IRIS

Integrated and Replicable Solutions for Co-Creation in Sustainable Cities

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A Roadmap for replication of activities

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Disclaimer

Executive Summary

The present document is the Deliverable D8.1 entitled as “A Roadmap for replication of activities” for the IRIS project. The deliverable is related to the task T8.1 “Replication activities planning and roadmap creation”. In task T8.1 all lighthouse cities and follower cities in the IRIS project will create a common roadmap together, to be able to plan replication of activities, both for expansion of activities of LHs to other regions, and for FCs to develop a replication plan based on their own specific experience, local conditions and best practices. The roadmap presented in this document will guide replication actions, both for LH cities, and FCs in the IRIS project.

The replication plans that the follower cities are going to create with the help of this roadmap will summarize replication of activities for demonstration plans and post-project replication with a Gantt chart and a Work Breakdown Structure (WBS), as well as a schedule per task, responsible partner related subtasks, related deliverables, and dependencies on other tasks. Report will focus on removing obstacles to investment, providing visibility and technical assistance to investment and replication in additional areas and making smarter use of new and existing financial resources.

This report is the main document in guiding FCs to produce replication plans and to move forward step by step in the process of replicating the integrated solutions demonstrated by the lighthouse cities in the IRIS project.

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List of Abbreviations and Acronyms

Abbreviation	Definition
API	Application Programming Interface
BIM	Building Information Model
DSO	Distribution System Operator
CIP	City Innovation Platform
CPB	Consortium Plenary Board
DHS	District Heating System
EIP-SCC	The European Innovation Partnership on Smart Cities and Communities
EMS	Energy Management System
ESCO	Energy service company
EU	European Union
FC	Follower City
FIWARE	A curated framework of open source platform components to accelerate the development of Smart Solutions
ICT	Information and Communication Technologies
IS	Integrated Solution
KPI	Key Performance Indicator
LHC	Lighthouse City
RES	Renewable Energy System
ROI	Return on Investment
SC	Smart City
SCIS	The Smart Cities Information System
SCC1	Smart Cities and Communities lighthouse projects
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TG	Task Group
TSO	Transmission System Operator
TT	Transition Track
USEF	Universal Smart Energy Framework
WP	Work Package

1. Introduction

IRIS replication definition and vision:

The dictionary definition of replication is to copy something exactly as it is, however in a smart city perspective this would be a narrow techno-economic perspective that would be rather impossible to achieve, this according to research carried out by SCIS (Vandevyvere, Why may replication (not) be happening - Recommendations on EU R&I and regulatory policies, 2018). That is why the IRIS project defines replication with a wider approach to include also other dimensions, as smart city solutions rarely are a simple product or service, but rather complex urban interventions involving several different parties, technologies, business models, governance structures and time-schedules. The definition of the IRIS project focuses more on the journey of the city in their transition in different areas regarding smart city solutions.

The IRIS definition of replication is not to copy something exactly as it is, but instead to inspire the follower cities to take up solutions demonstrated within the five IRIS Transition Tracks that will help them in their transition areas. A successful replication within the IRIS project is achieved when a follower city has planned implementation of and investment for a locally adapted solution based on one of the demonstrations carried out within the IRIS project.

The vision of the IRIS project is for all follower cities to have a replication plan with activities for implementing the solutions inspired by the demonstrations carried out by the lighthouse cities, and for 30 city members of the EU smart cities networks to have plans/planning in progress for a similar smart city strategy, and lessons learned from the demonstrations of IRIS Innovative solutions adopted by at least 20 other cities.

Replication activities so far:

Replication activities in the IRIS project, during the first two years (M1 – M25), have included investigations of results from other smart city projects, reports and findings from organisations involved in smart city activities, arranging and participating in different replication events together with both lighthouse and follower cities from within the IRIS project but also with other lighthouse projects. The results from all these activities have formed the base and information upon which this roadmap has been created.

Replication workshops have been arranged, to the present date 12/2019, in Gothenburg, Nice and Vaasa within the IRIS project. Replication workshops in which the IRIS project has participated have been arranged in Stavanger, San Sebastian, Tampere and Oulu.

The target groups for this deliverable are:

Primary target group: IRIS follower cities, for the purpose of being able to replicate the integrated solutions in the IRIS project, and to be equipped to know about what kind of support can be expected, who to contact and where to find it, within the IRIS project and in other European smart city initiatives.

Secondary target group: IRIS lighthouse cities, for the purpose of knowing how to support FCs in their replication activities and planning, and also themselves learn from the needs of the FCs.

Secondary target group: Cities outside the IRIS project, cities that are LHCs and FCs in other projects within the Smart Cities & Communities programme, for the purpose of learning about the replication process, methods and tools used in the IRIS project.

1.1. Scope, objectives and expected impact

The main objective of this deliverable is to provide a roadmap for replication actions carried out by LHCs and FCs. By following the step-by-step structure of the roadmap, and using the tools provided for each step, follower cities will be able to create their individual replication plans and carry out the process of implementing replication of chosen LH demonstrated solutions.

The secondary objectives of this deliverable are:

- To guide FC to prioritize the replication solutions.
- To guide FC in making a list of risks and a possible mitigation plan during replication activities.
- To guide FC in making a post-replication/implementation KPIs monitoring plan.

The expected impact of this deliverable is that all replication activities performed by LH or FC shall be better prepared and carried out; the replicated projects can be faster implemented, with lower risks and leading to higher impact on the city level.

The deliverable will focus on removing obstacles to investment, providing visibility and technical assistance to investment and replication in additional areas and making smarter use of new and existing financial resources.

1.2. Contributions of partners

All LHCs and FCs will contribute to the implementation of the common roadmap. The LHCs will focus on the follow up and documentation of their demonstrations and provide insights into details regarding upscaling of pre-pilots and the processes entailed in doing so. The FCs will focus on their needs for being able to replicate the demonstrated solutions, and create the roadmap based on the identified areas where input is needed for the process of replication.

1.3. Relation to other activities

Table 1 depicts the relation of D8.1 to other activities (deliverables) developed within the IRIS project.

Table 1 Relation of D8.1 with other activities (deliverables)

Number	Title	Relation
D1.2 – D1.6 (M9)	Requirements & Specs of TTs Solutions	Input used from specifications and requirements from pre-pilots for planning replication activities for FCs

D1.7 (M12)	Transition Strategy – Commissioning Plan	Input from frameworks used for replication activities planning setup and roadmap creation
D1.7 (M12)	Transition Strategy – Commissioning Plan	Input from methodologies and guidelines used for preparing planning of FCs replication activities
D2.1 (M60)	Lessons learnt though cooperation with other Lighthouse projects	Input from lessons learnt on barriers and drivers used for setting up planning of replication activities and the creation of a common roadmap, and FCs individual replication plans
D2.2 (M60)	Report on improvement of existing standards/ interoperability issues of ICT	Input from best practices and guidelines used for roadmap creation and planning of replication activities
D2.3 (M60)	Recommendations for KPIs based on CITYKEYS and SCIS	Input from best practices, guidelines, barriers and drivers on planning of replication activities and creation of roadmap
D3.1 (M48)	Learnings from innovative business model adaptation tool	Input for IS business models during replication implementation in FCs
D3.2 (M24)	Sustainable Business Model Dash-board tool	Input for IS business models during replication implementation in FCs
D3.7 (M24)	Financing solutions for cities and city suppliers	Input for IS funding options for FCs during replication design phase
D3.8 (M24)	IRIS exploitation plan and operations	Input for FC replication
D4.2 (M6)	Functional & technical requirements for integrated, interoperable and open solutions, standards and new business models	Input for business models for replication of integrated solutions
D4.4 (M12)	Document with technical solution reference architecture for CIP-components	Input for understanding solution reference architecture
D5.1 (M12)	Report on baseline, ambition & barriers for Utrecht lighthouse interventions	Input for the evaluation of what is being done in the demonstrations in Utrecht
D5.2 (M12)	Planning of Utrecht integration and demonstration activities	Input for the evaluation of how the IS are being carried out in Utrecht
D5.3 – D5.7 (M24)	Launch of Transition Tracks activities (Utrecht)	Input with information needed for identification and evaluation of IS to be chosen by replicators

D6.1 (M12)	Report on baseline, ambition & barriers for Nice lighthouse interventions	Input for the evaluation of what is being done in the demonstrations in Utrecht
D6.2 (M12)	Planning of Nice integration and demonstration activities	Input for the evaluation of how the IS are being carried out in Utrecht
D6.3 – D5.7 (M24)	Launch of Transition Tracks activities (Nice)	Input with information needed for identification and evaluation of IS to be chosen by replicators
D7.1 (M12)	Report on baseline, ambition & barriers for Gothenburg lighthouse interventions	Input for the evaluation of what is being done in the demonstrations in Utrecht
D7.2 (M12)	Planning of Gothenburg integration and demonstration activities	Input for the evaluation of how the IS are being carried out in Utrecht
D7.3 – D5.7 (M24)	Launch of Transition Tracks activities (Gothenburg)	Input with information needed for identification and evaluation of IS to be chosen by replicators
D9.2 (M8)	Report on monitoring and evaluation schemes for integrated solutions	Input for verification of suitable IS for replication by FCs
D9.5 (M24)	Report on monitoring framework in LH cities and established baseline	Input for verification of suitable IS for replication by FCs
D9.6 (M38)	Intermediate report after one year of measurement	Input for verification of suitable IS for replication by FCs

1.4. Structure of the deliverable

This deliverable focuses on the process description that the replication roadmap is for the follower cities in the IRIS project, and also other districts within the LH cities. Chapter one describes the purpose and structure of the deliverable and the context to which it belongs, information about the WP and specific related deliverables. Chapter two gives an overview of the methodology that has been applied when creating this document. The Replication Roadmap process description begins in chapter three and constitutes the mayor part of the deliverable. The structure of the roadmap is arranged in a chronological order, with the start being the beginning of the process for replication by the follower cities in the project. Following this deliverable in a chronological order should help the follower cities in the process of carrying out successful replication projects.

An overview of the structure of the roadmap showing the steps in the replication process for the follower cities:

Baseline and challenges

1. Identify Follower city needs, challenges and prioritization

Vision & ambition

2. Identify, evaluate and choose IRIS Integrated Solutions for identified transition needs
3. Create working groups for chosen Transition Tracks and Integrated Solutions
4. Map similar integrated solutions in other national smart city projects

Implementation

5. Plan knowledge exchange actions
6. Plan capacity building actions
7. Design integrated solution and adapt to local circumstances
8. Use adapted business model and map funding options
9. Create and finalize city IRIS replication plan
10. Integrate user involvement and Citizen Engagement
11. Identify barriers and risks, and how to solve them
12. Implement

Monitoring

13. Monitor implemented projects using KPIs

Steps in the process may be added, modified or skipped depending on the situation in the city aiming for replication.

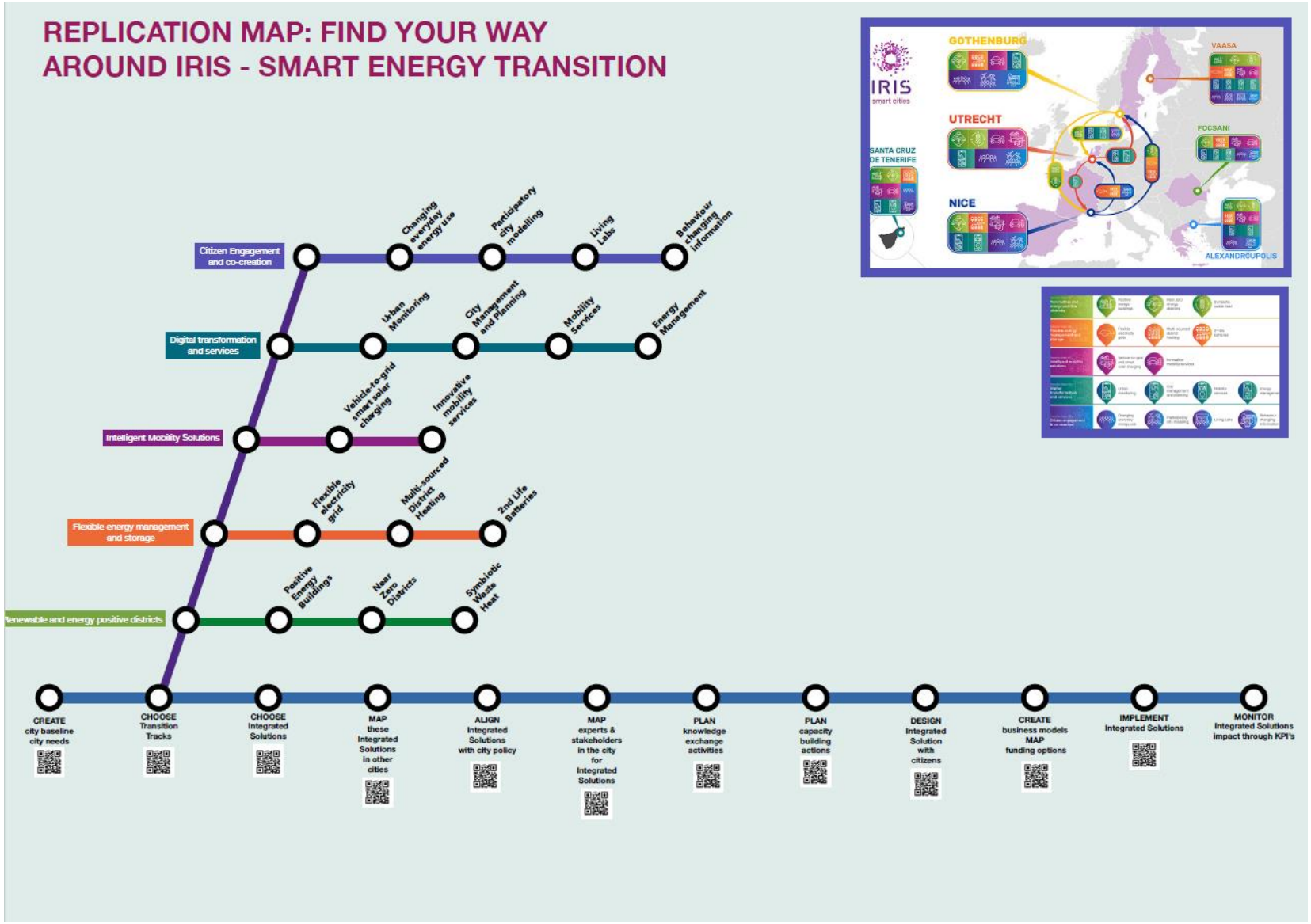

Figure 1 Replication Map: Find your way around IRIS - Smart Energy Transition

2. Methodology

This deliverable is part of IRIS **WP 8: Replication by Lighthouse regions, Follower cities, European market uptake**, and it is related to **T8.1 Replication activities planning and roadmap creation**. Deliverable **D8.1 A Roadmap for replication of activities** provides an overview of the replication process and guides FCs in creating a replication plan with activities for implementation of the solutions, inspired by the demonstrations carried out within IRIS.

The roadmap is created through communication and workshops with all the project partners involved in IRIS and through research done regarding replication activities in the 14 SCC01 Lighthouse.

During the process of creating the roadmap, the IRIS project has also worked together with the EU Smart Cities Information System (SCIS), and the Marketplace of the European Innovation Partnership on Smart Cities and Communities (EIP-SCC, notably Action Cluster Integrated Planning), as well as the SCC01 Collaboration Framework's Task Group on Replication.

2.1. Lessons learned from other SCC01 Lighthouse projects and related initiatives

2.1.1. Other SCC01 Lighthouse projects

Other SCC01 Lighthouse projects' approaches to replication have been taken into consideration and evaluated in order to learn as much as possible from others, and avoid doing things already done elsewhere. Other SCC01 Lighthouse projects active during the creation of this report are: REMOURBAN, Grow Smarter, Triangulum, Sharing Cities, SmartEnCity, Smarter Together, REPLICATE, RUGGEDISED, mySMARTLife, MAtchUP, STARDUST, +CityxChange, and MAKING-CITY.

In the IRIS project five transition tracks are addressed;

1. Renewables and energy positive districts
2. Flexible energy management and storage
3. Intelligent mobility solutions
4. Digital transformation and services
5. Citizen engagement and co-creation

All of these transition tracks can be identified in other SCC01 Lighthouse projects, and SCIS is actively mapping all of the areas where actions are being taken within the projects. Most of the solutions in the SCC01 Lighthouse projects fit into three categories: Energy, Mobility & Transport and ICT.

For the first lighthouse projects (Growsmarter, Triangulum and Remourban) replication was not a focus in the same way as it is in newer lighthouse projects. Because of this, examples of other roadmaps and replication tools were hard to come by. While the newer Lighthouse projects had not yet produced much material that could be reviewed. However some of the projects had some high quality results regarding replication that was of great use when creating the roadmap for the IRIS project.

National network meetings also floated to the surface as valuable sources of information and inspiration when Vaasa attended a meeting in Tampere where all the cities involved in lighthouse projects in Finland gathered for exchange of experiences (Helsinki, Tampere, Oulu, Vaasa and Kerava).

2.1.2. SCC01-related initiatives

During the planning phase of the IRIS replication roadmap two follower cities (Vaasa and Santa Cruz de Tenerife) acted as test beds for the Smart City Guidance Package created by the EIP-SCC (J. Borsboom-van Beurden, 2019), these test-runs proved to be very valuable in the creation of the roadmap.

Partners in the IRIS project has also been actively involved in the SCC Replication Task Group and especially followed the work being done by SCIS and the publications they have produced. The most interesting publication during the creation of the IRIS roadmap has been the Solution Booklets on E-buses (Vandevyvere, *E-Bus Solution Booklet*, 2019), Urban Freight Logistics *(Vandevyvere, Solution Booklet Urban Freight Logistics*, 2019) and Batteries and PV (Vandevyvere, Solution Booklet Batteries and PV, 2019), and the publications *Why may replication (not) be happening - Recommendations on EU R&I* (Vandevyvere, Why may replication (not) be happening - Recommendations on EU R&I and regulatory policies, 2018) *and regulatory policies* and *The making of a smart city: replication and scale-up of innovation in Europe* (Jorge Nunez Ferrer, 2017).

2.1.3. Lessons learned, do's and don'ts in replication

The communication and workshops with other SCC01 Lighthouse projects and related initiatives showed do's and don'ts in replication. The following four main factors were identified that undermine replication:

- too specific solutions which are difficult to adapt to local cases;

- not enough information available regarding the demonstrations;

- local stakeholders are preferred to those in the project, and

- similar funding options not available for those who are trying to replicate.

More specifically, amongst the things to do:

- Use icons, figures and schemes
- Clear problem statements
- Be to the point at all times
- Always provide info on next steps
- Make the process stages visually clear
- Provide links for more information
- List benefits
- Always lift most relevant information
- Keep documents short
- Straightforward contact details
- Honest and realistic regarding implementation challenges
- Basic information about implemented projects needs to be available in English

And amongst things to not do:

- Unclear distinction between challenge and solution
- Use of vague language
- Too long and poorly structured output
- Inclusion of irrelevant content
- Bad layouts
- Trying to create results too early in the project
- Not creating summaries

In general, communication seems to be a challenge in most SCC01 Lighthouse projects. Finding good ways to communicate the progress of the project and the demonstrations is important to the success of the projects.

One good point made by the SCIS is to focus on the city journey: understanding of the process of becoming a smart city and how to get there, instead of focusing too much on technical details, even though they also are very important.

2.2. Lessons learnt from the IRIS Follower cities

After a short introduction to the Follower cities in the IRIS projects, an overview is provided on how they have worked together in the project during workshops held in the CPB meetings in the IRIS project.

2.2.1. Introduction to the Follower cities

VAASA

Vaasa is the largest economical center in Vaasa region which consist of seven municipalities in the northwest of Finland. The Vaasa region is in first place in Finland due to its strengths in innovation, work productivity, employment rate and high level of education. Vaasa Region is therefore one of most economically vital, successful and international areas in Finland. The City of Vaasa has 67.600 inhabitants, and is rapidly growing. Population has grown with almost 9.000 inhabitants since 2000. The population of Vaasa region is about 114.000. In addition, within 120 km distance there are over 500.000 inhabitants with 55.000 university students. In proportion to the population, Vaasa is also the largest University city in Finland. Vaasa Region has over 140 private enterprises which operate in the energy cluster (www.energyvaasa.fi). Those companies employ over 10.000 employees from which about 1000 work with R&D. The turnover of the energy cluster is about 4.4 M€ with export value of 3,5 M€ which covers 80 % of export of the energy cluster of Finland, and is the largest energy technology cluster in the Nordics. The R&D investment volumes are extremely high in the Vaasa region, especially in private companies. In 2014 the total amount was over 194 million euros, of which over 161 million was from private companies. Only Helsinki region has more R&D investments in Finland.

ALEXANDROUPOLIS

The city of Alexandroupolis is the administrative center of the Regional Unit of Evros, of Region of East Macedonia-Thrace and is of extremely strategic importance for Greece, due to its geographical position

near the border with Turkey, since it constitutes an interconnection gate between the Mediterranean and the Asian countries. Local authorities' vision for the city is to transform Alexandroupolis into a sustainable city for its citizens with the use of new, efficient and user-friendly technologies and services in the areas of energy, transport and ICT. At the same time, Alexandroupolis has the ambition to become an internationally recognized hub of innovation, where the utilization of scientific knowledge for the development and the production of innovative technologies, products and services with a marked impact on sustainable economic growth will take place. Alexandroupoli's local authorities are committed in implementing a number of activities as part of the urban plans of the city that already exist (Urban Plan compiled for the Covenant of Mayors, Sustainable Urban Mobility Plan and others) and integrate buildings planning, energy networks, ICT, transport/mobility planning and other additional issues. Alexandroupolis is an active member of Covenant of Mayors initiative and co-founder of the Greek Green Cities Network.

SANTA CRUZ DE TENERIFE

The city of Santa Cruz de Tenerife is the shared capital (with Las Palmas de G.C.) of the Autonomous Community of Canary Islands of around 206,000 citizens, the southernmost autonomous community of Spain.It is of strategic importance for Spain, due to its geographical position since it constitutes an interconnection gate between Europe and Africa, and Europe and Latin America. The strategic plan of the city pursues to transform Santa Cruz into a more sustainable and economically active city for its people with the use of new, efficient and user-friendly technologies and services in the areas of energy, transport and ICT. In addition, Santa Cruz de Tenerife has the determination to become an internationally recognized attraction hub of high standard of well living for professionals from all over the world, thanks to its high connectivity, great technological development and its well know quality of life. Santa Cruz de Tenerife local authorities are committed in implementing a number of activities as part of the urban plans of the city that already exist (Urban Plan compiled for the Covenant of Mayors, Sustainable Urban Mobility Plan and others) and integrate buildings planning, energy networks, ICT, transport/mobility planning and other additional issues. Santa Cruz de Tenerife is a member of Covenant of Mayors and member of the Spanish Smart Cities Network. Until today, Santa Cruz de Tenerife has implemented and is planning to implement significant mobility projects that have already enhanced the quality of mobility in the city by means of investing in electrical tramlines powered by RES. Therefore, Santa Cruz de Tenerife can play a role as a committed partner of Lighthouse project (follower city) in order to implement innovative measures and actions that are fully in line with the political ambitions and strategies.

FOCSANI

Focșani is a medium sized city in Romania, and the capital of Vrancea County. Focsani city is situated at the border between Moldova and Muntenia historical regions of Romania. The city is crossed by the railway corridor no.9 (Helsinki - Moscow - Chișinău -Bucharest - Plovdiv) and, in the future, by road corridor no.1 (Tallinn - Warsaw - Bucharest - Cernăuți). Focșani city needs to react both to its local internal cross-sectorial challenges and to the external pressure related to the economic disparities between western and eastern European countries, recently more influenced by the geopolitical context with our neighbour Moldova and Ukraine. Focșani is committed to become a smart and sustainable urban centre, starting from efficiently tackling all local issues (economic, social, administrative, environmental etc.) through an integrated innovative approach. Together with its citizens, the key stakeholders and urban utilities' providers, the municipality is focused on: increasing buildings' energy efficiency and the living standards; mitigating CO2 footprint by reducing primary energy resources consumption and

implementing adequate RES, in areas of interest with no DHS; developing an eco-smart public transport, efficiently managed and monitored; implementing an ICT decision-based management tool in order to develop a transparent and efficient public administration process; securing its citizens' safety and enhancing their level of knowledge, awareness and engagement; maintaining a low unemployment rate by increasing the economic potential of the city (SME development; attracting foreign investment; tourism).The Municipality gained experience in running several investment projects financed by Pre-accession and Structural Funds, and is therefore well-prepared to submit new project proposals for the next period.

2.2.2. Cooperation between IRIS FCs so far

During the CPB in Gothenburg (March 2018) the LHCs and FCs worked with the questions on how the cities in the project will prepare for replication, how the replications are supposed to be carried out, and how the project can benefit from information regarding barriers from other SCC01 Lighthouse projects. During the workshop the project partners worked on the most important steps in the replication process, which solutions were closest to go from demonstration to replication, and on what tools would be needed in a toolbox for replication.

The results and outcome from the workshop in Gothenburg showed that there was a common understanding in the project with all partners regarding what should be done.

Regarding what steps are the most important in the replication process the workshop in Gothenburg concluded the following:

- Regulatory framework, incentives and barriers
- Need for effective information sharing
- Financial resources
- Demonstration activities needs to be documented thoroughly
- Reference materials needed
- Understanding the context in which demonstration is done
- Business model needs to be part of the documentation for scalability, profitability, sustainability
- Business model canvas
- Training activities
- Knowledge transfer and competence building

Regarding which solutions that were identified as being the closest to go from demonstration to replication process, the workshop in Gothenburg concluded the following:

- Managing heat, cooling solutions systems
- City innovation platform to improve services
- District cooling
- E-mobility
- Low temperature district heating
- Zero energy buildings

Regarding what would be needed in a toolbox for replication the workshop in Gothenburg concluded the following:

- Business models for the integrated solutions demonstrated
- All essential information needed for successful replication activities
- Reference material to standards used in the demonstrations
- Eliminate the need to start from scratch

During the CPB meeting in Nice (October 2018) the FCs presented their replication interest, and which integrated solutions being demonstrated in the IRIS project they were most interested in that they were following most closely. The FCs also presented the barriers and challenges that they had identified, and what they needed from the LHCs at that stage.

Demonstrations that were most interesting for the FCs were:

- Multi-sourced district heating
- Positive energy buildings
- Near zero energy districts
- Vehicle-to-grid and smart solar charging
- Mobility services
- Urban monitoring
- City management and planning

Challenges and barriers for replication that the FCs identified:

- Technical
- Legal
- Financial
- Social
- Environmental
- Decision making criteria
- Communication
- Knowledge transfer
- Business models
- Citizen engagement
- Energy poverty

Needs presented by the FCs for the LHCs:

- Efficient and effective knowledge transfer
- Information regarding the demonstrations
- Lessons learned from implementation of demonstrations
- Description of decision-making process, stakeholder involvement, citizen's engagement
- Technical information and calculations regarding demonstrated solutions
- Cost-benefit information on demonstrated solutions
- Business models and incentives
- Operating and maintenance costs of solutions

The workshop held in Nice worked with the definition, expectations, structure and content of the roadmap and toolbox under work, and to define the steps to be taken in the process of creating them.

Regarding the roadmap the following results were achieved during the workshop in Nice:

Definition: The roadmap is the most general guideline for the replication part of the IRIS project, it is a guiding principle base for replication and a guiding document to let cities replicate the demonstrations from the LHCs.

Expectation: The roadmap is a description of the replication process working as a checklist of activities for successful replication.

Structure: The roadmap should be structured as a road to the replication plan that is to be done by the FCs in the IRIS project.

Based on the results from the workshop in Nice a working group was established and called the IRIS replication core group and was made up of the partners with the most resources for the creation of the roadmap. This core group worked with the structure, content and finalization of the roadmap for replication activities in the IRIS project.

Next steps: Creation of a work group that will draft the roadmap and tune it will all project partners.

In the workshop held in Vaasa, the FCs presented what they had done regarding replication activities since the start of the IRIS project. The structure for the roadmap was presented and during the workshop the project partners worked with the structure and suggested alterations and changes that could be done before starting the work on the content of the roadmap. The structure in the roadmap that is this deliverable comes as a result from the workshop held in Vaasa.

After the workshop during the CPB in Vaasa (June 2019) the replication core group created the first draft of the roadmap for replication activities, which was then distributed to all project partners in the project that were working with replication related tasks for input and comments. In this way the roadmap for replication activities in the IRIS project was created.

2.3. Lessons learnt from the IRIS LHCs

In the first draft of the deliverable *D2.1: Lessons learnt through cooperation with other Lighthouse projects* there is a first preliminary overview of identified barriers and drivers for all the transition tracks in the LHCs in the IRIS project. Following is an excerpt from the deliverable D2.1.

2.3.1. Barriers and drivers in renewables and energy positive districts

Social housing refurbishment: barriers

> **In citizen engagement** (LHC Utrecht). It took time and quite some effort (up to one-to-one conversations) in Utrecht to get 70% of the tenants of the apartment buildings to agree with refurbishment of their flat, while 70% agreement is needed legally for a housing corporation in NL to be allowed to start this kind of renovation.

Wall insolation decreased the living area of the house (LHC Gothenburg). Tenant saves energy but gets less, very valuable, living area in return. **Solution**: have other technology / material that does not thicken the walls At time of writing this solution is not agreed upon.

Social housing refurbishment: drivers

Model house in the demonstration area for showcasing refurbishment: insulation, solar panels, energy management systems in the house, and hybrid heating solutions (LHC Utrecht). This helps citizens to understand the change, gain trust, and agree with refurbishment of their home.

District Energy Management System: barriers

National regulation prohibits sharing of electricity and connecting 2nd life batteries in one housing block (LHC Utrecht). Suppliers and consumers of renewable energy in one housing block cannot be connected. Change of this national regulation is postponed to 2023.

2.3.2. Barriers and drivers in flexible energy management and storage

Open local electricity trading platform: barriers

The Universal Smart Energy Framework (USEF) works on international deployment and valorisation of local flexibility in energy supply and demand through home EMSs and district EMSs for reducing grid stress and curtailment in the electrical grid, in the form of a local electricity trading platform. The sum of contracted flexibility can be the starting point for aggregators to activate flexibility as a solution to grid stress. Aggregators can contact the Balance Responsible Party and the Distribution System Operator to find a good balance between self-consumption and delivery to the net, and ensure an optimal business case for the consumers. Further development of the open electricity trading platform USEF aims for European deployment, focusing on aspects of standardization and interoperability, legislation and local culture. December 2018 there was substantial international interest in USEF for implementation of parts of USEF. However, broader adoption is currently slow due to:

Pending new regulations (LHC Utrecht)**.**

Investment is considered too high risk in this specific market (LHC Utrecht).

Open local electricity trading platform: drivers

Publication of European guidelines (LHC Utrecht). The USEF organization contributed in 2019 actively to guidelines that will be published in 2019 by the EU Task group EG3.

2nd life batteries: barriers

Low cost of 2nd life batteries (LHC Gothenburg). Volvo provides RB with plenty of 2nd life automotive (bus) batteries for free, because GOT is their test lab. Impact: no delays. Replication: depends on local presence of large automotive industry (is not the case in Utrecht, e-cars are owned by Renault).

Location requirements of 2nd life batteries (LHC Utrecht). The second-life batteries (300KW) in Utrecht had to be placed outside of buildings, as it was perceived as too dangerous and technically not possible to have them inside, e.g. in garages (not even with the floor reinforced). Outside means more expensive, which will affect the business model.

2.3.3. Barriers and drivers in intelligent mobility solutions

Smart charging of electric vehicles: barriers

The PWC report Smart charging of electric vehicles: institutional bottlenecks and possible solutions (PWC, 2018), commissioned by several IRIS partners together with other stakeholders, is a relevant and valuable base for description of barriers and drivers encountered in IRIS. The report describes 23 institutional bottlenecks and possible solutions, 7 of which are considered key barriers. The report has been shared in 2018 by WP2 with three other Lighthouse projects, as well as with Energy Cities, the EIP-SCC Action Cluster Mobility coordination, and the SCIS. Also, a questionnaire was sent to stakeholders in Europe in the framework of the Innovation Deal on Electric Vehicles to assess and upscale the outcomes and recommendations of the report. The outcomes of the questionnaire were presented at EVS32 in Lyon.

Uncertain depreciation cost of batteries (LHC Gothenburg). It is unclear how charging and discharging between rides negatively impacts the lifetime of batteries. Impact: possibly increases cost or even availability of resources, thus viability of the solution.

Co-creation can be at odds with planning (LHC Gothenburg). Due to the co-creation process with residents, the number and location of smart charging poles are demand-driven, which causes some delay.

Difficulties in organization of charging the shared electric cars around charging stations (LHC Nice). **Solution**: charging control platform?

Research needed on number of e-cars needed to avoid having to strengthen the grid (LHC Utrecht).

Smart charging of electric vehicles: drivers

App, based on urban data platform, developed to reduce traffic that is searching for a free charging pole (LHC Utrecht). The app combines charging pole parking space occupation data with charging pole data.

Mature technology of bidirectional charging of shared e-vehicles (LHC Utrecht). Utrecht has now (2019) a city-wide network of 18 solar charging poles and shared e-cars (Renault Zoe) that can be charged and discharged bidirectional (AC 15118). Worldwide unique to regroup three technological innovations (solar charging, bidirectional charging, and shared e-cars), making the city-wide charging system operational. Result of close cooperation between local authority and companies. Impact: free-floating batteries result in better air quality due to e-vehicles, shared cars result in less cars in the streets, and bidirectional charging ecosystem results in lower mobility and energy costs for people. **Communication and dissemination driver**: LHC Utrecht had the Dutch king officially open the smart charging ecosystem in Utrecht.

Electric busses: barrier

Insufficient political support to get citizens out of private cars into public transportation e.g. by tax and/or traffic regulations (LHC Gothenburg).

Mobility as a Service app: driver

EC2B mobility as a service app successfully engages citizens to use other forms of transportation than private cars, thus decreasing the need for parking places (LHC Gothenburg). **Specific success factors**: focus group to design the service, end-users testing the service beforehand. Of households approached, 50% accepted personal visit of mobility consultant. One week after app-launch already 50% membership on car-sharing service.

2.3.4. Barriers and drivers in digital transformation and services

Urban data platform: barriers

Availability of data (LHC Gothenburg). Certain data of real estate (BIM) and traffic companies are not available for data service development (APIs) by third parties. Impact: hinders development of energy/mobility data services. Concerns mostly data that the company does not want to share for competitive reasons (FR: some of the data requested are used in stock exchange). **Solution** could include: connect data with specific objectives, provisions in procurement when possible, level of detail of data asked for, and/or provide something (e.g. data) in return?

Lack of information/knowledge how to implement a CIP. Solution: information on technical infrastructure?

Lack of information/knowledge how to use CIP to develop new services and businesses. How to build and manage new relationships between cities and companies? **Solution**: involvement of entrepreneurial schools for better understanding of local opportunities, exchange of lessons learnt with other LH projects. Solution may also be in the TG Data, esp. the CoP for Developers mid-June 2019 in Brussels and follow-up, including discussion about IP, e.g. publish everything on Github or not everything? Stakeholders should be more aware of their role in the value chain: how to decide what is in it for them, and why?

Lack of information/knowledge how open data can be used, what roles there are in data trade and processing, and how value can be added (LHC Gothenburg). **Solution**: modular access to data sets, packages of data?

Not all needed FIWARE components are available yet; to provide a 'package' more components are needed. **Solution**: find equivalent component free of charge?

Urban data platform: drivers

International collaboration on reference architecture and data models (LHCs Utrecht, Gothenburg and Nice). In 2018, all three IRIS Lighthouse cities joined the newly established TMForum / FIWARE Foundation Frontrunner Program, a collaboration to support the adoption of a reference architecture and compatible common data models that underpin a digital market of interoperable and replicable solutions for smart cities. This standardization makes it easier for cities to access and use data.

2.3.5. Barriers and drivers in citizen engagement and co-creation

Citizen engagement: barriers

Getting tenants of social housing properly informed about and agree with refurbishment of their home

In Nice language and cultural barriers played a part among non-native residents. It is not easy to speak about the solutions in terms citizens, especially non-native residents, can relate to. It does not help if it is unclear if / how cost-savings will be passed on to the tenants. Sometimes technical installations are damaged by tenants.

In Utrecht it took time and quite some effort (up to one-to-one conversations) for the housing corporation to get 70% of the tenants of the apartment buildings to agree with refurbishment of their flat, while 70% agreement is needed legally for a housing corporation in NL to be allowed to start this kind of renovation.

In Alexandroupolis, there are many house owners, therefore we should focus on public administrative buildings for energy efficient measures and renewable energy sources.

In Santa Cruz de Tenerife, it proved difficult to explain the change to citizens of different ages, educational level etc. **Solution:** link with project CONRED which promotes intercultural living and participative democracy from the perspective of diversity.

Co-creation can be at odds with planning (LHC Utrecht). Due to the co-creation process with residents, the number and location of smart charging poles are demand-driven, which causes some delay in the implementation.

Insufficient insight into why citizens do not use the available public transport (LHC Gothenburg).

Citizens are not always able to present their preference in co-creation of housing situations, and/or citizens do not see what participation could mean for them (FC Vaasa)**.**

Citizens do not see the problem and oppose solutions (FC Focsani). After 1998, everyone bought a car. This caused traffic jams and parking problems. 1998-2012 was the time of citizen engagement, but after 2012 city council lost interest and policies became more top-down again. Now citizens oppose solutions. **Solution**: we need to regain the trust of the citizens by bringing together the plans of the city with the ideas of citizens, in long lasting campaign (4 years), coordinated by external company, with funding of city council.

Citizen engagement: drivers

Model house in the demonstration area for showcasing refurbishment: insolation, solar panels, energy management systems in the house, and hybrid heating solutions (LHC Utrecht). This helps citizens to understand the change, gain trust, and agree with refurbishment of their home.

Solutions in the educational systems of youth (10-12 years old): Minecraft (LHC Gothenburg). Establishing new contacts and practices in the educational system?

Involve professional schools in the demonstration district (LHC Utrecht).

2.3.6. Barriers and drivers in the process of plan development

Barriers

Unclear for Follower cities how to select solutions from Lighthouse cities (FCs Alexandoupolis and Vaasa). Local stakeholders find it difficult to select the best solutions: what are decision criteria for selecting the best (energy) solutions for the area? Follower cities need clear and simple (technological) descriptions of solutions, including figures on costs.

Unclear how to plan the whole process (FCs Vaasa and Alexandroupolis). When should we start doing what? How to get technical, legal, financial, and social acceptance? It takes a long time to get decisions from the municipality, get financing, and then do the tendering. Impact: risk for replication plan. Solutions mentioned: develop a smart city vision for the area, engage stakeholders from the beginning, have information available on decision criteria for selecting (energy) solutions for a specific area, link with other running Lighthouse projects.

Implementation strategies of regional partners are fragmented and not well connected (LHC Gothenburg). **Solution**: smart city solutions implementation coordinator per city / region.

Drivers

Publication 'The making of the IRIS Utrecht demonstration' (LHC Utrecht). To provide inside in and guidance on how to develop an implementation plan around specific solutions with local stakeholders, Utrecht interviewed the coordinator of the making of the IRIS Utrecht demonstration, Carolien van Hemel, director of the Utrecht Sustainability Institute (part of Utrecht University) and Inge van de Klundert, senior policy advisor Energy of the Municipality Utrecht. The report of the interview has received very positive feedback from Vaasa Fellow city and others. Plan is to continue the interviews with the coordinators of the making of the Gothenburg and Nice demonstrations, and with the coordinator of the making of the City Information Platform demonstration.

2.4. Towards a Roadmap in steps and tools

In the deliverable **D8.3 Replication tool box** a complete list of all available tools can be found.

In **D8.1 A Roadmap for replication of activities** you will find the replication process described in steps, with useful tools mentioned for each step of the process.

Based on the lessons learnt from FCs and LHCs (2.2, 2.3), the Roadmap is structured around 13 steps in the replication process, with tools supporting each step. By following the step-by-step process, and using the tools, FCs will be able to create their individual replication plan and carry out the process of implementation of chosen integrated, locally adapted solutions.

The 13 steps are:

1. Identify Follower city needs, challenges, and stakeholders
2. Identify, evaluate and choose IRIS Integrated Solutions for identified transition needs
3. Create working groups for chosen Transition Tracks and Integrated Solutions
4. Map similar integrated solutions in other national smart city projects
5. Plan knowledge exchange actions
6. Plan capacity building actions
7. Design integrated solutions adapted to local circumstances

8. Use adapted business model and map funding options
9. Create FC implementation plan
10. Involve users and engage citizens
11. Identify barriers and risks, and how to address them
12. Implement
13. Monitor

In the IRIS project the LHCs have concluded that citizen engagement is an important parallel process and not just a stage in the process. Because of the importance of citizen engagement for the replication process the user of this Roadmap is advised to have a look at section 3.11 (User involvement and Citizen Engagement) and interpret that section as a parallel process to be considered with every step in the replication process.

3. Roadmap

This section provides a step-by-step structure for the process of replication.

3.1. Identify Follower city needs, challenges and prioritization

In order to successfully replicate and scale-up the proposed solutions, a detailed baseline research for the cities should be conducted. Management structure, city governance and information, summary of city strategies and visions are key for a strong roadmap for replication activities ((Alliance for Internet of Things Innovation (AIOTI) WG08 – Smart Cities, 2018), (Ferrer, Taranic, Veum, Van den Oosterkamp, & Wilson, 2017), (GrowSmarter Project EU, 2015), (REMOURBAN Project EU, 2016), (SharingCities Project EU, 2016), (SmartEnCity Project EU, 2017), (mySMARTLife Project EU, 2017)). In fact, this stage is critical for providing a proper and substantial roadmap for replication actions. The baseline research constitutes of defining and in depth describing:

- City, user, and citizens' needs (3.1.1),
- Local context (3.1.2)
- Relevant stakeholders (3.1.4)
- Risks (3.1.2)
- Prioritization of replication activities

The Municipality has a certain number of major domains of activity. All Municipality's activity can be usually divided into the following six directions ((Albino, Berardi, & Dangelico, 2015), (EIB Institute , 2017)).

SMART GOVERNANCE - Smart Government makes use of available technology to be aware of -and coordinate with the activities carried out by other municipalities, achieve synergies through collaborations with other stakeholders and reach out citizens needs in order to improve both, public services, and confidence in the public institutions.

SMART ECONOMY - An urban economy is a Smart Economy when the sector gathers innovation and productivity to adapt to the market and workers' needs to enhance new business models and a resilient global model for competing both locally and globally.

SMART MOBILITY - Smart Mobility pursues to offer the most efficient, clean and equitable transport network for people, goods and data. It leverages the available technologies to gather and provide information to users, planners and transport managers, allowing the reshaping of urban mobility patterns, of planning mechanisms and the enhancement of multimodality by improving the coordination and integration of different transportation modes.

SMART ENVIRONMENT - Smart Environment uses data collection from utility networks, users, and air, water, and other city resources in order to establish main areas of action in urban planning and city infrastructure planning as well as to inform urban services managers to achieve a more efficient and sustainable urban environment while improving the citizens' quality of life.

SMART PEOPLE - A Smart City needs citizens' involvement in order to implement different projects. Citizens involvement can lead to new solutions and creative solutions, innovation and diversity. Education appears as the main tool to improve this dimension, as well as initiatives to retain creative profiles.

SMART LIVING - As a conclusion, Smart Living is considered the wise management of facilities, public spaces and services using ICT technologies to put focus on improving accessibility, on flexibility of uses, and on getting closer to the citizens´ needs.

Based on these directions of action the Municipality can plan a strategy for development towards a smart and sustainable city. The strategy shall include projects in different areas/domains and these projects can be based on the five IRIS Transition Tracks.

1. Transition Track #1: Smart renewable and closed-loop energy positive districts.
2. Transition Track #2: Smart Energy Management and Storage for Grid Flexibility.
3. Transition Track #3: Smart e-Mobility Sector.
4. Transition Track #4: City Innovation Platform (CIP).
5. Transition Track #5: Citizen engagement and Co-creation.

The Municipality's strategy for smart and sustainable development should include and analyse the following major issues:

- Identify and analyse city transition needs in different areas/domains. This can include the identification of different city sectors that need improvement (e.g. transportation, energy, buildings, etc.) and different city areas that has greater need for improvement compared to other districts. This action can be done based on IRIS Transition Tracks and all IRIS experience and available information for knowledge exchange. If there are any specific problems in a certain city area or activity domain that need to be urgently addressed, then these issues should have a priority.
- Based on city transition needs there should be set several goals regarding city development. These goals should include both development of a certain city area and/or a city activity or domain. Achieving these goals should lead to sustainable and smart city development.
- The strategy should include all the information regarding different funding sources. These sources should include local, regional or national funding programs, as well as different EU funding opportunities.
- The analysis of regional, national and EU regulation. This analysis can lead to overcoming certain obstacles, reducing certain risks for city development / projects implementation and to finding new opportunities for project financing.

3.1.1. Transition needs per IRIS Transition Track per Follower city

For a replication roadmap it is important to start with assessment of the city needs and better understand the demand, the strategy and vision in the cities. The result of this action should prioritize the transition tracks and solutions per city. City managers should identify which are their city's main needs and how important the different needs are. Each city team should identify if there is lack of already implemented infrastructure or they want to improve in one domain.

In Figure 2 smart city needs and challenges are presented, following the structure of the five IRIS Transition Tracks.

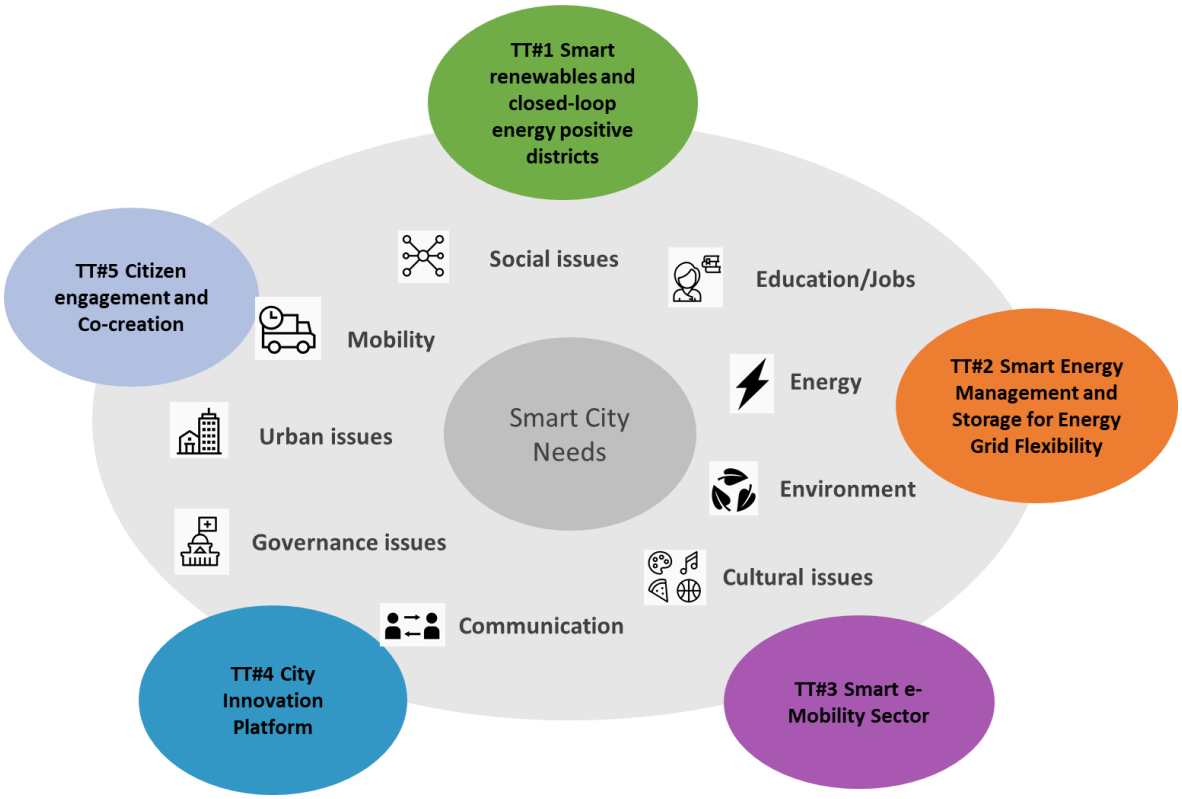

Figure 2 Smart City Needs and Challenges

City needs for innovation may vary for each Transition Track identified in the IRIS project and depending on the solution. In *D3.2 Sustainable Business Model Dash-board tool* weaknesses and strengths of the LHCs are described in view of capturing the opportunities of replication from the LHs to the FCs. FCs could get both insights and a benchmark from D3.2 on the replicability of IS from LHCs to FCs. One of the conclusions of D3.2 is that FCs need to develop inhouse 'absorptive capacities' to absorb external solutions provided by LHCs during the process of replication, especially by strengthening the quality of entrepreneurial projects under incubation. In the context of WP1 and for each TT, identification of FCs' needs has been implemented in deliverables D1.2 to D1.6 and in the context of WP8 will be further updated. This should be done based on the city strategy and vision.

In general, solutions will have to be:

- Reliable, i.e. system availability to the end user at any given time
- Affordable, i.e. all citizens should be able to afford a certain or any service, and those who cannot should be supported by Municipality
- Efficient, e.g. throughput, response time, transit delay, latency
- Perform well
- Ensure quality of service

- Scalable, i.e. the system is available to more users and cover wider areas
- Expandable, i.e. the system can be expanded with new types of service
- Interoperable, i.e. the system is able to interact with other external systems
- Secure
- Meet privacy regulations
- Maintainable
- Resilient

In summary, the replication activities should be:

1. Financial/economic feasible
2. Reducing environmental impact
3. Have public impact
4. Acceptable implementation time
5. Clear on investment capital needs
6. Technically feasible
7. Fitting the policies of the country

The key performance indicators collected in *D9.5 Report on monitoring framework in LH cities and established baseline* can serve as a starting point for the evaluation of replication potential of smart technologies for a city.

The main stakeholders and experts that can be involved in preparing city development strategy are the following:

- Municipality and Local Council. They can identify the major directions for action and city areas where these actions shall be implemented.
- City transportation and utilities companies. These stakeholders, together with Municipality, can identify IRIS Transition Tracks that can be used replicability.
- Consulting companies in different areas. These stakeholders, with support from Municipality, can elaborate city transition strategy.
- Citizens, that can come up with different ideas/projects/proposals.

To match, implement and integrate the IRIS Integrated Solutions on the local challenges on ecosystem level it is required to have a good understanding of the **local context**. Aspects to assess:

- Stakeholder network: what are the relevant stakeholders for the challenges/solutions/financing/decision making and what are their ambitions in view of the IRIS challenges/solutions?
- Policy context: what are the relevant policy cycles in the city?
- Financial context: what are the relevant financial options and instruments available for solving challenges (public/private/mixed), who are controlling these instruments?
- Infrastructure context: what are the relevant existing infrastructures: energy, mobility, ICT?
- District context: for the selected district(s), functional distribution, the socio-economic status, geographical aspects, marketing/framing of the district

- Social context
- Local technical-scientific capacity context

To be successful and sustainable, smart city projects should start from people - by focusing on **citizen needs**, embracing citizen-centric design and their search for an integral quality of life. Citizens must be at the core of any smart city activity, and engagement must be granted from the very beginning in order to satisfy their demands. These demands should serve to define the local challenges of each FC. Citizens will be involved in certain aspects of the replication roadmap and data will be collected concerning their needs. As personal data is being collected, the consortium will have to comply with any European and national legislation and directives relevant to the country where the data collections are taking place.

As described in *D1.7 Transition Strategy, Commissioning Plan for the demonstration & replication work* actions should take place including citizens' engagement activities and workshops. Channels of communication with the citizens in order to better address their needs are:

1. Local Council
2. Through local associations
3. Information points
4. Municipal websites for citizens
5. Social Media
6. Discussion forums

Through these communication channels representatives of the FC and LH will have the ability to properly asses citizens' need regarding cities' needs. Mechanisms that will be deployed that include citizens' involvement should ensure the continuity of a project regardless of political changes, and a framework for assessment and iteration based on citizen feedback.

For a successful replication, LHCs should cooperate and share their experience and knowledge through visits to FC and other LHC in order to get practical insight into citizens' engagement challenges. Each FC will decide how it will approach citizens and as a next step discuss and circulate the implementation roadmap to responsible for the replication activities.

All replication activities will be implemented based on the planning of the districts/neighbourhood of the LHCs and demonstration activities that are described in detail in D5.2, D6.2 and D7.2.

3.1.2. Assess risks

Cities have to strive for identifying all risks that may come across during the replication activities. As described in (Mosannenzadeh, Rosaria Di Nucci, & Vettorato, 2017) some related barriers to implementation of smart city projects are:

- Administrative:
  - Difficulty in the coordination of high number of partners and authorities
  - Lack of good cooperation and acceptance among partners
  - Lack of public participation
  - Lack of institutions/mechanisms to disseminate information
  - Long and complex procedures for authorization of project activities
  - Time consuming requirements by EC concerning reporting and accountancy
  - Complicated and non-comprehensive public procurement

    - Fragmented ownership
- Financial
    - Difficulty to finance project implementation
- Social
    - Lack of values and interest in energy optimization measurements
    - Low acceptance of new projects and technologies
- Information and Awareness
    - Insufficient information on the part of potential users and consumers
    - Lack of awareness among authorities
    - Perception of interventions as complicated and expensive, with negative socio-economic or environmental impacts

All the **risks** should be evaluated, and a risk mitigation plan should be developed. This way, different risks (e.g. delay for implementation, financing issues, legal issues, etc.) can be understood and approached in order to minimize their negative impact.

While planning and implementing solutions and replication activities there are several potential risks involved that need to be accounted for. Most importantly, these include:

1. Technological risks – low technological development, security and privacy issues, personal data handling;
2. Economic risks – feasibility of new/existing technology and its supporting systems, existing market barriers (previous investments, long-term contracts), changing regulations and instability, global financial market;
3. Environmental risks – carbon leakage, digital waste, alienation of the digital lifestyle from environmental awareness;
4. Social risks – loss of jobs when replaced by technology, new unmatched expectations concerning skills and capacity, energy poverty, privatization and restriction of public services;
5. Sociotechnical risks – low public acceptance, unrealistic expectations, insufficient accessibility.

Risk assessments have been described in detail in deliverables D5.1, D6.1, D7.1 and in D5.2, D6.2, D7.2 where the main barriers and drivers regarding the demonstration projects are defined together with barriers in each LH intervention. Risks could be divided in four main sections:

- Technical issues (risks related to technological issues)
- Project issues (risks related to general, organizational, behavioural and ethical (legal) issues)
- Financial issues
- Social issues

In ANNEX 2 risk identification and mitigation is presented.

3.1.3. Transition Track related tools

Tools for Transition Tracks are:

- City strategy for smart and sustainable development.

- General city plan.
- Zonal/local city plans.

3.1.4. Define and engage stakeholders in identified transition needs

After identifying relevant needs and challenges and the corresponding solutions, stakeholders who are involved in this process can be defined. Defining stakeholders is an iterative process that should be continuously be updated for best results. As described in D1.7 IRIS considers as main stakeholders those: a) whose interests are affected by a project, b) whose activities affect a project, c) who possess/control information, resources and expertise needed for the implementation of a project and d) whose participation and active involvement is necessary for the successful implementation and/or dissemination of results. In this step, different types of stakeholders, ways to identify stakeholders, and different levels of involvement of stakeholders are presented.

Internal and external stakeholders in the IRIS LHC's local ecosystems are:

- Governing bodies of the Municipality of each LH or FC
- DSOs
- Technology and Services providers
- Citizens
- Citizens Ambassadors
- Transport associations
- Housing organisations
- Funding organisations
- Consumers
- Other possible stakeholders

Companies and entities with which FCs are in contact with, are stated below:

Table 2 Relevant Companies and Organizations of FCs that are not partners in the IRIS project

FC	Stakeholders' Group	Relevant non- members of IRIS entities (with which FCs are in contact with)
VAASA		
Alexandroupolis		
Santa Cruz de Tenerife		

Foscani		

Relevant companies and entities with which LHCs are in contact that were presented in D1.7 are included in ANNEX 1.

As described in D1.7 the active involvement of relevant stakeholders plays a dominant role in the successful implementation of any Smart City Project. Smart city development requires solutions and managing from a variety of actors. Responsibilities, knowledge and power are distributed among the involved actors depending on their domain and their experience. With a view to enhance stakeholder's mutual sharing of common interests, all the involved actors with direct effect to smart city development have been identified per stakeholder group. Additionally, the following five key roles of actors have been already distinguished:

- **Enablers** (framework instigators): The specific actors can boost the exploitation of IRIS results and the realization of long-term impact; can help overcome barriers (especially legal and policy related) and ensure a favourable environment for implementation. For IRIS, key actors playing the role of enabler are local/regional/national authorities, EU policy makers and standardization/regulation bodies.
- **Providers** (knowledge ecosystem): The specific actors can grow the body of knowledge; can boost innovation and knowledge distribution; act as data interpreters; support and test new technologies and develop synergies to maximize impact. For IRIS, key actors playing the role of provider are knowledge institutes and universities, relevant EU funded projects and providers of technical solutions that serve IS.
- **Utilizers** (value partners): The specific actors are potential collaborators and catalysts for delivery; improve products/processes, profitability and skill in the field; are the primary users in new markets and innovation. Most of the involved actors in IRIS fall under the specific category including energy network operators and suppliers, public transport operators, SMEs and industry, ESCOs, architects, planners, ICT consultants and others (see Table 1), since their participation in the project is essential to deliver solutions.
- **End – users** (point of delivery): The specific actors can provide feedback and improvement loops; can act as data providers/testers; are definitive to the success or failure of the Project. For IRIS, key actors playing the role of end-user are residential and non-residential consumers and drivers being the end beneficiaries of IRIS IS.
- **Facilitators** (financial provisions and support): The specific actors can navigate complex financing issues; roll-out IRIS results and ensure IRIS and replication projects are achievable and sustainable; present a high level of engagement and support further communication. For IRIS, key actors playing the role of facilitator are investors, financial institutions, banks and residents and non-residential agents with high interest in IRIS results (forming representative citizen groups and citizen ambassadors).

Mapping of the stakeholders and the experts involved could be implemented by answering the following questions (RUGGEDISED Project, 2017):

- What will the stakeholders contribute to the process?
- What kind of knowledge and experience do they have?
- What are the relevant interests and goals of the stakeholders?
- How do the stakeholders interpret the issue at hand?
- How well informed are the stakeholders about the issue?
- What are the (possible) motives for these stakeholders to participate, or not to participate?

For each solution, depending on the extracted city needs, the degree of the stakeholders' involvement should be defined. According to Gerrits and Edelenbos (Gerrits & Edelenbos, 2004) stakeholders' involvement in policy processes can range from none to co-creation and co-decision:

- Closed authoritarian (stakeholders are not involved)
- Open authoritarian (stakeholders are informed and remain passive)
- Consulting style (stakeholders are consulted)
- Participative style (stakeholders give advice)
- Delegating and Co-operative style (stakeholders become co-producers)
- Facilitating style (Stakeholders produce solutions and decide about them)

Through webinars, workshops and specific visits regional and local stakeholders could be engaged gaining continuous feedback through co-creation process for each solution of the transition tracks. For each solution of the corresponding transition track each stakeholder should define their level of interest together with the aspects of the project that they are likely to be interested in as presented in Figure 3. If their interest with the solution is low, motivation could be conducted. Influence refers to times or contexts in which they have more/less influence over the outcomes of the solution. And finally, it is important to have knowledge on conflicts/alliances that stakeholders may have with other stakeholders of the solution.

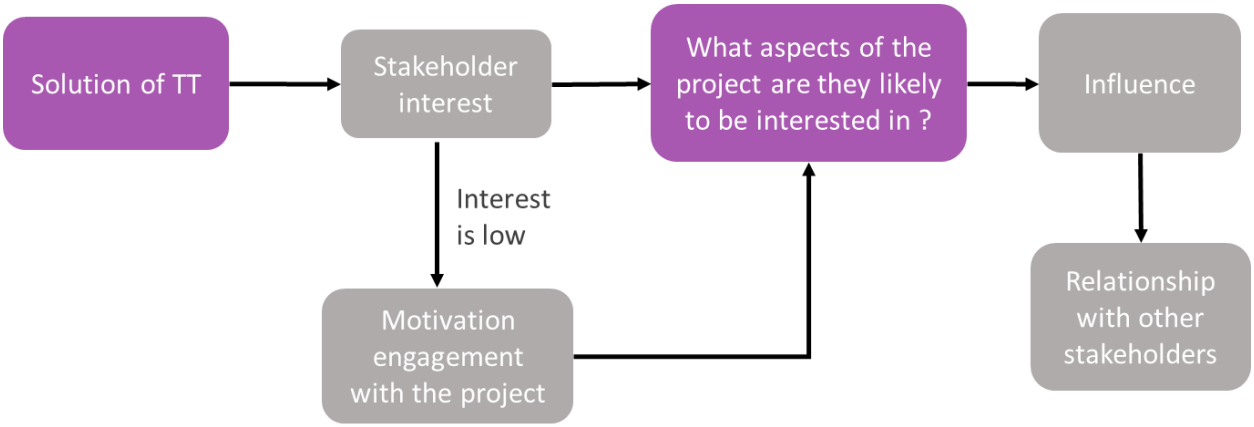

Figure 3 Defining stakeholders' uptake

3.2. Identify, evaluate and choose IRIS Integrated Solutions for identified transition needs

Based on identified IRIS Transition Tracks the Municipality can now identify, evaluate and choose IRIS Integrated Solutions within each Transition Track. These Integrated Solutions should respond to city needs, achieve city goals and objectives and meet citizens' expectations.

The implementation of each Integrated Solution should be based on a specific planning and should include the following steps:

- Create a work team within Municipality that shall address the implementation of the chosen Integrated Solution.
- Elaborate, together with different stakeholders (e.g. consulting companies) all technical documentation (feasibility study, design/technical study, etc.). Technical documentation should include the evaluation of the implementation solution based on different KPI's. There can used KPI's defined within IRIS project or, if needed, there can be defined other specific KPI's. The KPI's should cover areas as technical/energy, economic, environmental and social.

3.2.1. Solution specific information and contact information

Every Transition Track of IRIS project has several Integrated Solutions. Below there are presented all Integrated Solutions for every Transition Track, and actions/projects aimed to be developed/implemented by each Lighthouse and Follower cities. The letters in tables mean the following:

- P – means Pre-Pilot project implemented by city.
- D – means Demonstration project implemented by city.
- R – means Replication project intended to be implemented by city.

Table 3 – Initial planning for demonstration and replication of TT1 integrated solutions

Transition Tracks	Integrated Solutions	Lighthouse Cities									Follower Cities			
		Utrecht			Nice Cote d'Azur			Gothenburg			Vaasa	Alexandroupolis	Santa Cruz de	Focsani
#1 Smart renewables and closed-loop energy positive districts	IS-1.1: Positive Energy Buildings	-	-	R		D	R	P	D	R	R	R	R	R
	IS-1.2: Near zero energy retrofit district	P	D	R	P	D	R	P	D	R	R	R	R	-
	IS-1.3: Symbiotic waste heat networks	-	-	R	P	D	R	P		R	R	R	R	-

Table 4 – Initial planning for demonstration and replication of TT2 integrated solutions

Transition Tracks	Integrated Solutions	Lighthouse Cities									Follower Cities			
		Utrecht			Nice Cote d'Azur			Gothenburg			Vaasa	Alexandroupolis	Santa Cruz de	Focsani
#2 Smart Energy Management and Storage for Energy Grid Flexibility	IS-2.1: Flexible electricity grid networks	-	D	R	P	D	R	-	D	R	R	-	-	-
	IS-2.2: Smart multi-sourced low temperature district heating (DH) with innovative storage solutions	P	-	R	P	D	R	P	D	R	R	R	-	R
	IS-2.3: Utilizing 2nd life batteries for smart large-scale storage schemes	-	D	R	P	D	R	-	D	R	-	-	R	-

Table 5 – Initial planning for demonstration and replication of TT3 integrated solutions

Transition Tracks	Integrated Solutions	Lighthouse Cities									Follower Cities			
		Utrecht			Nice Cote d'Azur			Gothenburg			Vaasa	Alexandroupolis	Santa Cruz de	Focsani
#3 Smart e-Mobility Sector	IS-3.1: Smart Solar V2G EVs charging	P	D	R	P	D	R	P	-	R	R	R	R	R
	IS-3.2: Innovative Mobility Services for the Citizens	P	D	R	P	D	R	P	D	R	R	R	R	R

Table 6 – Initial planning for demonstration and replication of TT4 integrated solutions

Transition Tracks	Integrated Solutions	Lighthouse Cities	Follower Cities

		Utrecht			Nice Cote d'Azur			Gothenburg			Vaasa	Alexandroupolis	Santa Cruz de	Focsani
#4 City Innovation Platform (CIP)	IS-4.1: Services for Urban Monitoring	P	D	R	P	D	R	P	-	R	R	R	R	R
	IS-4.2: Services for City Management and Planning	P	D	R	-	-	-	P	D	R	R	-	-	R
	IS-4.3: Services for Mobility	P	D	R	-	D	R	-	-	-	R	-	R	R
	IS-4.4: Services for Grid Flexibility	P	D	R	-	-	-	-	D	R	R	R	-	-

Table 7 – Initial planning for demonstration and replication of TT2 integrated solutions

Transition Tracks	Integrated Solutions	Lighthouse Cities									Follower Cities			
		Utrecht			Nice Cote d'Azur			Gothenburg			Vaasa	Alexandroupolis	Santa Cruz de	Focsani
#5 Citizen Engagement and Co-creation	IS-5.1: Co-creating the energy transition in your everyday environment	P	D	R	P	D	R	P	D	R	R	R	R	R
	IS-5.2: Participatory city modelling	P	D	R	P	D	R	P	D	R	R	R	-	-
	IS-5.3: Living labs	-	D	R	-	-	-	P	D	R	R	R	-	-
	IS-5.4: Apps and interfaces for energy efficient behaviour	P	D	R	P	D	R	-	D	R	R	R	R	R

Solution specific information can be found in the IRIS deliverables:

- LHC Utrecht D5.1-9

- LHC Nice D6.1-9
- LHC Gothenburg D7.1-9

Specific contact information regarding transition tracks and integrated solutions can be found:

Mirjam Harmelink - Municipality of Utrecht, email: m.harmelink@utrecht.nl

Pierre-Jean BARRE - UNS IMREDD, email: pjbarre@unice.fr

Eva Pavic - Johannesburg Science Park AB, email: Eva.pavic@johannebergscienepark.com

3.2.2. Integrated Solution related tools

The tools that can be used for implementation of an Integrated Solution are the following:

- City strategy for smart and sustainable development.
- City urban development plan
- Pre-feasibility study.
- Feasibility study.
- Technical/design project.
- SCIS (EU Smart Cities Information System) resources (booklets, publications, guides, webinars, etc.).

3.3. Create working groups for chosen Transition Track and Integrated Solution

At the Municipality level there should be designated a person/team for coordination of all other working groups responsible for implementation of different projects. For each Transition Track the Municipality should create a working group. The working group should coordinate all activities for projects implementation within a Transition Track. Cities that have experience with setting up such city teams should share their views and lessons learnt.

For a successful replication a key challenge is to create an environment for being able to deliver the planned activities in a detailed and structured manner. Each working group for a Transition Track should have a responsible person or team that communicate with all stakeholders involved in project implementation. The activity of each working group should be very well structured, with well-defined tasks, milestones, deliverables, deadlines and other imported information for project implementation.

More specifically for the working group to overcome these barriers this working group should have deep and structured knowledge of:

- FC needs
- FC legislations
- Urban planning
- Financing opportunities at local/national and EU level
- Users and citizens needs and profiling

- Stakeholders needs having close cooperation with them
- Transition Tracks
- Solutions of each TT description and goals

These city teams will be responsible for taking part in the workshops and meetings held as part of the knowledge exchange actions as well as establish a close relationship with public and stakeholder groups together with consultation with experts. These actions are further described in section 3.7 of this document.

The main stakeholders and experts that can be involved in preparing and implementing a project based on an Integrated Solution are the following:

- Municipality through the working team that develops and implements a specific project. This working team is a core component for project implementation, which gathers around it other stakeholders involved in project implementation.
- City transportation and utilities companies. These stakeholders should provide all necessary data for elaborating technical documentation, and they can also be involved in supporting the elaboration of technical documentation.
- Consulting companies in different areas. These stakeholders, with support from Municipality, city transportation and utilities companies, elaborate all technical documentation for project implementation.
- Regulation and Legal bodies on local and national level, which can positively influence/support project implementation.
- Financial institutions (local, national, international) for project financing
- Citizens, that can come up with different ideas/projects/proposals.

3.4. Map similar integrated solutions in other national smart city projects

When it comes to national barriers and drivers for replication activities, such as legislative barriers or incentive drivers, finding other cities in the same country can be of great value. Establishing knowledge-exchange and learning from other cities within the same national content is of outmost importance if the possibility is there. Sharing many of the local circumstances and possibilities, establishing a national network of smart cities can accelerate the process of replication greatly.

Check if there are other active Smart City projects in the same country as the city that will replicate, or if there are projects that are already carried out. Regulatory, governmental and juridical details may be more in line if replicated from a city within the same nation.

3.4.1. Links to Smart City projects available

During the writing of this deliverable, the easiest way to track down other Smart City projects is through the SCIS website:

EC-funded projects tracked by the Smart Cities Information System

https://smartcities-infosystem.eu/sites-projects/projects

On the SCIS website projects can be searched according to countries, which makes the search for other national cities easier.

At the time of writing the FC of Vaasa can find six other cities within Finland that are participating in Smart City projects, Alexandroupolis can find one other city and Focsani can find two other cities.

Within the Horizon 2020 SCC 1 funding programme the following projects are ongoing, or finished, at the time of writing:

IRIS: https://irissmartcities.eu/

GrowSmarter: http://www.grow-smarter.eu/home/

REMOURBAN: http://www.remourban.eu/

Triangulum: http://www.triangulum-project.eu/

REPLICATE: https://replicate-project.eu/

SmartEnCity: https://smartencity.eu/

SMARTER TOGETHER: https://www.smarter-together.eu/

mySMARTLife: https://www.mysmartlife.eu/mysmartlife/

RUGGEDISED: https://ruggedised.eu/home/

MAtchUP: https://www.matchup-project.eu/

STARDUST: http://stardustproject.eu/

+CityxChange: https://cityxchange.eu/

MAKING-CITY: http://makingcity.eu/

3.4.2. Smart Cities and Communities SCC1 related tools

Tools regarding Smart Cities and Communities SCC1 can mostly be found on the SCIS and EIP-SCC platforms.

The Smart Cities Information System (SCIS): https://smartcities-infosystem.eu/

The tools on the platform are gathered in different sub-sections consisting of information about smart city projects, specific lighthouse projects, information on smart city technologies, experiences gathered from smart city projects and a library gathering knowledge from the projects.

A structured overview of the information to be found on the website:

Table 8 A structured overview of information found on the SCIS website

Technologies	Experiences	Library
Solutions	Lessons Learned	Publications

Energy	Stories	Resources
Mobility & Transport	Project data visualization	Cities participating in EU initiatives
ICT		Webinars
		Projects documentation library
		SCIS Project Coordinators Meeting
		CONCERTO publications archive

Notably useful tools on the SCIS platform have been the Solution Guides created by SCIS in co-operation with smart city projects, currently there are three finished solutions guides: E-bus, Urban Freight Logistics and Batteries and PV, and more are to come.

The Marketplace of the European Innovation Partnership on Smart Cities and Communities (EIP-SCC): https://eu-smartcities.eu/

The EIP-SCC platform has a wide selection of guides, toolkits and blueprints helpful for cities looking for help with smart city solutions.

In the IRIS project one document of particular interest has been the Smart City Guidance Package: A Roadmap for Integrated Planning and Implementation of Smart City projects ((J. Borsboom-van Beurden, 2019). This guidance package is of great help when planning and implementing smart city solutions and when creating smart city visions and strategies.

3.5. Plan knowledge exchange actions

Actions will be carried out by FCs regarding the IS chosen according to available information from LH cities. Knowledge exchange actions includes

- mentoring visits,
- events,
- webinars,
- tools,
- guidelines and
- handbooks

Through all these actions, replication training will be implemented equipping the cities that will implement the replication roadmap with techniques and methodologies facilitating self-learning and strong cooperation.

The goal is to provide the LH and the FC with such tools like proper roadmaps and guidelines and facilitate discussion among the cities. LHs will be active as mentors to FCs on the creation of this roadmap including advices, lessons learnt and sharing their overall experience. Mentoring visits will be implemented in FCs. Experts from LH city will visit FCs as mentor, to help them work out how the chosen measure/solution could be adapted/implemented in their own context. The aim of the visits is to support short-term wins and improvements, which can accelerate the follower city replication roadmap. Towards this aspect an

individual site manager, with a deep know-how of all its aspects in terms of technology, legislations and citizens profiling for each of the cities has already been selected and is represented in the organizational structure of the IRIS project. Below a timeline with proposed visits is presented:

Table 9 Timeline with proposed visits

Years	Activity	Lessons learnt and Outcomes	Partners
3-5	1 mentoring visit per FC	Manual, Handbook	LH & FC

The most popular topics of these visits are considered the following:

- Business modelling;
- Technical issues;
- Communication;
- Citizen Engagement;
- Data Management Platform; and
- Monitoring.

Knowledge carriers & exchange instruments are presented in the following table:

Table 10 Knowledge carriers & exchange instruments

Instrument	Expected Impact	Level of detail	Required effort
IRIS Deliverable	Inform in detail in/external IRIS on IRIS solutions	High	High
SCIS Solution guide	Attract external interest on IRIS solutions & EU exchange	Medium	Medium
IRIS Factsheet	Attract external interest on IRIS solutions	Low	Low
IRIS Exploitation plan	Internal IRIS understanding of exploitation process and roles of partners	Low	High
Webinar	Expert discussion on specific topics to solve implementation barriers and to disseminate	Medium – High	Low
Site visit & Mentor visit	Understand, facilitate & support the implementation process of demonstrators	Medium – High	Medium
Comm's content Social media	Attract internal & external interest and guide people to Calls to Action (CTAs) for IRIS	Low – High	Medium - high

Website redesign	Attract external interest on IRIS solutions	Medium	Medium

These activities can ensure that cities share their experience, develop the proper skills for replication and can cooperate with experts of LH when it is necessary. All materials from the face to face meetings will be part of the knowledge exchange procedure together with videos, webinars, tutorials from online meetings.

Existing knowledge, experiences and lessons learned will be analysed and shared with the stakeholders. Experts from LH cities will identify, and present possible risks and critical factors and solutions already implemented will be proposed. In this stage, the project partners will be preparing for the following activities by creating local cooperation between the actors, experts, stakeholders and public. More detailed description of knowledge exchange actions is presented in D1.7 in section 3.3 where the structure of the knowledge exchange plan is based on the transition tracks. The **main objectives** of the knowledge exchange are the following:

- Facilitate the process of finding solutions, solving barriers and facing challenges within IRIS consortium (mediation of knowledge);
- Accelerate the knowledge transfer from one LH/FC/TT expert to another; and
- Community formation among LH/TT partners (people with same interest and skills can come in contact and interact more easily).

An effective communication strategy should employ several ways to bring together partners, propagate the knowledge, create related groups and address topics of interest.

Instruments that were firstly presented in D1.7 for achieving knowledge exchange are:

- Physical meetings, workshops and regular virtual meetings;
- Webinars;
- Presence at related events (internal and external);
- Collaboration or visits to other LH cities and demonstration sites; and
- Use of an online digital platform.

Within the structure of the knowledge exchange scheme, key roles should be identified, and responsibilities should be assigned. Other two crucial parameters are the definition of specific thematic topics and the arrangement of special interest groups and task forces.

The **key identified roles** within the IRIS knowledge exchange plan are:

- **Process facilitators**;
- Respective **TT leaders or partners** from LH cities; and
- Respective **TT partners** from horizontal work packages (mainly WP3, WP9, WP10).

And the proposed **interest groups** are:

- **Energy:** TT1 & TT2 (perhaps they can be merged, because they address complementary technologies);
- **Mobility:** TT3;

- **ICT:** TT4;
- **Citizen Engagement:** TT5 (maybe in combination with TT4 – ICT helping interaction with citizens);
- **Coordinators exchange:** WP 5, 6 and 7 leaders and LH cities Site managers.

3.6. Plan capacity building actions

In order to transfer knowledge and benefit from the cooperation and the exchange knowledge activities capacity building actions will be organised by LH and FC.

Microsoft Teams platform will be used by the city that will implement the replication roadmap in order to store information and allow cities aiming to follow the roadmap for replication if they are interested to take-up a similar solution. Other activities can include:

- surveys and studies on specific reform issues
- policy and expert advice
- conferences, seminars, workshops, round tables
- staff trainings on policy issues
- organisation of awareness-raising campaigns

A successful preparation of the cities for replication of the smart measures involves meetings with both representatives from the public sector (procurement, technical, economic and design) and with representatives from the private sector (consultancies, constructors, car dealers, retailers, providers for technologies and equipment) together with business dialogues with companies involved in implementation.

More concrete, for the replication roadmap of the cities, local-level stakeholder capacity-building workshops will be organised.

3.7. Design integrated solution adapted to local circumstances

This section describes the design of the chosen IS for replication according to city needs, circumstances and possibilities. Important aspect is to tailor the solution to fit the demands of the city that will replicate. Additional information for this section can be found in deliverables D5.1, D6.1, D7.1 and D1.7.

In order to successfully design the integrated solutions for each FC a well-structured strategy should be followed separated in the following phases as it was described in D1.7:

- Initiation
- Planning
- Implementation
- Monitoring and Evaluation

For the **initiation** phase FC should identify the visions and objectives in order to detect the compliance with each TT. Another important step towards policy integration is the identification of relevant municipal,

regional and national strategic development plans, so as to ensure the alignment of the proposed actions with already set objectives. Citizens awareness, stakeholders participation and business case development are key factors for this stage.

The first step of the **planning** phase is recommended to be the investigation and assessment of the baseline situation within each LH city in order to identify the actual needs and the potential barriers. A SWOT analysis will also be of great importance for presenting strengths, weaknesses, opportunities and threats of TTs and LH, FC ecosystems. The SWOT analysis should be conducted by the site managers of FC having as a guideline the corresponding SWOT analysis from LH cities. Key aspects of this phase include:

- Identification of the city components and the physical assets in terms of infrastructure in each demonstration area
- Budget estimation and financial plan
- Technical, financial and environmental impact analysis
- Risk analysis report
- Funding mechanisms and financing schemes
- Legal and regulatory framework compliance

Before the actual implementation phase feasibility assessments tests should be conducted for better and more efficient management of the replication activities.

For the **implementation** phase the FC teams should be fully aware of the administrative steps and procedures needed to be performed for the integration of replication activities within their cities. Before the launch of implementation activities, it is recommended to test some indicative or crucial measures/components using tools such as other pilots or demonstration projects. Other activities of this phase include:

- Following a project management approach
- Establishment of key performance indicators
- Quality assurance plan
- Training sessions for the staff involved in the implementation (from responsible from LH cities)
- Communication with the team members for motivation, sharing experiences, visions
- Frequent reporting of success and failure activities

For the **monitoring and evaluation** phase necessary step is the measurement and implementation of the proper Key Performance Indicators that can be either quantitative or qualitative.

3.8. Use adapted business model and map funding options

When it comes to replication in the IRIS project the business models and funding options are one of the most crucial steps in the process for successful replication actions, if not the most crucial. This is a critical step that needs a lot of resources and focus when planning the replication in the follower cities. If the business model for the chosen solution is not working, the replication will most likely not succeed, and the same thing with the securing of funding for the replication. This step requires significant effort and will most probably decide if the replication will succeed or not.

In this step the follower city should evaluate the business model that was used for the integrated solution that is of interest to the city replicating it. Similar possibilities should be investigated within the national regulatory framework in which the city is located. Available funding options should be mapped and assessed, using the information available through the IRIS project and with the tools provided.

One of the most valuable resources to be found within the IRIS project at the moment regarding this step of the replication process is the deliverable *D3.7 Financing solutions for cities and city suppliers* created with the lead of IMCG.

The deliverable concludes that the real challenge lies not within finding the financing opportunities, or how to find contact information about them, but rather on how to build knowledge, and find the resources, to navigate through the financing landscape and finding an option with reachable eligibility rules. Other challenges identified in D3.7 are matching the expectations of the financers within their due diligence processes and matching the additional needs of information. Usually the financial processes take a lot more time and effort than expected.

According to D3.7 the EIB is the main provider of funding in Europe and therefore their public policy goals are a good starting point for any city looking to replicate the solutions of the IRIS project:

- Potential in increase in growth and employment – including SME and Mid-cap support
- Supporting economic and social cohesion by addressing economic and social imbalances, promoting the knowledge economy/skills and innovation and linking regional and national transport infrastructure
- Building environmental sustainability - including supporting competitive and secure energy supply
- Supporting action for climate-resilient growth

In the deliverable D3.7 there is valuable information regarding financing found in section 3 and 4, and a tool-section providing answers to what to do, and how to do it.

Mapping national funding options is another good place to start for follower cities, followed by starting communication with the funding programmes identified to start estimating what options would work for the chosen solutions for replication.

The most efficient way to find a working business model for the chosen solution to replicate is to look at the business model used for the demonstration. More information on the integrated solutions and the business models used for them in each transition track can be found in IRIS deliverables:

- D5.3 Launch of T.T.#1 activities on Smart renewables and near zero energy district (Utrecht)
- D5.4 Launch of T.T.#2 activities on Smart energy management and storage for flexibility (Utrecht)
- D5.5 Launch of T.T.#3 activities on Smart e-mobility (Utrecht)
- D5.6 Launch of T.T.#4 activities on City Innovation Platform and information services (Utrecht)
- D5.7 Launch of T.T.#5 activities on Citizen engagement and motivating feedback (Utrecht)
- D6.3 Launch of T.T.#1 activities on Smart renewables and near zero energy district (Nice)
- D6.4 Launch of T.T.#2 activities on Smart energy management and storage for flexibility (Nice)
- D6.5 Launch of T.T.#3 activities on Smart e-mobility (Nice)
- D6.6 Launch of T.T.#4 activities on City Innovation Platform and information services (Nice)

- D6.7 Launch of T.T.#5 activities on Citizen engagement and motivating feedback (Nice)
- D7.3 Launch of T.T.#1 activities on Smart renewables and near zero energy district (Gothenburg)
- D7.4 Launch of T.T.#2 activities on Smart energy management and storage for flexibility (Gothenburg)
- D7.5 Launch of T.T.#3 activities on Smart e-mobility (Gothenburg)
- D7.6 Launch of T.T.#4 activities on City Innovation Platform and information services (Gothenburg)
- D7.7 Launch of T.T.#5 activities on Citizen engagement and motivating feedback (Gothenburg)

Other tools that can be of use at this stage are:

- National funding agencies
- EU and NON-EU funding opportunities
- D3.7 Financing solutions for cities and city suppliers: section 5. Financial tool adapted for cities replication of IRIS integrated solutions (MS5)
- REMOURBAN Deliverable D5.2 Annex 2,3: Programs for direct funding and structural funds

3.9. Create FC implementation plan

The replication activities planned to be implemented by a Lighthouse or Follower city should be based on an implementation plan. The replication plan should be developed by a working team nominated by Municipality with a strong support from experts/consultants/stakeholders with expertise in areas of replicated/implemented projects.

Each identified IRIS Integrated Solutions for implementation/replication should be analysed from technical, economic, environmental, social and organizational points of view. In this respect, each replication project should be analysed following a well-defined methodology. This methodology can basically represent the core structure of the implementation plan. The main steps that can include a implementation plan are presented below. There should be mentioned that depending on the local context, legal framework, specific conditions there can be also some additional actions that can be included in the replication plant.

The creation of each implementation plan should be based on the following structure.

1. Identification of IRIS Transition Track and IRIS Integrated Solution matching the replication project. Within this phase the working team should take advantage and use all information and tools available and developed within IRIS project for chosen Integrated Solution in order to facilitate project implementation, to avoid barriers, to mitigate risks and to contribute to successful project replication.
2. Elaboration of all technical documentation specific for the replication project. The main objective of elaboration of all technical documentation is to show/prove the technical, economic and environmental reduction impact feasibility of the replication project. All the performed analyses within this stage should be based on specific KPI's; some of them can be used from IRIS project, some of them can be specifically defined for the analysed case. The elaborated technical documentation should include a detailed implementation plant (e.g. Gant diagram) specifying all implementation steps, deadlines, responsibilities, financing sources, etc. This stage should also

include risks analysis: risks identification and their mitigation. It is recommended to perform a SWOT analysis for each replication project. It is important to mention that technical documentation should also include the legal framework analysis on the EU level and specific to the country where the replication project is implemented. The result of this stage of the replication plan should be the firm decision, assumed by working team and Municipality, to implement the replication project.

   a. Opportunity study.
   b. Pre-feasibility study.
   c. Feasibility study.
   d. Evaluation and decision for project implementation.

3. The next stage of the replication plan should focus on project implementation. In this stage some of the activities can be performed in parallel.
   a. Negotiation for equipment & works.
   b. Elaboration of the detailed technical/design project.
   c. Procurement and contracting for equipment & works.
4. Project implementation including construction works, equipment installation, etc.
5. Putting into operation with all necessary tests for major equipment and, in parallel, personnel qualification if needed.
   a. Personnel qualification.
   b. Equipment tests.
   c. Starting operation.

After the implementation plan has been elaborated it has to be approved by the Municipality/City Council before implementation should begin.

3.10. User involvement and Citizen Engagement

While the benefits of the IRIS approach in terms of deploying Integrated Solutions are clear to many of the stakeholders, these solutions often encounter many barriers, of which some of the most important are that:

- citizens have heavily individual profiles, with corresponding customs, needs and indeed preferences
- local average climate conditions (e.g. sunny days or not) for each city will differ greatly
- there are energy or mobility related technical barriers (e.g. grid stress due to energy peaks in offer and demand)
- the local citizens wealth status differs, as does their intention to invest and pay for services
- the local industrial and city key stakeholders' willingness to invest in new technologies also varies and there is a need to critically assess whether the new proposed technologies will make profit for them and/or their citizens respectively
- regulatory or legal city-specific barriers exist
- there is a perceived lack of interest by society in general in being part of these innovative solutions
- citizens struggle with life issues which put energy transition on a lower position on their life priorities

For these reasons, any proposed solutions can be deployed in real-life and economy terms, only if the underlying multidisciplinary expertise of cities, citizens, industrial partners, city decision makers and knowledge centers are extensively integrated as well.

This diversity in stakeholders and the crucial role of citizens as enablers, requires us to make use of co-creation methods in order to create attractive and inclusive services that support people in their own motivations to engage, express ownership, and change behaviour. This problem has already been clearly identified elsewhere as crucial to the success or failure of these types of initiatives. With IRIS we have therefore chosen to seek an innovative approach for citizen engagement and co-creation.

HKU designed the Citizen Engagement Ladder approach following in-depth consideration of complementary activities in related Smart City and other ICT-driven projects, participation in the related EIP-SCC activities, and an extensive tour d'horizon of related approaches and methodologies.

This approach involves extensive awareness-raising among project stakeholders and capacity building on related issues. LH cities are currently following this approach with local stakeholders and stakeholder groups in order to raise awareness of the importance of citizen engagement in the deployment of Integrated Solutions.

The six phases in the ladder are:

1. **Awareness raising**

The awareness phase is intended to create a shared framework of thought, language, definitions and models that can be shared amongst the many stakeholders participating in the project, both at a local as well as at a European level.

2. **Mapping**

Phase 2 consists of a mapping exercise of all the proposed integrated solutions in each LH city on the Citizen Engagement Ladder model. This mapping exercise is intended to identify what level of citizen engagement is appropriate for a particular solution. An important criterium is what we call 'touchpoint'. A 'touchpoint' is the ability for a citizen to actively engage with a service in terms of usage and control.

Solar panels, for example, will once installed perform their duty without active user interference. Installing these will probably require consent, might cause some inconvenience, but once in place will probably not require any user interference except for some maintenance or check-up.

Installing a smart meter in a household is a different solution. The effectiveness of a smart meter depends on proper usage to have a positive impact on (less) energy consumption. This would require more citizen engagement in terms of training, raising awareness and provoking adoption.

A third category, which will involve the highest potential for citizen engagement, is in the development of new services; whether this is a stand-alone app or a digital service on a city innovation platform. In these instances, co-creation with citizens lowers the risk of non-acceptance dramatically.

3. **Scoping**

Knowing the actual citizens in your demonstration area is vital to ensure adoption and proper usage of the proposed integrated solutions. Technology push might easily lead to citizen disengagement and it is

essential that this issue is tackled coherently from the earliest possible moment in order to avoid the typical types of problems that arise within Smart City initiatives. The Scope model is a series of questions a city might use as a reflective tool or checklist to verify whether the stakeholders have a sufficient understanding of the intended target group or demo area to successfully deploy an integrated solution. The answers to these questions can be found in a variety of ways. Desk research based on available resources at community level might provide some basic answers. Interviews with professionals embedded in a particular neighbourhood might complement these. A third type of activity is actively searching for answers through street interviews, house visits, or visiting local social hubs to engage citizens (tea rooms, community centers, etc).

4. Co-creation and Design Scenarios

Based on the outcomes of the mapping exercise and the scoping exercise, there follow three scenarios:

Scenario 1: If an Integrated Solution lacks an active touchpoint nor has an indirect impact on an existing touchpoint, it is mapped as a level 1 or 2 solution. This means the primary task around this solution is proper communication. Although official letters are often employed, social media channels are often vital complementary actions to reach out to citizens. In the Utrecht demo area, Facebook offers bottom-up access to self-organized clusters of citizens that might be reached where official letters fall short.

Scenario 2: If an integrated solution is mapped as a level 3 solution, it means there is an existing active touchpoint. This might either be adapted and modified to optimize its future use and adoption, or support material might be designed to ease citizens to adopt the solution. The design of these materials could easily be subject of co-creation and design sprints.

Scenario 3: If an integrated solution is a level 4 type solution, it means there will be a new service which will get a touchpoint in the project which does not yet exist; a number of NEW apps or webservices will be developed in the project and without an existing interface, this would clearly be more suitable for citizen engagement co-creation.

It is strongly advised to add to your local stakeholder assembly a particular stakeholder with design expertise; this can be a local agency; a part of a university; but dedicated design expertise pays off in getting the best from this approach.

5. Touchpoints and Influencers

The term touchpoint refers to all of the contact points between the customer and the service provider, which involves an interaction with a human need in specific time and place (Risdon, 2013). As mentioned before, whether a solution has an active touchpoint is an important criterium to decide on the level of citizen engagement needed. Local influencers can also be considered as touchpoints in reaching out to groups of citizens that are hard to reach. These individuals should have a position of influence in the neighbourhood, formal or informal. The side-step using influencers can be important in situations where (a lack of) trust might have a negative impact on citizen participation. An example of influencer strategy is involving local schools and use children in school as advocates to mobilize their parents on energy transition.

6. Feedback Loops

The final phase is stress testing all design related co-creation activities against the scope model to ensure proper alignment with projected project outcomes. It is a validation exercise to ensure all activities undertaken are still within the intended design space as defined collectively in Phase 3.

Complete information regarding the Citizen Engagement Ladder approach can be found in the IRIS deliverable D1.6 Report on Citizen Requirements from the Transition Track #5 Solutions.

Stepped approach for FCs:

- Set up a project organization with your stakeholders. If you have problems to meet with your stakeholders, it will be a large challenge. Every stakeholder should have one contact person to contact regarding citizen engagement.
- Make an inventory of your chosen integrated solutions.
- Map them on the ladder model based on touchpoints.
- Use the SCOPE model quick scan to fix your blind spots.
- Set up your local news desk for communication.
- Ensure “design thinking expertise” in your consortium – organization using a local design savvy partner.
- Choose a level 3 or 4 “integrated solution – priority.
- Try to pinpoint “influencers” in the target area: invite them – fieldwork.
- Design a first series of citizen encounters (a booklet in English will be available from the Utrecht workshop series) – design work.
- Capture and publicize results – communication.
- Evaluate & iterate.

3.11. Identify barriers and risks, and how to solve them

A project implementation plan should always include barriers and risks identification, analysis and proposal of different ways of mitigation. This is very important for project implementation phase, project success during operation, future replication and city sustainable development. The main barriers and risks and their possible mitigation ways are presented below. However, it is important to notice that there can also be identified other barriers and risks for a specific city/region/country.

1. Implementation risk. This risk refers to the project implementation and can include low experience in project implementation, which can lead to delays, budget increase or even project implementation failure. To mitigate this risk there should be involved in project implementation companies/experts with prior experience in the field, the project implementation plan should be very detailed with all tasks clearly defined and all responsibilities clear shared among all involved parties and with very strict deadlines. In case of major equipment/works/services suppliers/providers firm contracts with clear penalties for delays should be signed. There should be also a constant monitoring of project implementation by a Municipality representative.
2. Technological risk. This risk can usually appear when a new technology is used. To mitigate this risk the Municipality can use the experience and expertise provided through IRIS project. The working team from the Municipality can also reduce this risk by trying to better document and

analyse on the EU or worldwide level different similar projects that have already been implemented.

3. Commercial risk. This risk can include a potential increase of investment costs and it can be mitigated with firm contracts with equipment/works/services suppliers/providers. This risk can include some problems that can appear during operation, e.g. not achieving the specified equipment's efficiency, and it can be mitigated with firm contracts with equipment suppliers specifying clearly all technical data of the equipment, and through very detailed equipment tests before putting into operation.
4. Financial risk. This risk includes problems with financing the project and can be mitigated through diversifying and increasing the number of the financing sources. For countries with non-Euro currencies there can be also a rate exchange risk that can be mitigated through financial/currency hedging.
5. Legal risk includes the possibility of delays for project implementation due to different approvals (construction, environmental, etc.) delays. To mitigate this risk the Municipality can address some consulting/services companies that can speed up the approval process. There is also a legal framework change risk. This risk is quite difficult to address especially if the country's legal framework is changed. However, a good legal framework analysis at the technical documentation phase can significantly reduce the appearance of this risk.
6. Political risk. This risk has quite a low potential of appearance since the EU policy is well-known and well-defined for quite a long period of time. However, on the local/country level there can be situations that can lead to some risks for replication project. A good understanding of country's policy can be an advantage to avoid such a risk.
7. Force major risk. This risk has a quite low possibility of appearance and it is very difficult or even impossible to mitigate. However, taking into consideration all local specific conditions (e.g. seismic areas) and taking all measures to reduce the impact of this risk can be an advantage.

3.12. Implement

The implementation of a replication project based on an IRIS Integrated Solution should include a very clear and detailed plan. The implementation plan should specify the activities, roles, deadlines, financing sources, responsibilities, etc. The project implementation should be performed by experts/companies with expertise and experience in the field. IRIS experience with similar projects, already implemented, should be used in order to avoid as much as possible barriers and mitigate some of the risks.

For the implementation of a replication project there can be used the following tools:

- Kick-off meetings.
- Project management performed by the Municipality's working team.
- Regular meetings with all parties involved in project implementation with clear milestones deadlines/deliverables/reports.
- Project implementation monitoring on a regular basis (e.g. weekly, monthly).
- Efficient use of communication channels among all involved parties in project implementation.
- Constant information of citizens to ensure their full support.

3.13. Monitor implemented projects using KPIs

This action is needed to evaluate the impact of the implemented projects and to compare it with initial estimations in order to learn. During the monitoring process problems/issues an appear after the implementation that also help for future roadmap updates and for improving replication tools.

The following list of KPIs that can be used for monitoring has been compiled for the IRIS project:

KPI # / KPI name

1. Accessibility of open data
2. Access to vehicle sharing solutions for city travel
3. Advantages for end-users
4. Battery Degradation Rate
5. Carbon dioxide Emission Reduction
6. Carbon monoxide emission reduction
7. CO2 reduction cost efficiency
8. Data loss prevention
9. Data safety
10. Degree of energy self-supply by RES
11. Developer engagement
12. Ease of use for end users of the solution
13. Energy savings
14. Expiration date of open data
15. Fine particulate matter emission
16. Improved access to vehicle sharing solutions
17. Increased awareness of energy usage
18. Increased consciousness of citizenship
19. Increased environmental awareness
20. Increase in Local Renewable Energy production
21. Increased system flexibility for energy players/stakeholders
22. Local community involvement in the implementation phase
23. Local community involvement in the planning phase
24. NOx emission
25. Number of connected urban objects
26. Number of e-charging stations deployed in the area
27. Number of efficient vehicles deployed in the area
28. Number of Free-Floating subscribers
29. Open data-based solutions
30. Participatory governance
31. Peak load reduction
32. People reached
33. Platform downtime
34. Reduced energy cost for costumers
35. Reduced energy curtailment of RES and DER
36. Reduction in annual final energy consumption by street lighting

37. Reduction in car ownership among tenants
38. Reduction in driven km by tenants and employees in the district
39. Share of RES in ICT power supply
40. Storage capacity installed
41. Trialability
42. Usage of open source software
43. User engagement
44. Yearly km driven in e-car sharing systems
45. Quality of open data
46. Total investments
47. Grants
48. Total Annual costs
49. Payback
50. Return on investments

KPIs per Integrated Solution and Transition Tracks

T.T. #1: Smart renewables and closed-loop energy positive districts

Table 11 T.T. #1: Smart renewables and closed-loop energy positive districts

	Positive Energy Buildings	Near zero energy retrofit district	Symbiotic waste heat networks
Technical	Energy demand and consumption	Energy demand and consumption	Energy savings
	Energy savings	Energy savings	Technical compatibility
	Degree of energetic self-supply by RES	Degree of energetic self-supply by RES	Improved interoperability
	Maximum Hourly Deficit	Maximum Hourly Deficit	
	Technical compatibility	Technical compatibility	
	Improved Interoperability	Improved interoperability	
Environmental	Carbon dioxide Emission Reduction	Carbon dioxide Emission Reduction	Carbon dioxide Emission Reduction
	Increase in Local Renewable Energy Generation	Increase in Local Renewable Energy Generation	Increase in Local Renewable Energy Generation
	Reduction in annual final energy consumption	Reduction in annual final energy consumption	Reduction in annual final energy consumption
			Decreased emissions of Particulate matter
			Decreased emissions of Nitrogen oxides
Economic	Total Investments	Total Investments	Total Investments
	Grants	Grants	Grants

	Positive Energy Buildings	Near zero energy retrofit district	Symbiotic waste heat networks
	Total Annual costs	Total Annual costs	Total Annual costs
	Payback	Payback	Payback
	Return on Investment (ROI)	Return on Investment (ROI)	Return on Investment (ROI)
	Fuel poverty	Fuel poverty	CO2 reduction cost efficiency
	CO2 reduction cost efficiency	CO2 reduction cost efficiency	Financial benefit for the end user
	Financial benefit for the end user	Financial benefit for the end user	Stimulating an innovative environment
		Reduction of energy cost	
		Stimulating an innovative environment	
Social	Professional stakeholder involvement	Professional stakeholder involvement	Professional stakeholder involvement
	Advantages for end-users	Advantages for end-users	Advantages for end-users
	Increased environmental awareness	Increased environmental awareness	Increased environmental awareness
	Increased consciousness of citizenship	Increased consciousness of citizenship	Social compatibility
	Increased participation of vulnerable groups	Increased participation of vulnerable groups	Advantages for stakeholders
	Ease of use for end users of the solution	Ease of use for end users of the solution	
	Social compatibility	People reached	
	Consumers engagement	Advantages for stakeholders	
		Social compatibility	
		Consumers engagement	
ICT	Reliability	Reliability	Reliability
		Increased system flexibility for energy players	
Legal	Change in rules and regulations	Change in rules and regulations	Change in rules and regulations
	Green Building self-consumption Legal Framework Compatibility	Green Building self-consumption Legal Framework Compatibility	Symbiotic waste heat Legal Framework Compatibility

T.T. #2: Smart Energy Management and Storage for Grid Flexibility

Table 12 T.T. #2: Smart Energy Management and Storage for Grid Flexibility

	Flexible electricity grid networks	Smart multi-sourced low temperature district heating with innovative storage solutions	Utilizing 2nd life batteries for smart large-scale storage schemes
Technical	Degree of energetic self-supply by RES	Energy demand and consumption	Battery Degradation Rate
	Reduced energy curtailment of RES and DER	Energy savings	Storage energy losses
	Average number of electrical interruptions per customer per year	Smart Storage Capacity	Smart Storage Capacity
	Average length of electrical interruptions (in hours)		Reduced energy curtailment of RES and DER
	Energy demand and consumption		
	Energy savings		
	Smart Storage Capacity		
	Maximum Hourly Deficit		
Environmental	Carbon dioxide Emission Reduction	Carbon dioxide Emission Reduction	Increase in Local Renewable Energy Generation
	Increase in Local Renewable Energy Generation	Increase in Local Renewable Energy Generation	Financial benefit for the end-user
Economic	Reduction of energy cost	Payback	Payback
	Total Investments	Return on Investment	Return on Investment
	Financial benefit for the end-user	Reduction of energy cost	Reduction of energy cost
	Total Annual costs	Total Investments	Total Investments
		Financial benefit for the end-user	
		Total Annual costs	Total Annual costs
		Energy Return on Energy Investment	
Social	Consumers' engagement	Social Compatibility	Consumers' engagement
	Professional stakeholder involvement	Advantages for end-users	Professional stakeholder involvement

	Flexible electricity grid networks	Smart multi-sourced low temperature district heating with innovative storage solutions	Utilizing 2nd life batteries for smart large-scale storage schemes
	Social Compatibility	Thermal comfort	Social Compatibility
	Ease of use for end users of the solution		Advantages for end-users
	Advantages for end-users		
ICT	Peak load reduction		
	Number of costumers that are positive about how energy systems are controlled		
	Increased system flexibility for energy players		
Legal	Energy flexibility policies Legal Framework Compatibility	Symbiotic waste heat Legal Framework Compatibility	
	Change in rules and regulations	Change in rules and regulations	

T.T. #3: Smart e-Mobility Sector

Table 13 T.T. #3: Smart e-Mobility Sector

	Smart Solar V2G EVs charging	Innovative Mobility Services for the Citizens
Technical	Energy demand and consumption	Energy demand and consumption
	Energy savings	Energy savings
	Energy consumption data aggregated by sector fuel	Improved interoperability
	Number of EVs charging stations and solar powered V2G charging stations deployed in the area	Energy consumption data aggregated by sector fuel
	Number of efficient vehicles deployed in the area	Free Floating subscribers
		Yearly km are made through the e-car sharing system instead of private conventional cars
Environmental	Carbon dioxide Emission Reduction	Carbon dioxide Emission Reduction
	Noise pollution	Noise pollution
	Increased efficiency of resources consumption	Increased efficiency of resources consumption
	Reduction in annual final energy consumption	Reduction in annual final energy consumption
	Decreased emissions of Particulate matter	Decreased emissions of Particulate matter

	Smart Solar V2G EVs charging	Innovative Mobility Services for the Citizens
	Decreased emissions of Nitrogen oxides (NOx)	Decreased emissions of Nitrogen oxides (NOx)
Economic	Total Investments	Total Investments
	Total Annual costs	Total Annual costs
	Payback	Payback
	Return on Investment (ROI)	Return on Investment (ROI)
	CO2 reduction cost efficiency	CO2 reduction cost efficiency
	Financial benefit for the end user	Financial benefit for the end user
		Stimulating an innovative environment
Social	People reached	People reached
	Professional stakeholder involvement	Professional stakeholder involvement
	Advantages for end-users	Advantages for end-users
	Advantages for stakeholders	Advantages for stakeholders
	Consumers engagement	Consumers engagement
	Increased environmental awareness	Increased environmental awareness
	Increased consciousness of citizenship	Increased consciousness of citizenship
	Local job creation	Local job creation
ICT	Reliability	Reliability
	Increased hosting capacity for RES, electric vehicles and other new loads	Impact of ICT apps into mobility
Legal	Change in rules and regulations	Change in rules and regulations
	Smart EVs Legal Framework Compatibility	
	Energy flexibility policies Legal Framework Compatibility	

T.T. #4: City Innovation Platform (CIP)

Table 14 T.T. #4: City Innovation Platform (CIP)

	Services for Urban Monitoring / Services for City Management and Planning / Services for Mobility / Services for Grid Flexibility
ICT	Developer engagement
	Data safety
	Data loss prevention
	Usage of open source software
	Expiration date of open data

	Services for Urban Monitoring / Services for City Management and Planning / Services for Mobility / Services for Grid Flexibility
	Quality of open data
	Platform downtime
	Open data-based solutions

T.T. #5 Citizen engagement and co-creation

Table 15 T.T. #5 Citizen engagement and co-creation

	Co-creating the energy transition in your everyday environment / Participatory city modelling / Living labs / Apps and interfaces for energy efficient behaviour
Technical	Improved flexibility of service delivery following citizen feedback phases
Economic	Awareness of economic benefits of reduced energy consumption
Social	Increased environmental awareness
	Local community involvement in the implementation phase
	Increased citizen awareness of the potential of smart city projects
	Number of city officials and urban experts trained to conduct the meaningful and ethical engagement of citizens
	Provision of a localised multi stakeholder co-creation and co-production Field Guide for Citizen Engagement activities
	Participation of citizens, citizen representative groups and citizen ambassadors in the co-creation of local/micro KPIs for Citizen Engagement for Smart Cities
ICT	Number of active 'touch-points' identified where citizens have a degree of agency and interaction with solution
Legal	Measure extent to which privacy by design has been ensured

More information on KPIs and monitoring can be found in the IRIS deliverables:

- D1.1 Report on the list of selected KPIs for each Transition Track
- D9.2 Report on monitoring and evaluation schemes for integrated solutions
- D9.5 Report on monitoring framework in LH cities and established baseline

4. Output to other work packages

This deliverable is a roadmap, or process description, with the follower cities as the main target group and is specifically created with them in mind, to help them achieve the goal of replicating the integrated solutions demonstrated in the lighthouse cities within each transition track. Therefore, the output is partly limited to WP 8. With the help of the roadmap the follower cities will create replication plans.

However, there is valuable output to other work packages to be found in this deliverable as well.

WP 2 *EU wide cooperation with ongoing projects, initiatives and communities* will be able to share the public roadmap with other projects, initiatives and communities, and in that way create an exchange of experiences, lessons learnt and a contribution to the wider spreading of smart city solutions to other cities within the EU and beyond. Together the projects can create more standardized guidelines and tools for replication of smart city solutions.

WP 3 *Development of Bankable Business Models and Exploitation Activities* will find this report useful in the offer to cities outside of Europe, with the knowledge exchange process between the LHCs and FCs in the IRIS projects, and the understanding of the process involved.

WP 10 *Communications and Dissemination* will have a process flow to follow when communicating the progress of the FCs in the IRIS project in their journey towards replication.

And on a general level, the layout of the work for replication in the FCs, is of interest for the whole IRIS project as it will generate a need of understanding the technical solutions, business models, and the work on how to engage the citizens when needed.

5. Conclusions

One of the most important requirements for smart city solutions is that they should be replicable. A solution containing technical innovation, with a validated business model and a proven impact for the better in a city, is interesting for any city, if they are able to replicate it.

Replication might seem not too complicated, but many projects, including IRIS, have realized that replication is something that cannot be taken lightly as replication needs a lot of work from the ones doing the demonstration, to the ones trying to understand it and trying to make it work within their own city's circumstances.

SCIS publication on the subject *Why may replication (not) be happening - Recommendations on EU R&I and regulatory policies* was finished when the task of replication was taking off in the IRIS project and provided valuable insight to the subject at hand. The policy analysis investigated the reasons why replication of smart urban energy, mobility and ICT solutions may be difficult. The paper identified and discussed some general barriers and presented opportunities for overcoming them.

This roadmap is in the form of process description, the process of replication, and if the city interested in replicating a chosen integrated solution follows the steps in the process, then replicating should be successful. However, each one of the steps might require a lot of effort and should not be taken lightly. And as the steps in the replication roadmap are quite many, a city planning replication should take into consideration the amount of work needed and apply the necessary resources in form of personal resources and management of the process itself.

One identified key in the roadmap is the importance of understanding the journey that the city is taking to becoming a smart city. Even though technical specifications regarding each integrated solution is of importance, more important is the why and the how for the city. To really understand the importance of the city visions and strategies to embrace the smart city solutions, and to come to a point where the solutions have a budget of their own, resources to carry them out, a political backing and an acceptance amongst the citizens.

Following and carrying out each step in the roadmap should prepare the follower cities to be able to create replication plans for their cities, create city teams for the transition tracks, align the aims of the replication plan with the city's own visions and strategies, and most important of all find funding for the implementation of the solutions.

The roadmap contains the identification of city needs, identification of project implementation, citizen involvement, monitoring, and most other things needed to guide any city through a project implementation process.

6. References

Alliance for Internet of Things Innovation (AIOTI) WG08 – Smart Cities. (2018). *Smart City Replication Guidelines Part 1: Cross-Domain/Application Use Cases.*

Ferrer, J., Taranic, I., Veum, K., Van den Oosterkamp, P., & Wilson, C. (2017). *The making of a smart city: Replication and scale-up of innovation in Europe.* Smart Cities Information System (SCIS).

Gerrits, L., & Edelenbos, J. (2004). Management of Sediments Through Stakeholder Involvement - The risks and value of engaging stakeholders when looking for solutions for sediment-related problems. *Management of Sediments, JSS - J Soils & Sediments 4 (4)*.

GrowSmarter Project EU. (2015). *Replication Assessment Reports of the Follower Cities Cork, Graz, Porto, Suceava and Valletta.*

J. Borsboom-van Beurden, J. K. (2019). *Smart City Guidance Package - A Roadmap for Integrated Planning and Implemantation of Smart City Projects.* Norwegian University of Science and Technology.

Jorge Nunez Ferrer, I. T. (2017). *The making of a smart city: replication and scale-up of innovation in Europe .* SCIS Smart Cities Information System.

Mosannenzadeh, F., Rosaria Di Nucci, M., & Vettorato, D. (2017). Identifying and prioritizing barriers to implementation of smart energy city projects in Europe: An empirical approach. *Energy Policy, Volume 105*, pp. 191-201.

mySMARTLife Project EU. (2017). *D6.1 Baseline assessment & PESTEL Analysis of Palencia's Initial Replication Plan, Transition of EU cities towards a new concept of Smart Life and Economy.*

PWC. (2018). *Smart Charging of electric vehicles: Institutional bottlenecks and possible solutions.*

REMOURBAN Project EU. (2016). *D5.2. Model for replication potential.*

Risdon, C. (2013). *Un-sucking the touchpoint.* Retrieved from Adaptive path.

RUGGEDISED Project. (2017). *D1.2 - Overarching Innovation and Implementation Framework, HORIZON 2020, H2020-SCC-2016.*

SharingCities Project EU. (2016). *Replication Strategy.*

SmartEnCity Project EU. (2017). *D8.2. Replication toolkit v.1.*

Vandevyvere, H. (2018). *Why may replication (not) be happening - Recommendations on EU R&I and regulatory policies.* Smart Cities Information System.

Vandevyvere, H. (2019). *E-Bus Solution Booklet.* SCIS Smart Cities Information System.

Vandevyvere, H. (2019). *Solution Booklet Batteries and PV.* SCIS Smart Cities Information System.

Vandevyvere, H. (2019). *Solution Booklet Urban Freight Logistics.* SCIS Smart Cities Information System.

Annex 1: Relevant Non-members of IRIS project Companies and Organizations

Table 16 Relevant Non-members of IRIS project Companies and Organizations

LH	Stakeholders' Group	Relevant non- members of IRIS entities (with which LHs are in contact with)
UTR	**Technology and Services providers**	Antea Group, Elaad, Senfal, Solease, Strukton, Suez, Sundata, TNO, van Scherpenzeel, Viriciti, Wocozon
	Policy-making bodies and Governance	Municipalities of Utrecht Province
	Representative citizen groups	Labyrinth B.V., Doenja Dienstverlening, Wijkraad Zuid-West, Buurtcentrum BuurtThuis - Kanaleneiland Zuid, Eyüb Sultan Moskee Utrecht, Theehuis Al-Asdekaa
NCA	**Technology and Services providers**	Apexenergies, Arcsis, ASI, Axun Solar, Azur Systeme Solaire, CEA Tech, DAIKIN, Ecorealis, Eneco, Engie, Farmgrid, Giordano Industries, Guiban Mediterranee, Helioclim, IUT Nice Cote D' Azur, Mines Paris Tech, Neurone, Osmose, O'Sol, Seazen, Sunpartner Technologies, Sustain'Air, Valenergies, Windpulse, AVEM, Chauvin Arnoux Energy, Le Confort Electrique, Cristopia Energy Systems SAS, Enoleo, Greencom Networks, Gridpocket, Hewlett Packard Enterprise, Ingespim, Legrand, Mobendi, Montelec, Orsteel Light, Ragni, Resistex, Schneider Electric, WIT, Acqua Solutions, Aitec Elec, Athanor, Bouygues, Energie Service, Dalkia, Engie Cofely, GRDF, GRT Gas, Jean Graniou, RTE France, Senseor, Techtel, Azzura Lights, Capitole Energie, DCR Consultants, ECO CO_2, Eiffage Energie, Ovezia, Vinci Facilities, Benomad, Busit SAS, Cirane, IBM, Imredd, IO Think Solutions, Izypeo, Orange, Qualisteo, SAP Labs, SFR Business, Smart Service Connect, Acta Consult, Adista, Alpheeis, Apave, Apis Mallifera, Artelia, Atiane Energy, Blue2BGreen, Cerema, Cesi, CSTB, Cust'Home, Dowel, Eiffage Constuction, Engie Axima, Euklead, Garcia Igenierie, GS2X, IA BTP, Joel Druelle Architecte, Kleber Daudin Bet, LE BE, Meritis Paca, MI2020, Polymage, Projetechnique, Scapes, SLK Ingenierie, SO WATT, Transenergie, Watinyoo, Capenergies, Pole Emploi 06
	Policy-making bodies	Association des Maires Du 06, Fédération Du Bâtiment Et Des Tp Des Alpes-Maritimes, Caisse Des Dépôts, Communauté D'agglomération Sophia Antipolis,

	Representative citizen groups	Communaute Communes Alpes D'azur, Nice Ecovalee
	Citizen Ambassadors	CCI Nice Cote D' Azur, Sictiam
GOT	**DSO**	Göteborg Energi, Mölndal Energi, Partille Energi, Härryda Energi
	Technology and Services providers	Metry, Trivector, Tyrens, Riksbyggen, HSB, Akademiska Hus, RISE, IMCG, Volvo AB, Volvo Cars AB, Ericsson, Bengt Dahlgren, Skanska, White, PEAB, Mölndala, Husqvarna
	Policy-making bodies	Regions: Västra Götalandsregionen, Västra Götalands län, Municipalities: Göteborg, Partille, Mölndal, Lerums, Härryda, Kungsbacka, Kungälv, Trollhättan, Borås, Skövde
	Representative citizen groups	IQ Samhällsbyggnad, Viable cities, Ekocentrum, CSR Västsverige

Annex 2: Risk Analysis

In D1.7 a detailed analysis of the risk assessment is presented and will be further described in this document. Risks can be assessed through the calculation of the Risk Priority Number (RPN) that is a measure used during the assessment helping the identification of critical failures linked to the design or process. The RPN values range from 1 (absolute best) to 1000 (absolute worst). The Risk Priority Number (for each risk) is calculated by Equation 1:

$$RPN = S \times O \times \frac{D + R}{2}$$

where S = Severity, O = Occurrence, D = Detectability, R = Recoverability

The value of each individual RPN calculated above is initially matched to five levels of severity, as defined in the following table:

Table 17 Correlation of Overall risk factor with overall risk severity level

Calculated RPN	Importance level
512-1000	I- Extremely important
216-512	II- Important
64-216	III – Moderate
8-64	IV – Slight
1-8	V – Insignificant

It is also useful to calculate the Total Risk Estimate (TRE) (Equation 2) for the overall project, as proposed by Bluvband and Grabov (2009):

$$TRE = \frac{\sum_{i=1}^{n} RPN_i}{1000n} \times 100\%$$

Where:

- RPN_i: individual RPN values for each item
- n: total number of items in the EFMEA analysis

TRE values range between 0.1% (no risk at all) and 100% (extremely risky), but it is unlikely that either of these extreme values will be obtained.

Once the critical items have been identified, the next step is to attempt to identify possible corrective actions or mitigating strategies. The possible success of these actions/strategies should also be identified and, where possible, quantified. There may be several possible options for each issue, and any risk reduction is an iterative process involving dependencies between the different issues. In terms of corrective actions, risk can be reduced in a number of generic ways:

- Reducing the magnitude (severity) of the consequences of the potential risk.

- Reducing the probability of the risk occurring.
- Increasing failure detection speed and probability.
- Protecting against the risk, mitigating strategies to compensate for a failure.
- Transferring the risk to another solution or transition track.

After the selection of the proper mitigation actions, these can be evaluated according to the following table.

Table 18 Definition of Mitigation possibility level

Mitigation Possibility	Definition
High	A solution is available at relatively little cost.
Medium	An achievable solution may be possible at reasonable cost or a reasonable solution is available at modest cost.
Low	An expensive solution may be possible, but system benefits may not justify these, and/or a solution needs further investigation or is highly complicated.
Improbable	Solutions are too expensive (likely to remain so) in relation to the reduction of risk(s) and the benefits gained from the functionality of the system and/or a solution is not available for the (extremely) severe risk that has been identified.

The risk assessment and the evaluation of the mitigation possibility level will contribute to the evaluation of the project's weaknesses and barriers. The outcome of this process can be used in the investigation of the proper confrontation measures, so as to make the project viable.