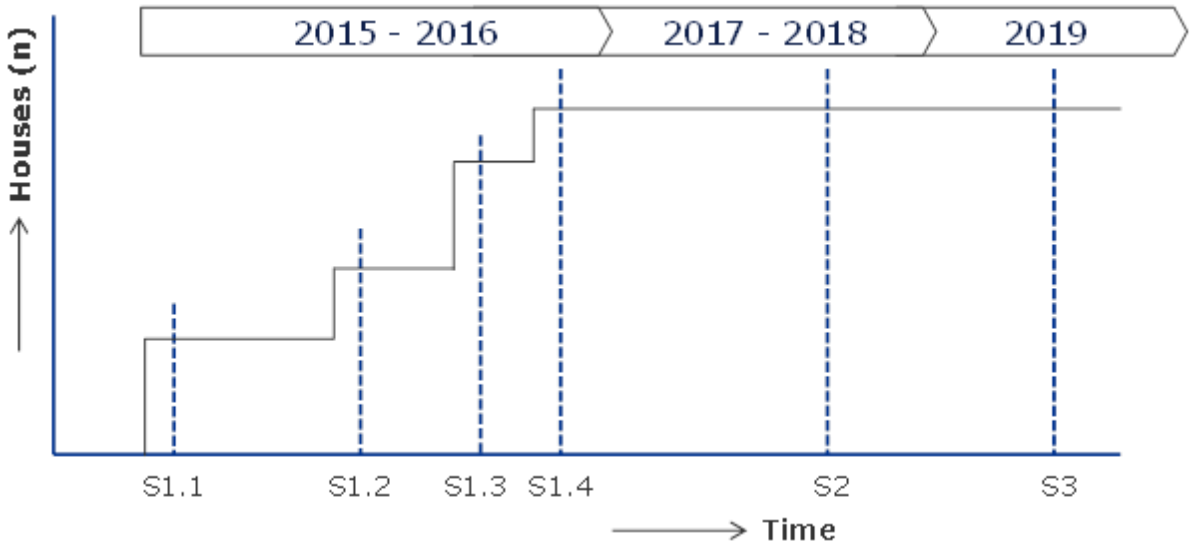
- S3: Survey after completion of the refurbishment.

In order to detect changes, all questions about the household characteristics (demographic, housing and contextual) will be repeated in S2 and S3. To detect impacts due to City-zen demonstrations, questions about attitude and behaviour will be asked again as well. The questions in S1 about expectations will be transformed into questions about satisfactions in S2 and S3. Finally, the questions about the information people received, their appreciation and their need for more information will be repeated.

Table 5 Data to be gathered per survey

S1	**S2**	**S3**
Household characteristics	Household characteristics	Household characteristics
Housing situation before refurbishment	Housing situation during refurbishment	Housing situation after refurbishment
Attitude towards energy	-	Attitude towards energy
Energy behaviour	-	Energy behaviour
Expectations of refurbishment, energy measures and City-zen project	-	-
Satisfaction with house before refurbishment	Satisfaction with house and specific measures during refurbishment	Satisfaction with refurbished house and energy measures
Evaluation of information provided	Evaluation of information provided	Evaluation of information provided
Need for (other) information	Need for (other) information	Need for (other) information

As the houses will not all be refurbished on the same date, surveys S1, S2 and S3 will be held at different times for different citizens (although in batches).



Distribution of surveys

The questionnaire(s) will be developed in English but should be translated into Dutch and French before distributing them to citizens. Moreover, completed questionnaires and input should be

translated back again into English for further analysis and comparison (only for open questions, which we try to minimize).

How to approach the citizens and target groups?

- In Amsterdam AIM is the responsible partner for distributing the questionnaires. AIM takes care of the communication with the citizens and may want to seek operational support from third parties (e.g. students). The questionnaires will be distributed together with a document from AIM and/or the housing corporation introducing the project and informing the citizen on plans and processes etc. For in-depth interviews and leading the focus groups TU Delft can support.
- In Grenoble ALEC (Energy Local Agency) would be the main local responsible for the questionnaires including the adaptation to the local context and coordination with the retrofitting actions (SPIRAL, Energy Positive Family Campaign, Mur-Mur).

Table 6 Summary of questionnaire-based survey per city and responsibilities

	Amsterdam	**Grenoble**
Prepare questions and questionnaire in English (S1)	AIM; TUD	MUNG; HESP
Translate questionnaire (S1)	Into Dutch: AIM; TUD	Into French: MUNG
Who distributes questionnaire	AIM	ALEC
How	Electronic, with support by local organisations in person	Electronic, web-based
# citizens to approach	Max 900	At least 100

4.3.2. Interviews and focus groups

To collect more in-depth information on specific parts of the project, both individual and group interviews will be held to collect qualitative data. Main target groups for interviews are

- Citizens and other participants taking part in a user/focus group (Amsterdam) or the Energy Positive Family Campaign (Grenoble).
- Other stakeholders, e.g. representatives of the energy supplier, grid company, housing corporation, municipality and installation companies(?). This may include representatives of City-zen project partners.

The questionnaires as developed for self-completion will be the basis for the interviews in the focus groups as well. However, up-front, the content and organisation of the interviews is to be determined, depending on the first results of survey S1.

CHAPTER 5 – Outline of questionnaire

The following provides an overview of questions that can be part of all questionnaires in the City-zen 'retrofitting to zero energy buildings' demonstrations. There will be room for specific questions related to city (Amsterdam / Grenoble) and (refurbishment) project, but those are not addressed below. In addition, the phrasing of the questions as well as the inclusion of the specific questions depend on the timing (S1, S2 or S3) of the survey are not considered below.

In the actual questionnaires sent out, it will be important to inform the respondent about the purpose of the survey, confidentiality of their answers, etc. Such items are not addressed here.

5.1. General information and socio-demographic characteristics

Housing/building characteristics will be collected from the housing corporations or owner-occupants. This includes for each home address:

- Zip code and house number
- Size of the home (m^2 gross floor area (GFA))
- Building type (RESID 1-G3 and NRESID according to the EUROSTAT classification)
- Age of the building. When was it built? (year)
- When was the last renovation of the building? (year)

Some information may be protected by the law. For example in France, the rules to be followed are explained in http://www.cnil.fr/english/. We will also ask whether the respondent is a tenant or owner-occupant. Since the majority of interviewees are tenants, the focus in the exemplary questions below is on social housing.

General questions, to be answered by the interviewee are given below. The questions, as well as the answers to pick from, should be translated to the relevant situation (e.g. in the Netherlands, the use of natural gas for heating is normally denoted in m^3 instead of kWh).

Please indicate your year of birth	Year
Are you male or female?	Male / Female
What is the highest level of completed education?	ISCED levels, translate to local situation
What is your nationality	
How many people live in your household?	No. children aged 0-18 yr: No. of adults aged 19 yr or older:
How high is the net monthly income of your household?	Use ranges to pick from
Does your household receive housing subsidies/ financial aid for housing costs?	Yes / no
Who is your landlord / housing corporation	
For how many years have you been living in your present home? OR When did you occupy your current home?	Use ranges to pick from Year
What type of heating system do you have for your house?	Gas heating Electrical heating

	District heating Other/ do not know
How high is the annual energy consumption in your household? Based on the latest bill	Electricity in kWh/yr Heating m^3/yr or kWh/yr Cooling
What are the annual energy costs in your household? Based on the latest bill	Electricity in €/yr Heating Cooling
Who is your electricity supplier?	Pick from drop down list of all possible suppliers?

The latter questions on energy consumption, the energy bill and energy supplier are potentially difficult to answer by the respondents. We could ask to have their latest energy bills available when filling out the questionnaire, but even that could be too difficult for some respondents. These questions are however important for identifying the baseline or starting point of the analysis. These questions will be addressed also in WP7.

5.2. CITY-ZEN QUESTIONS

For each criterion 1 to 6, the following tables provide examples of the questions and suggested answering options. Each table addresses a specific criterion. Note however that the actual questionnaires will probably use a different structure since the criteria should not be the concern of respondents.

Table 7 (1) Satisfaction and acceptance

	General	
	How satisfied are you with the following aspects of your home? ▪ Location ▪ Size and layout ▪ Rent / living cost ▪ Total energy cost ▪ Living comfort ▪ Indoor climate (temperature, moisture, draught, etc.) ▪ Neighbours ▪ Image of the neighbourhood ▪ Safety of the neighbourhood ▪ The house itself	5 point Likert scale: very satisfied – satisfied – neither satisfied nor dissatisfied – dissatisfied – very dissatisfied
	Do you (buy and) use the following items? ▪ Green electricity ▪ Energy saving light bulbs ▪ Electric (or hybrid) car ▪ Public transport ▪ Etc. (other items can be addressed here)	Yes/no/not applicable If applicable, how often: Never – sometimes – often – always – don't know.

	How much do the following statements apply to you[10] ▪ I pay attention to the energy friendliness of new appliances that I buy ▪ I leave electrical appliances like TV or personal computer on stand-by when not in use (e.g. at night) ▪ I lower the space heating at night ▪ I switch off the lights in unoccupied rooms ▪ I separate compost waste ▪ I separate chemical waste ▪ I look for ways to reuse things ▪ I encourage friends or family to recycle ▪ Etc.	5 point Likert scale: Never – sometimes – often – always – don't know
	To what extend do you agree with the following statements? ▪ I regard myself as an energy-conscious person ▪ I think using renewable energy is important ▪ My friends find using renewable energy important ▪ I feel obliged for future generations to use renewable energy ▪ It is good to be less dependent of energy companies ▪ When I use renewable energy, I am allowed to use more energy ▪ When I use renewable energy, this will benefit the environment ▪ Saving energy is important because it will benefit the environment ▪ Saving energy is important because it saves money ▪ I have a sustainable and environmental friendly lifestyle	5 point Likert scale: Totally disagree – disagree – don't agree nor disagree – agree – totally agree
	Rate each of the following items in response to the question.[11] "I am concerned about environmental problems because of the consequences for____." ▪ Plants ▪ Trees ▪ People in the community ▪ Me ▪ Marine life ▪ My lifestyle ▪ Humanity ▪ My future ▪ My health ▪ Whales ▪ Birds ▪ Future generations ▪ Children	

[10] Gatersleben, B., Steg, L., & Vlek, C. (2002). Measurement and Determinants of Environmentally Significant Consumer Behavior. Environment and Behavior, 34(3), 335-362; Schultz, P. W. & Zelezny, L. C. (1998). Values and proenvironmental behaviors: A five-country survey. Journal of Cross-Cultural Psychology, 29(4), 540-558.

[11] This addresses the environmental motives of people, see also Schultz, P. W. (2001). The structure of environmental concern: Concern for the self, other people, and the biosphere. Journal of Environmental Psychology, 21, 327–339.

	▪ Animals ▪ My prosperity	
	We would like to get your opinion on a wide range of environmental issues.[12] For each of the following statements please indicate the extent to which you agree or disagree. ▪ We are approaching the limit of the number of people the earth can support ▪ The balance of nature is very delicate and easily upset. ▪ Mankind was created to rule over the rest of nature ▪ When humans interfere with nature it often produces disastrous consequence ▪ Plants and animals exist primarily to be used by humans ▪ To maintain a healthy economy we will have to develop a "steady-state" economy where industrial growth is controlled ▪ Humans must live in harmony with nature in order to survive ▪ The earth is like a spaceship with only limited room and resources ▪ Humans need not adapt to the natural environment because they can remake it to suit their needs ▪ There are limits to growth beyond which our industrialized society cannot expand. ▪ Mankind is severely abusing the environment	5 point Likert scale: Totally disagree – disagree – don't agree nor disagree – agree – totally agree
1a	**City-zen measures**	
	How satisfied are you overall with the renovations?	5 point Likert scale
	How satisfied are you with the implementation of the technical measures? ▪ Glazing / Insulation ▪ Ventilation ▪ Heating system ▪ PV ▪ Solar thermal ▪ Lighting	If applicable: 5 point Likert scale: very satisfied – satisfied – neither satisfied nor dissatisfied – dissatisfied – very dissatisfied
	Please indicate how important each objective connected to the refurbishment is for you: ▪ Reduction of CO_2-emissions ▪ Improvement in comfort ▪ Energy savings ▪ Lowering the energy bill ▪ Increasing in market value of the building ▪ Improvement in indoor climate	5 point Likert scale: Very important – not important
1b	**Area, local involvement, social**	
	Place attachment to city or neighbourhood 'x'[13] ▪ I identify strongly with 'x' ▪ I am very attached to 'x'	5 point Likert scale: Totally disagree – disagree – don't agree

[12] Dunlap, R. E., & Van Liere, D. D. (1978). The new environmental paradigm: A proposed measuring instrument and preliminary results. Journal of Environmental Education, 9, 10-19.

[13] Derived from Williams, D. R., & Vaske, J. J. (2003). The Measurement of Place Attachment: Validity and Generalizability of a Psychometric Approach. Forest Science, 49(6), 830-840.

	▪ 'x' means a lot to me ▪ 'x' is the best place for what I like to do ▪ I get more satisfaction out of visiting 'x' than any other ▪ Doing what I do at 'x' is more important to me than doing it in any other place	nor disagree – agree – totally agree
	Social identity within a specified group[14], for example 'the neighbourhood ▪ I think my group has little to be proud of ▪ I have little respect for my group ▪ I would rather not tell that I belong to this group ▪ I identify with other members of my group ▪ I am like other members of my group ▪ I would like to continue working with my group ▪ I dislike being a member of my group ▪ I would rather belong to the other group ▪ I think I have sufficient qualities ▪ I generally feel like a failure ▪ I feel good about myself ▪ I am different from other people ▪ I feel like a unique person	5 point Likert scale
	Personal values[15] (In the final questionnaire the items should be ordered by number, so the value items will be mixed.) How much like you is the following described person? (male and female version) *Benevolence* 12. It's very important to him to help other people around him. He wants to care for other people. 18. It is important to him to be loyal to his friends. He wants to devote himself to people close to him. *Universalism* 3. He thinks it is important that every person in the world be treated equally. He wants justice for everybody, even for people he doesn't know. 8. It is important to him to listen to people who are different from him. Even when he disagrees with them, he still wants to understand them. 19. He strongly believes that people should care for nature. Looking after the environment is important to him. *Self-direction* 1. Thinking up new ideas and being creative is important to him. He likes to do things in his own original way. 11. It is important to him to make his own decisions about what he does. He likes to be free to plan and to choose activities for himself. *Stimulation*	6 point scale: Very much like me - like me - somewhat like me - a little like me - not like me - not like me at all

[14] Derived from Ellemers, N., Kortekaas, P., & Ouwerkerk, J. W. (1999). Self-categorisation, commitment to the group and group self-esteem as related but distinct aspects of social identity. European Journal of Social Psychology, 29, 371-389.

[15] Schwartz, S. H. (2012). An Overview of the Schwartz Theory of Basic Values. Online Readings in Psychology and Culture, 2(1). http://dx.doi.org/10.9707/2307-0919.1116

	6. He likes surprises and is always looking for new things to do. He thinks it is important to do lots of different things in life. 15. He looks for adventures and likes to take risks. He wants to have an exciting life. *Hedonism* 10. Having a good time is important to him. He likes to "spoil" himself. 21. He seeks every chance he can have to have fun. It is important to him to do things that give him pleasure. *Achievement* 4. It is very important to him to show his abilities. He wants people to admire what he does. 13. Being very successful is important to him. He likes to impress other people. *Power* 2. It is important to him to be rich. He wants to have a lot of money and expensive things. 17. It is important to him to be in charge and tell others what to do. He wants people to do what he says. *Security* 5. It is important to him to live in secure surroundings. He avoids anything that might endanger his safety. 14. It is very important to him that his country be safe from threats from within and without. He is concerned that social order be protected. *Conformity* 7. He believes that people should do what they're told. He thinks people should follow rules at all times, even when no one is watching. 16. It is important to him always to behave properly. He wants to avoid doing anything people would say is wrong. *Tradition* 9. He thinks it's important **not** to ask for more than what you have. He believes that people should be satisfied with what they have. 20. Religious belief is important to him. He tries hard to do what his religion requires.	
1c	**Degree of local involvement / citizens organised in local organisations**	
	Are you a member of a local organisation that is concerned with issues in your neighbourhood?	Yes/no; if yes, please indicate which organization and what its objectives are.
	Do you (also) actively take part in decision-making processes in such local organisations?	Yes/no; if yes, please explain your role
	Have you in any way been involved in the decisions / decision making process with respect to the renovations of your home?	Yes/no, if yes please indicate in what way

Table 8 (2) Information, knowledge and direct participation

2a	**Provision of information**	
	How satisfied are you with the information you received on the refurbishment / (technical) measures?	5 point Likert scale
	Do you feel more informed about energy topics after and because of the measures taken?	5 point Likert scale
	Have you been involved in the decision to refurbish your house and to take specific measures?	5 point Likert scale

Table 9 (3) Change in behaviour

3a	**Feedback systems**	
	Do you or your household take part in a feedback system on your energy consumption? (We should carefully explain 'feedback system'. This could mean use of smart meters, computerized monitoring of district heating use, manual monthly meter readings being reported, etc.)	Yes/no
3b	**Investment in energy efficiency**	
	How much money are you willing to invest in energy saving measures?	Amount per year
	What was your most recent energy-using purchase? Which energy label does it have? Would you purchase again with a similar label?	Open answer Choose from label range (or don't know) Yes/no(rather higher label)/no (rather lower label)
	Do you have a green electricity contract? Do you have a green gas contract? When did you last switch from electricity/gas supplier?	Yes/no/don't know Yes/no/don't know Year

Table 10 (4) Internal comfort level

4a	**Improvement in personal quality of life**	
	Please indicate how happy you are currently with the following items: ▪ Air quality in your home ▪ Temperature in your home ▪ Public open space ▪ Neighborhood noise (for example, street commotion, traffic, neighbors) ▪ General cleanliness (for example, trash, grime, smell, etc.)	5 point Likert scale

Table 11 (5) Economic-ecologic cost effectiveness

5a	**Reduction in fuel cost and consumption**	
	Energy bill already addressed in the general questions	
	Perception of effects on energy use and costs	

	How do you perceive the impact of the renovation measures on your ▪ Electricity bill ▪ Heating bill	5 point Likert scale

List of Tables

ANNEX A – LONG LIST OF CRITERIA

The socio-economic evaluation has four dimensions:

A. Social
B. Environmental
C. Economic
D. Household

These dimensions and the related long list of criteria are described below. Those criteria and indicators relevant for City-zen were selected in close communication with the project partners.

	Social and household dimension
A1 **D2**	**Degree of satisfaction with the City-zen measure(s)** How satisfied are citizens (and different stakeholders) with the measures they are affected by. This may include the refurbishment of their home, the application of a solar heating system, the implementation of district heating, energy checks, dissemination, etc.
A2 **D1**	**Improvement of demo-site acceptance / self-identification** To what degree do citizens identify with their local community, are they proud to live (and work) there, what is the districts' image and are they considering leaving their community.
A3	**Degree of local involvement / level of participation** How active are citizens, are they engaged in organisations, participate in community decision-making processes, hold shares of local renewable energy companies, try to take part in the project by changing certain habits, etc.
A4	**Degree of local social cohesion: pluralism and cultural values / educational opportunities / equality - gender and minorities / social inclusion** Everything related to equal opportunities in a community, independent from gender, origin, religion, etc. Show how the population in the area is put together and if and to which extent there are discriminations.
D3	**Information to citizens before, during and after refurbishment** If and to what extend were citizens informed. What were topics of the information campaigns (if any) or the kind of information material used. Do citizens feel well informed about the actions?
D4	**Energy checks and audits offered or conducted**
D5	**Citizens seeking energy advice or information** The number of households who requested information or advice of their own accord. It is an indicator of the level of pro-activeness of the citizens.
D6	**Participation in feedback-systems on consumption and renewables (metering); citizens understanding / using control instruments** Information about citizens taking part in any sort of feedback-system on their energy consumption is collected e.g. diaries, regular questionnaires on energy consumption, internet surveys, collecting energy bills, control instruments, etc. This criterion helps to assess whether citizens make use of (the results of) the feedback-systems and for example change their consumption behaviour. It also reviews whether citizens understand technical control instruments.
D7	**Citizens investing in energy efficiency measures** Whether citizens spend money on insulation, energy efficient equipment such as energy-saving appliances, or take further refurbishment measures in their homes, etc. It looks at proactive behaviour and indicates whether the project actions have had an impact on people's attitude.

D8	**Citizens organised in local agencies / tenants organisations** Information is collected on the number or percentage of citizens that are part of a local organisation that is concerned with local problems and issues. It shows how many actively take part in decision-making processes or are engaged in making the district a better place to live.
	Environmental dimension
B1	**Improvement of district quality of life and reduction of environmental pollution (air pollution and CO2)** Measures the improvement of the district quality of life in the districts/cities. Air quality and reduction of CO2 emissions are important. However, other possible aspects would include green spaces, pedestrian areas, appearance of the district, availability of different services like public transport, distance to these services, water and soil quality, noise levels, inconvenience because of odours, etc.
B2	**Improvement of indoor climate quality, health and comfort (personal quality of life)** Whether the indoor conditions have been improved. They can refer to the space available to each person, the air quality, materials used, the acoustic quality and the amount of daylight available, the temperature, etc. For City-zen the improvement according to the thermal refurbishment of buildings and the allocation of hot water, heating and electricity with more sustainable systems is vital.
B3	**Electricity / thermal consumption / balance** How much energy (electricity and thermal energy) is consumed by the citizens and where this energy comes from (source). Energy consumption could also be broken down according to various characteristics (households, companies, energy suppliers, public buildings, etc.) and to the sources (biomass, solar energy, hydropower, biogas, fossil fuels, etc.). The basis for this criterion is the technical monitoring and the indicators used for technical evaluation.
B4	**Sustainability criteria in tendering procedures for municipal land sales and new settlements** To show whether the municipalities use sustainability criteria when they sell land or establish new settlements and to what extent these criteria were used. Indirectly this criterion shows whether the municipality will develop in a more sustainable way in the future, as this influences which techniques, materials, etc. will be used for new buildings.
	Economic dimension
C1	**Economic viability and cost-effectiveness in relation to CO2-reduction** The cost-effectiveness of measures related to saved CO2 (€/avoided CO2). This method brings together the environmental and economic dimension. The costs of a project are connected with its main objective. In this case the costs of a project are compared to the CO2-reduction it affects.
C2	**Increase in local control of energy supply / local energy production** How much energy (electricity and thermal energy) was produced locally in the city (capacity of the power plants in the considered area), and how many inhabitants have access to this new energy infrastructure. Local production and supply of energy is an important factor for the security and independency of energy supply and for supporting decentralised paths. The basis for this criterion is also the technical monitoring and the indicators used for technical evaluation.
C3	**Reduction of fuel costs / consumption & lower energy (thermal / electricity) bills** Whether the measures to boost the share of renewable energy, to refurbish older buildings and build energy efficient new ones as well as the measures to increase the awareness had any effect on the energy bills of the citizens. Both lower consumption as well as lower fuel costs result in lower energy bills, which in turn creates satisfied customers.
C4	**Stimulation of local economy, incl. creation of local employment and services** There are many ways to measure economic growth. These are summarised with this particular

	criterion. Two sensible options, which are easily surveyed, are job and service creation. This criterion also refers to new business start-ups. Another way is to monitor revenues from business taxes.
C5	**Improvement of demo site (district) image / value, dwelling image / value and increased demand for new/refurbished flats** This criterion evaluates the success to make a district more liveable and appealing to citizens. It is assumed that by improving the district's image, more people may want to reside there. As a result, demand for flats and their prices may rise.
C6	**Changes in community demographics & community / neighbourhood growth** This criterion shows eventual increase in population and services in the district and how the population living there is put together according to age, income, education, nationality, etc. Moreover it refers to the ownership structure of the dwellings. A moderately growing flow of inhabitants and a balanced mixture of population ideally results in a liveable district with improved services and may positively influence neighbouring districts (spill overs).
C7	**Added value / profitability, internal rate of return (investor side)** Refers to common economic indicators which can also used in the cost-benefit analysis. The internal rate of return is the discount rate at which the net present value is 0. The net present value is defined as the monetary benefits minus the costs of a project.

ANNEX B – ADDENDUM DATA PROTOCOL

The Description of Work (DoW - dated 31 August 2014), task 8.1 requires the setting up of a data structure and analysis protocol. In fact the Social Monitoring Plan (SMP)[16] itself already provides for such protocol. In order to make the protocol more explicit, this condensed chapter is prepared. This data protocol only addresses the 'buildings' demonstration projects in City-zen, since the social aspects concentrate around these projects.

The building retrofit demo projects involve the installation of multiple measures to reduce energy use, with a focus on overall performance of the buildings and individual energy behaviour. Therefore, the protocol should capture the combined effect of the installed measures (including non-technical). We distinguish between two main groups of effects:

- Total savings, both in terms of energy and financial savings
- Behavioural / social effects

The savings realised can be derived from consumption data analysis where energy consumption is directly measured and/or by analysis of the bills (whether or not captured via the questionnaire). However, behavioural and social effects are derived from analysing the questionnaires filled out, complemented with e.g. interviews and focus group results. Ultimately, the effects on savings will have to be combined with the social effects.

Data hierarchy

The Cityzen social monitoring and questionnaire comes in four parts (compare with p.14 SMP):

1. General household, house, neighborhood: First, general data is collected on socio-demographic characteristics. This serves to put survey outcomes into perspective, e.g. enabling the aggregation of outcomes by gender, city, type of house, income level, etc., and as such to gain further understanding of a group of (building) occupants. In principle this data does not change due to the retrofit project and measures. However, sometimes the former occupants do not return after finalization of the retrofit and new occupants move in. The analysis will make the distinction between returning and new occupants.
2. Personal attitude and values: This data serves as a baseline for the occupant's personal attitude in life. Attitudes and opinions may change due to the retrofit project, and this will be monitored during the project.
3. Attitude on sustainability: Data is collected on the citizens' view on the environment and sustainability related to their home and neighborhood. Changes in sustainability attitudes will be monitored during the project, in particular in relation to changes in energy use.
4. Sustainable technologies (retrofit measures). Collects data on technologies implemented, measures taken, and the occupants' experience with the retrofit projects. Also energy use data is collected, which is monitored in combination with the retrofit measures during the project.

The graph below (Figure 1) provides an overview of the general structure of data capturing of the retrofit projects. The numbers correspond with those in the list above.

[16] Equivalent to project evaluation plan (PEP).

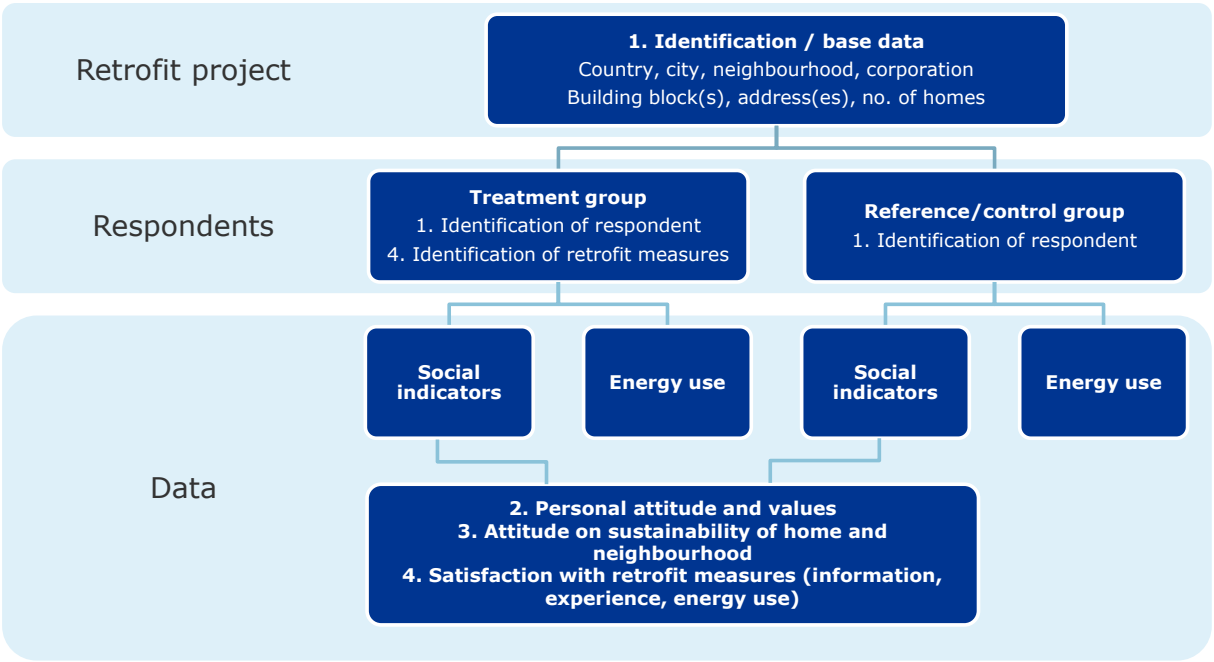


Figure 1 General data structure

Note that actual monitoring is undertaken by qualified specialists who bring the necessary expertise to the process. This protocol is not intended to substitute this.

Respondents: Specification of the reference group
Choosing the right reference group is important for successful data analysis. The goal is to measure the change in energy consumption and behavior from the pre-project period to the post-project period without including the effect of natural changes in consumption and behaviour not due to the project (exogenous changes). Exogenous changes may result for example from changes in fuel prices, general economic conditions, etc.

In order to isolate the project (treatment) effect and establish a causal link between the project and the effect, we strive to an approach, where the participants are assigned to one of two groups: a treatment group, where the project measures are implemented and a control group. The project related change is estimated as the difference between the treatment group pre-post difference and the control group pre-post difference. The latter control group pre-post difference represents only the exogenous change, while the treatment group pre-post difference represents the project-related change plus the exogenous change.

In WP8, the reference group (see SMP, section 3.3) will function as the control group. The reference group is designed to be as similar as possible to the treatment group during the pre-evaluation period, based on various characteristics such as geography, pre-project consumption levels, demographics (income, education), dwelling unit type, etc. In the terms of the graph on p.11 of the SMP, business as usual development represents the control group, whereas City-zen represents the treatment group. It has also been indicated in the SMP that it will probably be difficult to find a reference group providing sufficient data for the analysis.

Data analysis
Figure 2 provides and overview of the relationship between energy consumption and behavior and the City-zen retrofit measures (building characteristics) relevant in WP8. Energy consumption is

directly influenced by the use of various energy using system and appliances (e.g. heating systems, ventilation systems, airconditioning systems, electrical appliances, etc.) and by the use of space (e.g. number of rooms used, presence of people). Behavior may be affected or determined by factors such as building characteristics, household characteristics, perceptions, attitudes, values and beliefs. The figure also shows the direct relation between the retrofit measures (building characteristics) and energy consumption which is subject of study in WP7 and therefore disregarded here.

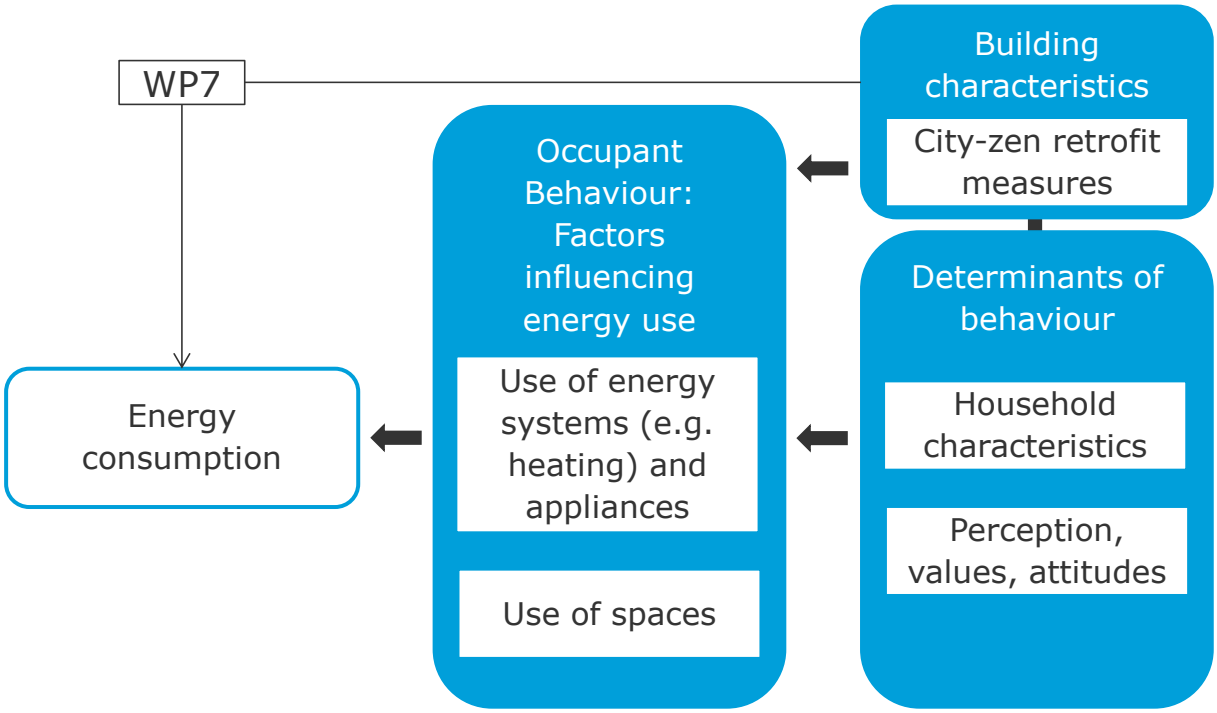


Figure 2 Relationship between energy consumption, retrofit measures and behaviour

For the interpretation of the collected data, the methodology for analysis is dependent on the type of questions chosen. Quantitative questions are interpreted by statistical methods, while open-ended question formats require a qualitative analysis.
Since the social monitoring questionnaire is designed such that primarily Likert scale (see SMP) answers are given, the social data can be analysed by statistical methods. In general terms, results need to be compiled by topic or question, which could then be presented in a series of graphs. Open ended answers need to be sorted by question and possible summarized. The data should then be put in context to sample size and sample composition (was there a good spread of participants/respondents?). Generalization of results is only feasible if the sample is representative for the local population.

Appendix: Background information, literature references

Retrofit measures and behaviour

Poortinga et al 2003 discuss a number of methodologies to find the relationship between energy consumption, retrofit measures and behaviour:

- Conjoint analysis: a technique to explain consumers' preferences in an indirect way; a decompositional method that estimates the structure of consumers'preferences. Preference of a particular stimulus/measure is built up by the separate contributions of different attributes.
- Analysis of variance anova: to examine whether various respondent groups differed in their acceptability ratings for the different types of (energy saving) measures.

Consumption data analysis (WP7)

Agnew and Goldberg (2013) distinguish between two general consumption data analysis approaches:

- The two-staged approach is recommended where there is a valid reference group and sufficient consumption data for each building in the analysis. In stage one of this approach, the weather-normalized annual consumption is estimated for each building based on longitudinal regressions. Then, in stage two, a cross-sectional analysis over all buildings is conducted.
- The pooled (fixed-effects) approach, combines all participants and time-intervals into a single analysis (time-series cross-sectional analysis or panel data analysis) because observations vary both across time and across buildings. This approach is particularly recommended when there is not a valid separate reference group or when the goal is to measure the average effect over multiple project years.

Both approaches assume regression analysis of the energy consumption data in relation to measures taken and characteristics of the participants, buildings and circumstances.

This consumption data protocol and evaluation method applies when all of the following conditions are met:

- The expected energy savings of the retrofit programs are expected to be significant statistically, given the natural variation in consumption and savings and the size of the projects.
- The baseline for determining energy savings is the condition of the building prior to the retrofits (and Cityzen measures).
- There is sufficient consumption data available for the participants (e.g. monthly energy use records), both before and after retrofitting.
- Consumption data is available for previous or subsequent participants in the same or equivalent retrofit project (in the same city or another city).

References:

- Ken Agnew and Mimi Goldberg for NREL. Chapter 8: Whole-building retrofit with consumption data analysis evaluation protocol. DNV KEMA, April 2013.
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- W. Poortinga, Linda Steg, Charles Vlek and Gerwin Wiersma. Household preferences for energy-saving measures: A conjoint analysis. Journal of Economic Psychology (2003) 24:49-64.