MONITORING AND EVALUATION

,

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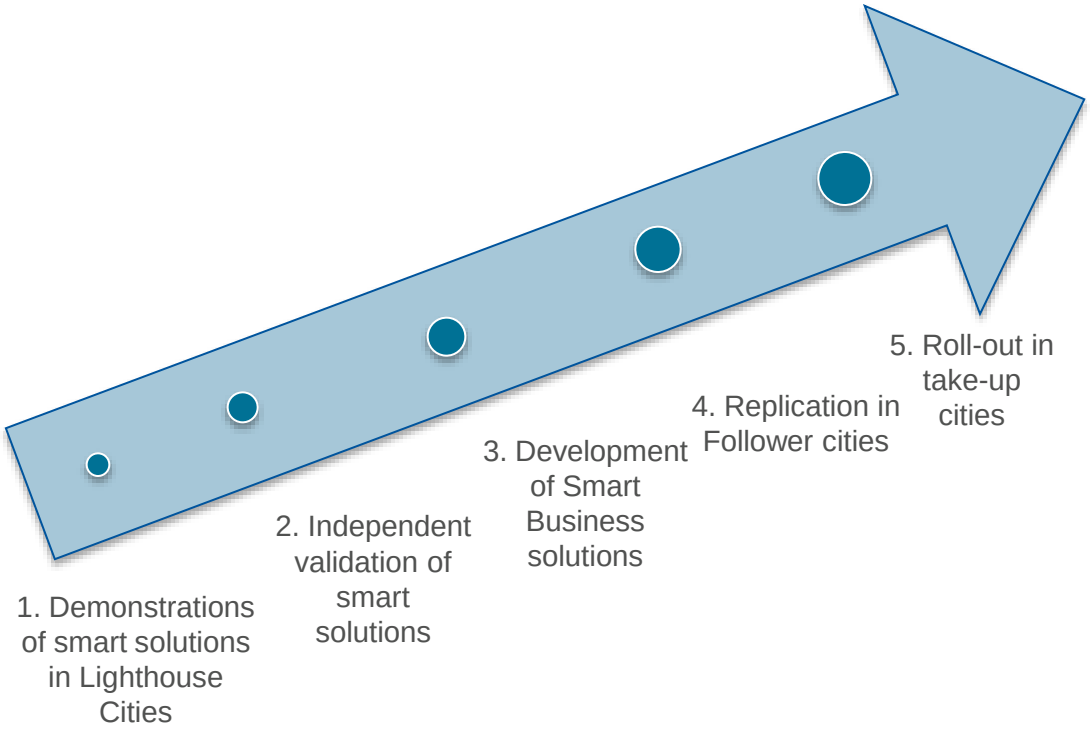
The GrowSmarter project

..aims to demonstrate, validate & market 12 smart solutions and thereby support the transition to a smarter, more sustainable Europe



12 smart solutions

..cover three areas: low energy districts, integrated infrastructure and urban mobility. They are designed to:

- reduce ecological footprint by reducing energy use and CO2 emissions
- improve the quality of life for the inhabitants in the city providing better dwellings, more reliable infrastructure & better mobility;
- help create growth in local enterprises that will help bring down unemployment and help improve the local economy;
- help save money for the municipality. This can be done by investing in smarter solutions to bring down operating costs.

12 smart solutions – low energy districts

Ways to create more energy efficient neighbourhoods...

1. Smart lighting, lampposts as hubs for communication
2. Efficient and smart climate shell refurbishment
3. Smart building logistics and alternative fuelled vehicles
4. Smart energy tenants though information

12 smart solutions – integrated infrastructure

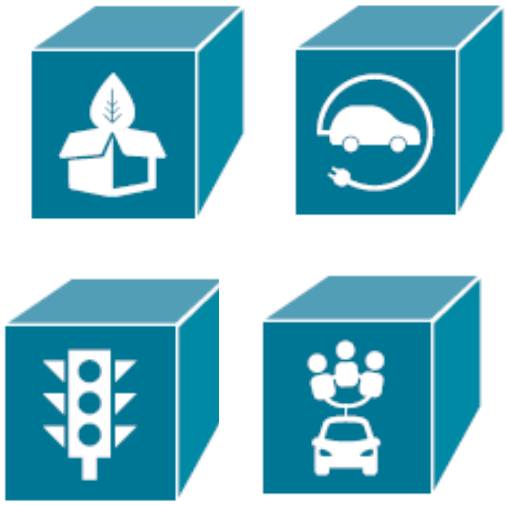
Ways of maximizing use of local energy through integrated infrastructure…

5. Smart local production of electricity and integration with buildings and grid
6. Waste heat integration by new business models
7. Smart waste collecting, turning waste to electricity, heat and biogas for vehicles
8. Use of ICT / Big data for saving energy and improving the quality of life

12 smart solutions – urban mobility

Ways to create a more sustainable urban environment…

9. Sustainable delivery
10. Smart traffic management
11. Alternative fuel driven vehicles for de-carbonising and better air quality
12. Smart mobility solutions



3 targets

…the 12 solutions are designed to meet the three pillars of sustainability: economic, social and environmental. As such it has set some tough targets:

- 1,500 jobs across Europe;
- aims to reduce energy usage by 60 percent;
- and cut EU transport emissions at project level by 60 percent.

Objectives of the evaluation and validation process

- *Assess the fulfillment of the targets of the GrowSmarter project.*

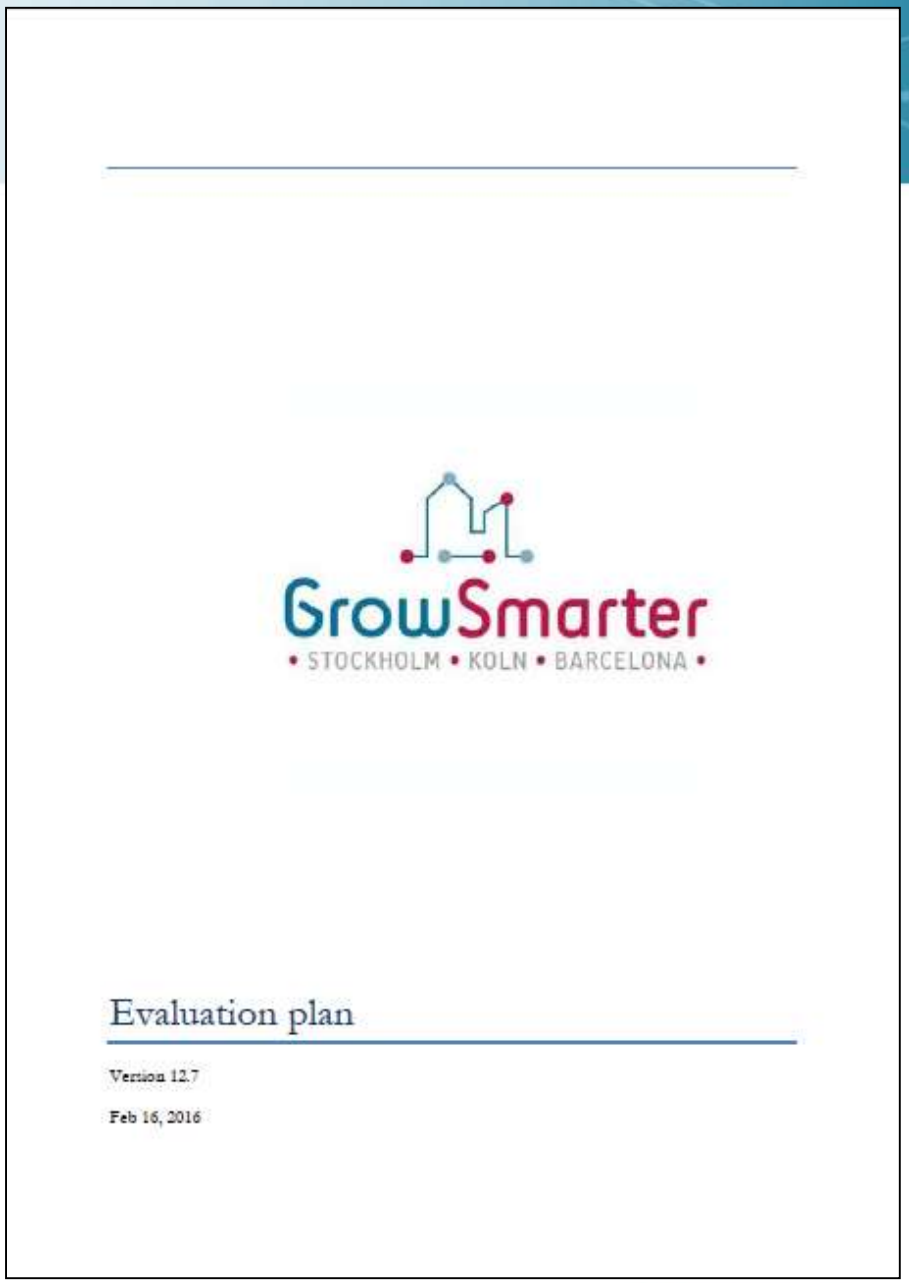
Objectives of the evaluation and validation process

Also:

- *Assess the vulnerability/robustness of the deployed smart city solutions, with specific focus on their cumulative effects on other resources, economics, and security of energy and transport service supply.*
- *Assess replicability of the implemented measures, including key success factors, impact of local specifics on success, key stakeholders to be involved, standardization and interoperability issues.*
- *Provide input for assessment of potential for wider market uptake of the implemented measures and pathways to upscaling*
- *Visualization and presentation of assessment results*

Evaluation plan

Defines the method of evaluation for each measure



Example from Evaluation Plan

3.2.2.2 Reducing hot water losses

Nr	Description	Responsible Evaluation Partner	Responsible Validation Partner
1.1.2	Reducing hot water losses	Skanska/ Stockholmshem	KTH-EGI,

Description of Measure

Poor insulation of the pipes in the hot water circulation have been overlooked for a long time and recent studies have shown that the heat losses can be in the range of 6-20kWh/m2(heated area) annually. In this measure the losses will be cut by 50 %. A new type of pipe in pipe hot water circulation pipe system will be used.

Intentions

1. Reduce heat losses from hot water circulation by 50 %

Definition of baseline and how it will be determined

1. Measure heat losses in hot water circulation as average over one year (kWh/h)

Specification of methodology for evaluation

1. Installation of flow meter and temperature sensors to make continuous measurements over one year.

Specification of quantifiable parameters to be measured/ monitored

1. Flow rate of circulated water should the measured together with temperature of the hot water supply and return. The data should be logged over one year for two reference buildings. Data should be average over one hour. Losses should be presented as average loss over one year (kWh/ h)

Specification of Key Performance Indicators to be determined

1. Hot water circulation loss factor (kWh/h)
2. Annual hot water circulation loss (kWh/m^2) (heated area of building).

Example from Evaluation Plan

3.2.2.3 Recovering waste water heat from the drain

Measure

Nr	Description	Responsible Evaluation Partner	Responsible Validation Partner
1.1.3	Recovering waste water heat from the drain	Skanska/ Stockholmshem	KTH-EGI,

Description of Measure

Recovering heat from the sewage system to preheat tap hot water is a new area for heat recovery with great potential. About 25 % of the energy for heating water will be saved.

Intentions

1. By installing waste heat recovery in the drain system 25% of the energy for heating domestic hot water (DHW) will be recovered.

Definition of baseline and how it will be determined

1. Measuring the heat used for DHW during one year, measuring heating energy required (kWh/ h).

Specification of methodology for evaluation

1. Installation of flow meter and temperature sensors to make continuous measurements over one year.
2. Installation of measurement equipment to determine heat recovered by the heat recovery unit.

Specification of quantifiable parameters to be monitored

1. Energy meter measuring water flow rate and temperature of the supply DHW leaving the heating unit, and the incoming cold water mains, sampling interval one hour
2. Energy meter measuring the amount of recovered heat using energy meters measuring water temperature before and after the heat recovery unit, and the corresponding flow rate, sampling interval one hour.
3. Temperature of supplied DHW to building and temperature of incoming water mains, sampling interval one hour.

Specification of Key Performance Indicators to be determined

1. DHW heating demand (kWh/h) during one year.
2. Temperatures (°C) of the delivered DHW.
3. Temperatures (°C) of the incoming water mains.

Some measures evaluated by questionnaires

Q	Environmental perceptions	Strongly Agree (5)				Strongly Disagree (1)
		5	4	3	2	1
1	I am concerned when I think about the environmental conditions that our children and grandchildren probably will face.					
2	Politicians are still doing too little for environmental protection.					
3	The major part of the population is still behaving little environmentally aware.					
4	If we go on acting as until today, we are facing an environmental disaster.					
5	When I read articles or watch television programs about environmental problems I am often shocked and become angry.					
6	There are limits to growth that the industrialized world already has exceeded or is going to exceed very soon.					

Q	Energy perceptions	Strongly Agree (5)				Strongly Disagree (1)
		5	4	3	2	1
1	I think using renewable energy is important					
2	My friends think that using renewable energy important					
3	I feel obliged for future generations to use renewable energy sources					
4	It is good to be less dependent of the energy companies					
5	When I use renewable energy, I am allowed to use more energy					
6	When I use renewable energy, this will benefit the environment					
7	Saving energy is important because it will benefit the environment					
6	Saving energy is important because it saves money					

GrowSmarter Travel Survey

F1

How long *in total* do you travel between home and work during a typical week (preferably last week)?
State the number of days per week for the main forms of transportation you use and the kilometres travelled with each transport mode (NOTE! BOTH WAYS).

(Example: If you travel to work 5 days a week by car, write the number 5 in the row "Car". If you travel 2 days a week by car and 3 days a week with public transport, write 2 in the "Car" row and 3 in the "Public transport" row).

	# days	# km
Car (as driver)		
Car (as passenger)		
Car sharing		
Park-and-ride (car) and public transport		
Public transport		
Long-distance train (+ connection)		
Long-distance bus		
Motorcycle/moped full distance		
Cycle full distance		
Walk full distance		
Other		
Total		

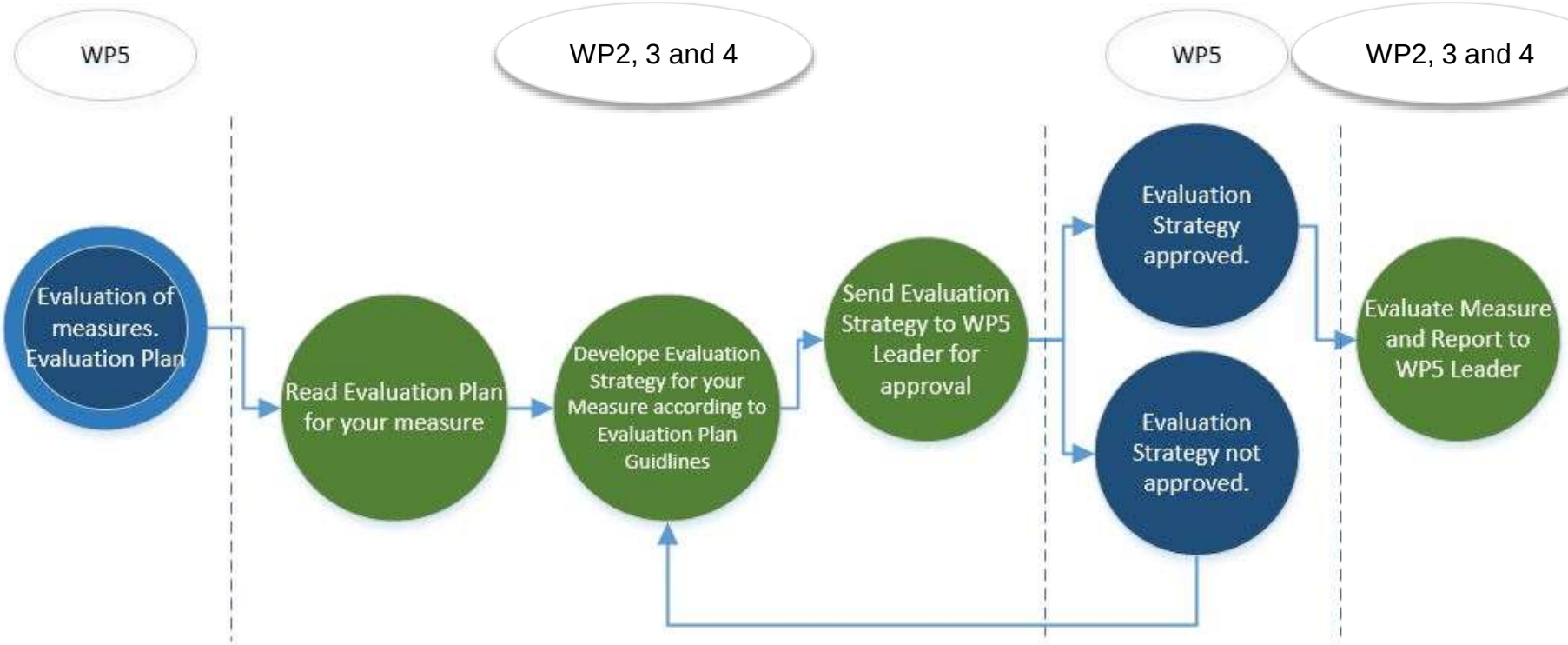
Transport

Table 1a. Stockholm baseline parameters per travel mode per year

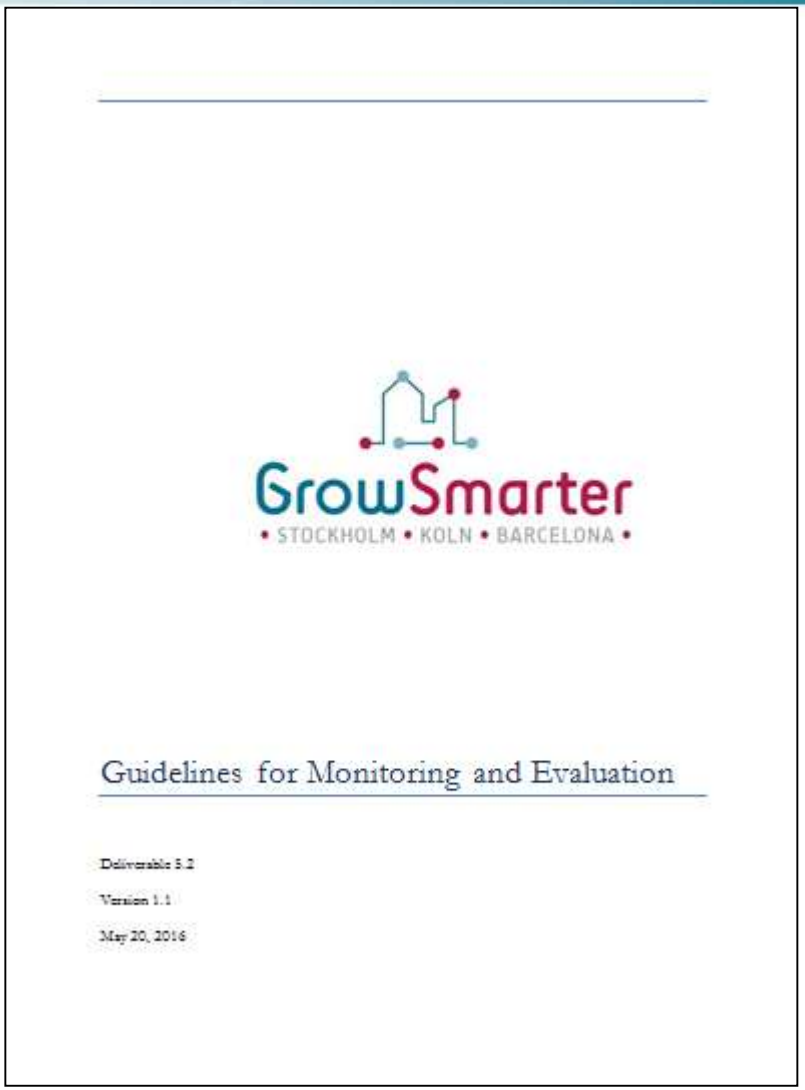
Site specific baseline parameters	Car (driver)	Car (passenger)	Car sharing	Park and Ride	Public Transport
Number of trips per travel mode					
Number of kilometers per travel mode					
Emissions per vehicle kilometer					
kWh per vehicle kilometer					
Emissions per person kilometer					
kWh per person kilometer					

Site specific baseline parameters	Train	Bus	MC/Moped	Bike	Walk
Number of trips per travel mode					
Number of kilometers per travel mode					
Emissions per vehicle kilometer					
kWh per vehicle kilometer					
Emissions per person kilometer					
kWh per person kilometer					

The evaluation and validation process



"… each partner responsible for any of the Measures is expected to develop a detailed evaluation methodology based on the guidelines in the Evaluation Plan. It is the task of WP5 to give support in this process, and the present document is a description of how this support is intended to be supplied."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Guidelines for Monitoring and Evaluation

Deliverable 5.2

Version 1.1

May 20, 2016

Distribution of work *[from the GA]*

Task 4.3 - Monitoring and Evaluation

Each implemented measure will be monitored for a minimum of 2 years. Gathered data (D4.3 and D4.5) will be used to evaluate innovation potential, theoretical vs practical energy savings, user acceptance and real investment costs, etc. The results will be main input to WP 5 where the data will be analyzed on a global project level and further validate the measures from technical, economic and social perspectives. The WP 5 leader will provide instructions prior implementation on data gathering format and monitoring methods to be used at each site to achieve comparable data from the measures. In addition, all demonstration partners will set up special quality systems to make sure the implementation is made with all care and precision possible. The results from the monitoring and evaluation will be compiled into a deliverable from each measure.

Distribution of work *[from the GA]*

Task 5.2 – Coordination of monitoring and evaluation activities

Following the Evaluation Plan, the WP5's team provides training sessions for the Local Evaluation Managers on monitoring and evaluation framework and methodology for measures on Low energy districts (WP2), Integrated infrastructures (WP3) and Sustainable urban mobility (WP4). During implementation stage, the WP's team will provide necessary guidance, quality control, eventual trouble shooting and other support to the local evaluation teams (D5.2).

The WP 5 leader is responsible for this task and will coordinate work in cooperation with the WP 2-4 leaders.

SUMMARY

For each measure an evaluation procedure is defined in the Evaluation Plan

For each measure:

- **Establish a baseline**
- **Evaluate through measurement/interview/questionnaire**
- **Determine KPIs**


Stockholms
stad


Stadt Köln


Ajuntament de
Barcelona


I·C·L·E·I
Local
Governments
for Sustainability


KTH


IESE
Business School
University of Navarra


GRAZ


tm
Transport Malta


Porto.


Comhairle Cathrach Chorcaí
Cork City Council


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Parking is fun


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AGT
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