SPARCS

Sustainable energy Positive & zero cARbon CommunitieS

January 21 2021 10:00-12:00 CET

SPARCS City Labs

Marielisa Padilla (FHG)

Horizon 2020
European Union funding
for Research & Innovation

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Topic: LC-SC3-SCC-1-2018-2019-2020: Smart Cities and Communities

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Fraunhofer IAO - Institute for Industrial Engineering

- **Founded:** 1949
- About **26,600** staff
- **72** institutes and research units around the world
- **Annual research budget:** 2.6 billion euros
- Over **70%** of this sum is **generated** throughprojects commissioned by industry and publicly funded research projects
- Roughly 30% is provided by the **German state and federal governments** for advanced research (looking at issues that will be of concern to the economy and society in general in five- or ten-years time).

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Our role in SPARCS

Among other we lead the Replication Activities in SPARCS, supporting our Fellow Cities in the process of developing their own **S**ustainable energy **P**ositive and
zero c**AR**bon **C**ommunitie**S**

Fraunhofer

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The SPARCS Cities

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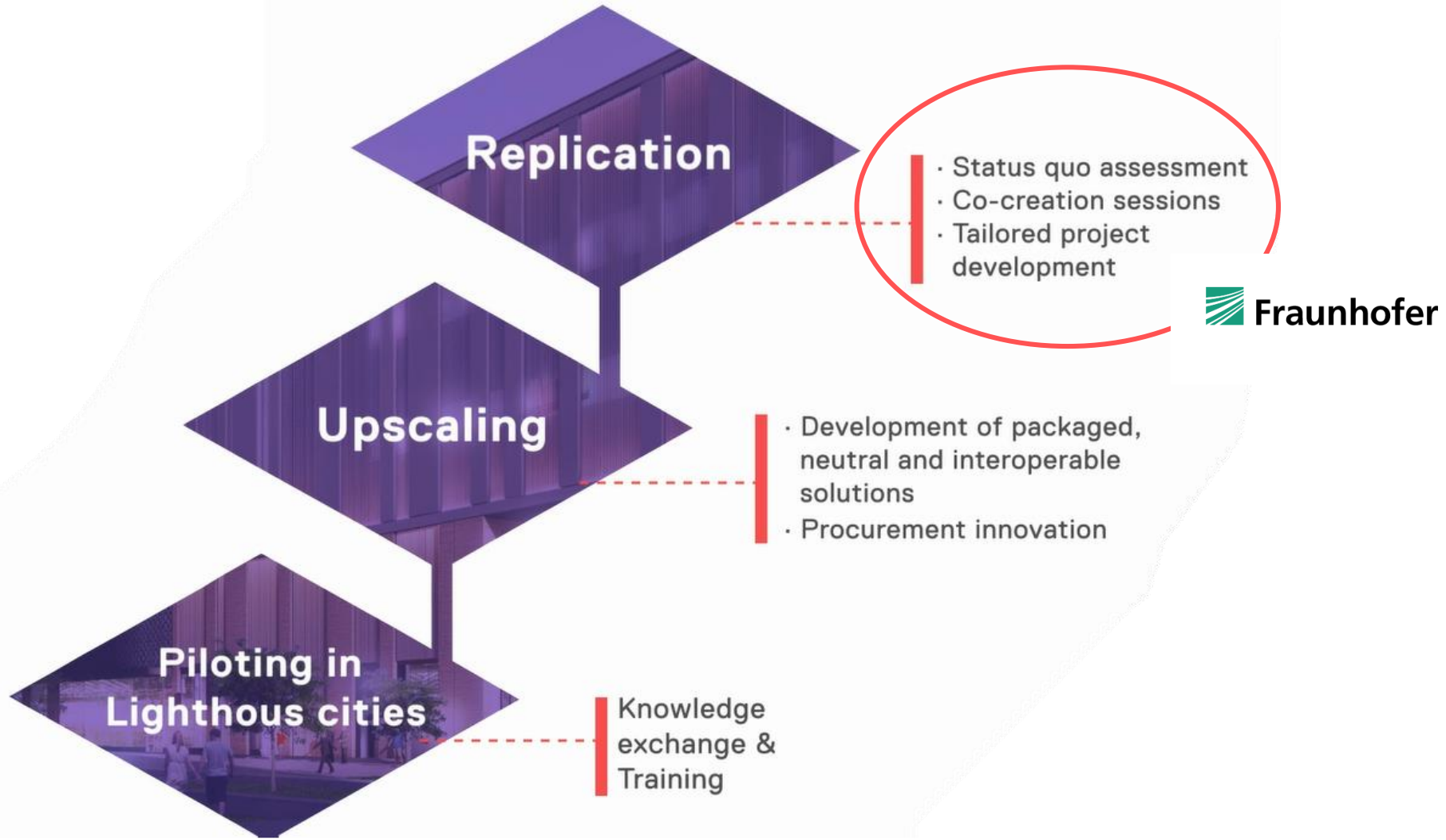
Replication Strategy



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How do we do it?

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Morgenstadt is a Fraunhofer Innovation Network designing sustainable cities since 2011

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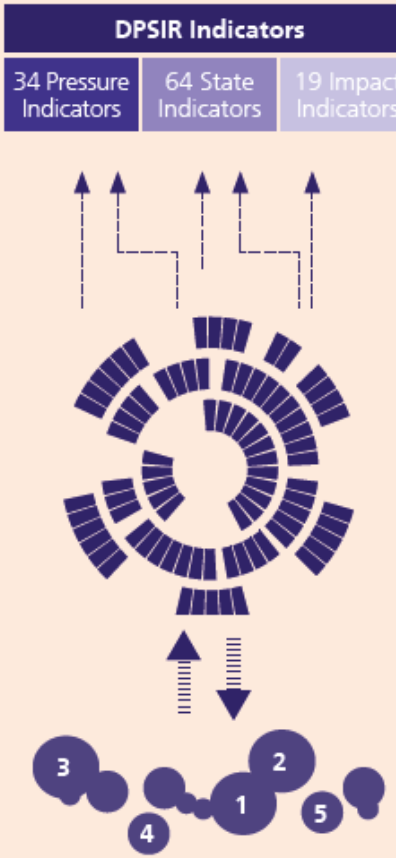
The Morgenstadt Framework

Standardized data assessment helps to identify key challenges & opportunities	Morgenstadt framework	Analysis of interfaces helps to design individual strategies for cities
What is the quantifiable sustainability performance of the city? → Assessment of Indicators		Relation Indicators – Action Fields shows measures and priorities: → **What** needs to be done?
How does the city address sustainability? → Assessment of Action Fields		
Why do or don't things work in this city? → Assessment of Impact Factors		Relation Action Fields – Impact Factors shows conditions of project development: → **How** do projects have to be designed? → **What** are the key factors to build on?

Source: Morgenstadt

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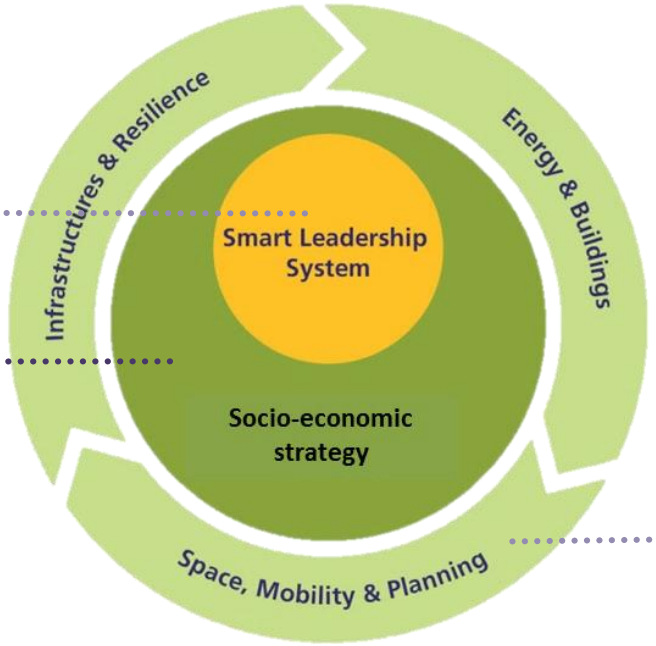
City Labs in SPARCS: Three levels of Action

Mobility Action Group

Innovation Challenge



Energy Plant

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Expected Results of City Labs

Individual sustainability city profile highlighting the drivers, barriers and opportunities in the city

Detailed analysis of specific sectors relevant to SPARCS

Catalogue of solution-oriented project outlines to be then further developed in a roadmap for implementation

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Implemented City Labs

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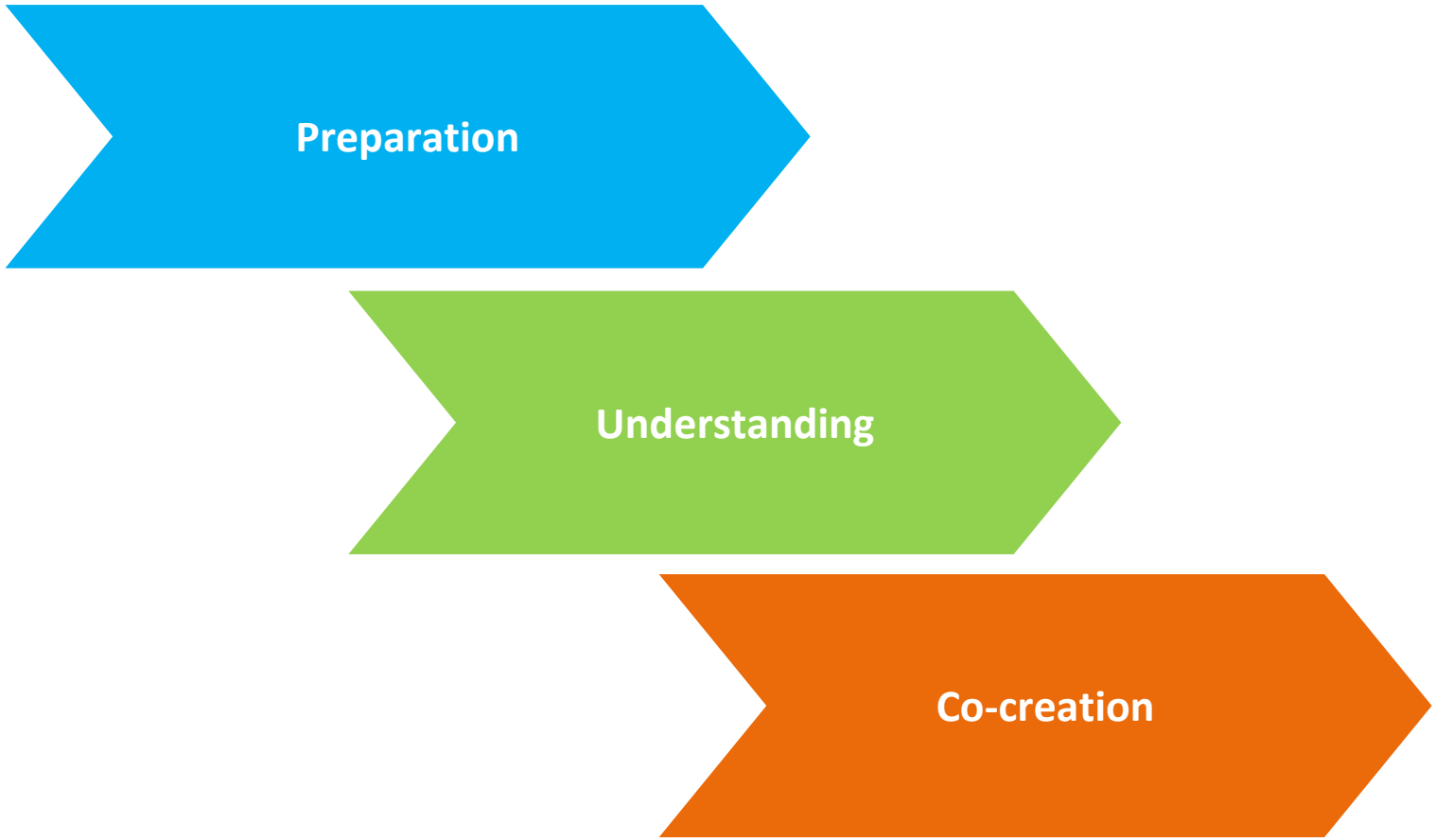
City Lab Phases and Process



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SPARCS City Lab Timeline

- Constitution of the city team and Fraunhofer team
- Methodology adaptation
- Exchange with partners
- Desktop research and preliminary analysis

Approx. 5 months

- Data collection and preliminary analysis
- Analysis of existing planning documents
- Preparation of the on-site assessment
- Elaboration of city profiles

Approx. 5 months

- On-site assessment
- Innovation Lab with local stakeholders

1 week on-site

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Preparatory Phase

Goal → familiarize researchers and local team with the city and defining the focus sectors.

Steps →

Constitution of the City Lab teams	Adaptation of mci methodology to the SPARCS project	Desktop research and preliminary analysis
		

Who?

• Fraunhofer • Local Teams	• Fraunhofer	• Fraunhofer

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Methodology adapted to the SPARCS sectors of focus

Indicators, action fields and benchmarks adapted and updated

Innovation

Social

ICT

Mobility

Buildings

Water & Sanitation

Solid waste and resources

Urban resilience

Environment

Governance

Industry

Energy

Economy

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Understanding Phase - Steps

Goal → Understanding the city and its core elements related to the focus sectors in our SPARCS project.

Steps →

Data collection and analysis	Analysis of strategic documents	Draft of city profile
		

Who?

• Cities & Fraunhofer	• Cities provide the documents • Fraunhofer analyzes/summarizes	• Fraunhofer

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Understanding Phase

Mci Framework adapted for SPARCS - 50 indicators defined and updated

Indicator Description	City Value	Green	Yellow	Red
Number of personal automobiles per cap (per cap.)	0.694	< 0.6	0.4 - 0.6	> 0.4
The ratio between the total number of passenger motorised vehicles (incl. cars and taxis) within the urban agglomeration and the population (passenger vehicles per 1000 city inhabitants)	749	< 250 (Amsterdam)	250 - 400	> 400 (poorly performing German cities)
Average age of fleet in use (years)	6	< 6	6 - 12	> 12
Kilometers of bicycle path per 100,000 population (km/100,000 inhabitants)	35.8	> 90	35-90	< 35
Number of mobile broadband subscriptions per 100 inhabitants (%)	119%	> 90	70 – 90	< 70

Analyzed Indicators example from RVK

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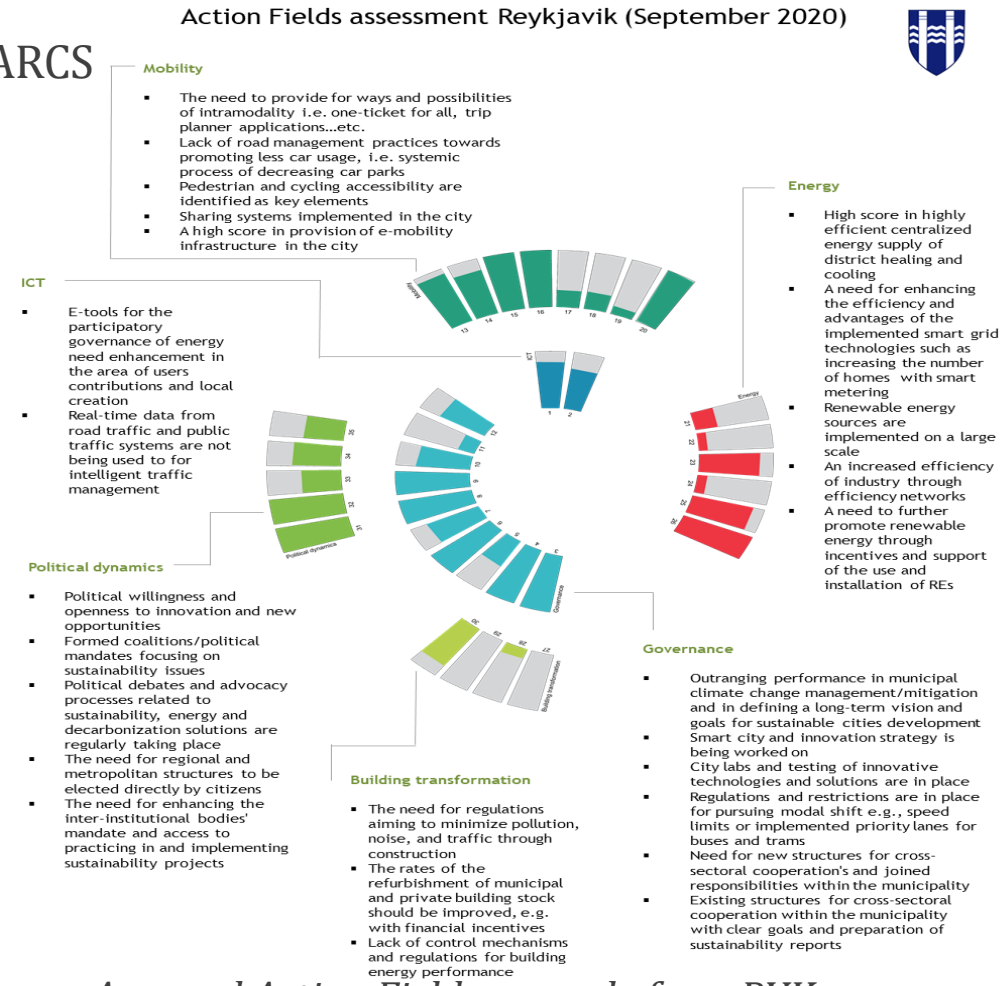
Understanding Phase

Mci Framework adapted for SPARCS - 35 action fields defined and updated



Assessed Action Fields example from RVK

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Understanding Phase

Reykjavik City Profile

Figure 4: Aerial view of Reykjavik (Hrönn Hrafnsdóttir, 2018)

Established in 1786, Reykjavik is relatively young in comparison to other European cities, in addition to being the northernmost capital in the world. It has a projected population of 130,000 for 2020, and encompasses a space of 274 km^2 with a density of 480 residents per kilometre squared (City of Reykjavik, 2011a). Reykjavik is located in southwest of Iceland, on the southern shore of Faxafloi bay. In total, the greater Reykjavik area includes about 60% of Iceland's residents (City of Reykjavik, 2011a), so it's not surprising that the city's culture influences the whole of Iceland. The coast is a large part of the city's identity, with its own portion within the **New Municipal Plan**, due to the fact that it is so closely tied to the economy.

City	Reykjavik
Population	131.136
Area	273km^2
Density	480/km^2
GDP/Capita	$73.191

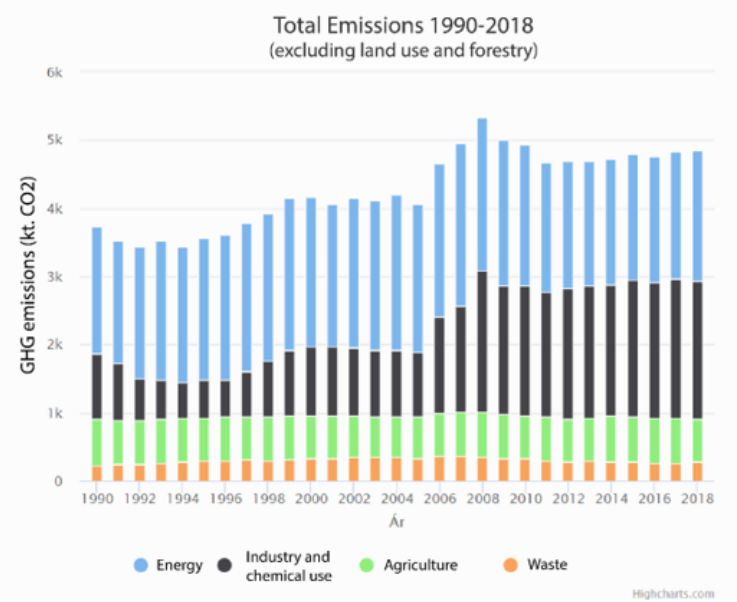

Figure 2: Iceland's total historical emissions, translated (Umhverfis Stofnun, 2018)

Icelanders benefit greatly from vast geothermal and hydropower resources. The electricity mix in Iceland is near 100% renewable with about 70% coming from hydropower and 30% from geothermal power plants (Orkustofnun, 2019a). In addition, geothermal energy covers over 90% of the heating demand in Iceland (Orkustofnun, 2019b). Affordable supply of electricity and heat has attracted foreign and domestic investment in various industries such as aluminum and silicon metal production, data-farming and geothermally heated greenhouses. Iceland intends to be carbon

Draft implementation plan example from RVK

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Co-creation Phase

Goal → Develop inter-relationship hypothesis within the analyzed system elements, possible project outlines, and future points of action.

Steps →

- High level and expert interviews

- Site visits in the city

- Project ideas development sessions

- Innovation workshop with local stakeholders

On-site week includes:

- 2 FHG researchers
- Approx. 12 interviews
- Approx. 3 site visits
- 1 workshop

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Co-creation Tools

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Co-creation Phase – On-site

Drafted project outline example from RVK's virtual on-site

ICT solution 1: Reykjavik turns green app

Citizen participation app for encouraging sustainable behaviour

Description and Objectives

There is a lack of sust
participate in environm
increase awareness a
the initiative. Users ca
exchanged for service
events.

Objectives:

- Increase awarer
- Reduce waste
- Support sustaina
- Promote sustain
- Promote refund
- Education

Waste solution 2: Introduction of Pay-as-you-throw system

Introduction of a usage-pricing model for disposing of municipal solid waste

Description and Objectives

Users are charged a rate based on how much w
local authority.Bin bags are taxed with pay-per—
cumbersome items, batteries, sofas, electrical a
that have a payment sticker attached, in official
purchased or weighed at central collection bins.
composting, are offered to a comparatively lowe

Objectives:

- Increase environmental awareness
- Promote separation at source
- Reduce waste production

Energy solution 3: Pilot Smart Grid at University

Universities´ Smart Grid project

Description and Objectives

The University Campus is an ideal location for implementing a Smart Grid project and gaining more circular systems experience. Local energy production and consultation, regulated by smart building management systems, could allow the city to gain experience with these systems and make more asserted decisions regarding the distribution networks, the existing regulations, and tariff systems.

Objectives:

- Promote the use of EV
- Reduce energy consumption
- Promote solar energy
- Develop adequate regulations for promoting the transition
- Increase environmental awareness

Suggested location:

Campus at the Reykjavik University

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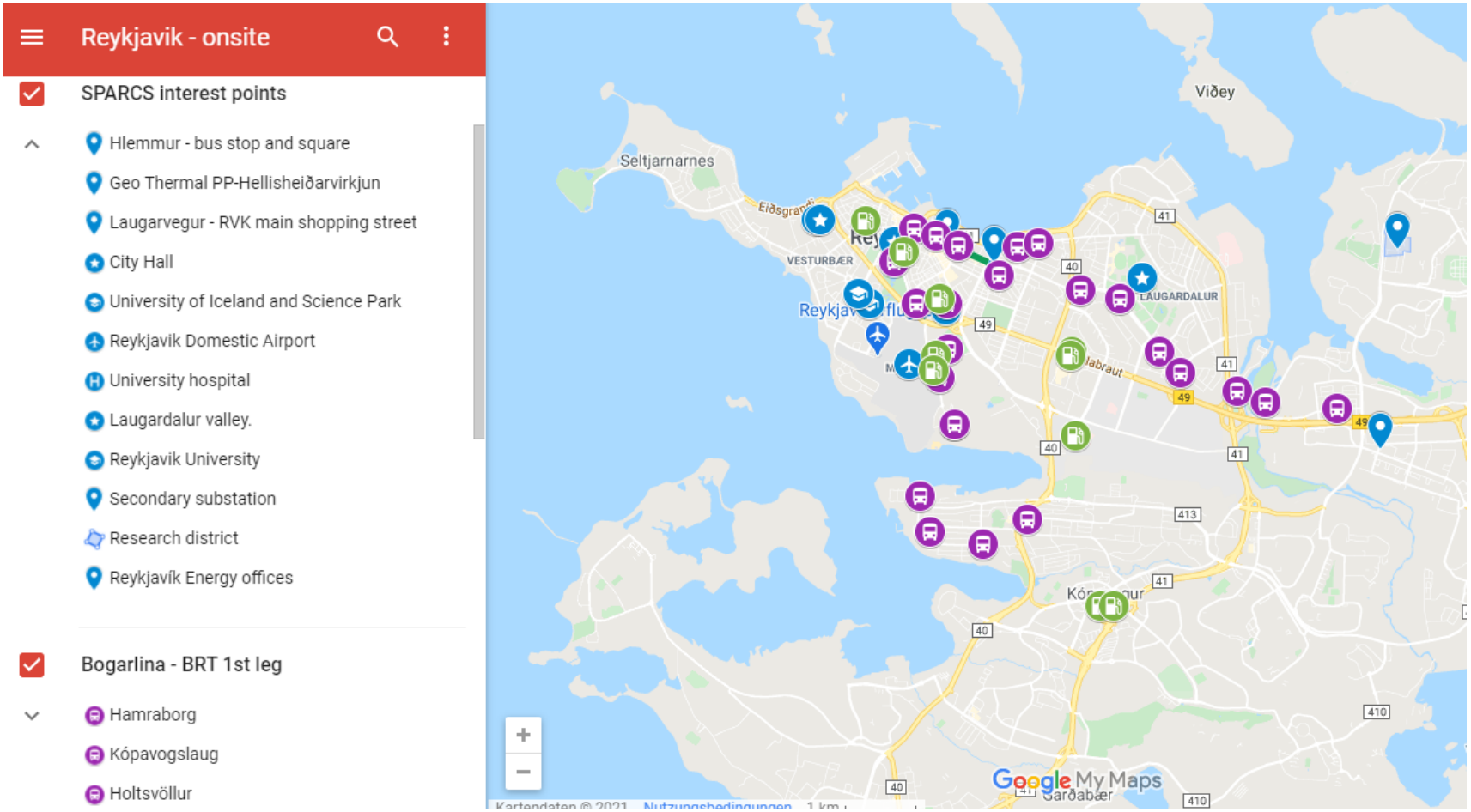
Co-creation Phase – On-site

Produced map of interest - example from RVK's virtual on-site



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Next steps

- Detailed project development

2: New circular bus routes

d Objectives

tem in Coimbatore is designed in a way that all bus lines go through
is radial routes. As a consequence the city center is very congested,
ea around Gandhipuram bus terminal. Many areas in between radial
grown with urban infill and these residents need bus route access.

v city growth patterns, the introduction of circular bus routes or ring
ion to current radial bus routes will increase the reach of bus

erefore proposed to introduce four circular bus routes for better
d to decongest the city center through these alternate ring routes.
ess bus service line as a high speed suggested with limited stops on
l road connecting airport.

jectives are:

t and provide access to residents between radial routes

congestion in the city center.

bus commuting experiences

irect travel to destinations without coming to the city center.

e project components finalized as given below.

tial Measures and impact

ils of proposed four circular lines are given below:

ng route sections overlapped with city ward map and blue line 1
d below:

Ramanathapuram Bus Stop - GH Bus Stop - Ukkadam Bus Stop - Poomarket Bus Stop- Coimbatore North Bus Stop - New Bus Stand - Housing Unit Bus Stop - Kannappa Nagar Bus Stop - Ganapathy Bus Stop - Voc Nagar Bus Stop - Villan Kuruchi Bus Stop - Cheran Managar Bus Stop - Peelamedu Bus Stop - Lakshmi Mills Bus Stop - Puliakulam Bus Stop

ng route sections overlapped with city ward map and yellow line 2
d below:

holes filled-up. The length of the road stretches for improvemen
Link1 about 12.01 km, Link 2 about 7.1 km, Link 3 about 3.21 k
about 0.90 km summed up to about 23 km.

This proposed express bus service on Avinashi arterial road net
to Shukravarapet was also earlier considered for an exclusive
system, but now the same is included in the proposed Metro trans
Therefore to differentiate the services of this express line operat
Electric bus operations and with limited stops, without speed
services line to help attract more commuters. Such route provid
till Metro commences its operations. The success of this route
other routes as well. Four electric bus services can initially be in
frequency. Overall about 2 new electric buses on each route and
services for express line route required to resume operations.

Legal / Policy

There is no legal hurdles to implement this project. Howev
Government state transport policy the proposed routes need ap
and RTA agencies. In other words,there are no policy or
implementing this project.

Financial (cost table)

Details	Quantity
Five new bus stops: Construction, amenities improvement, new amenities like bus poles, LED lighting, modernization with solar bus stops and other beautifications Unit costs estimated to be 25 lakhs per shelter	5
Brief road improvements to cover across 23 km in length across the proposed four routes considered. Most of the reasonable expenses on few stretches as paving/relaying and footpath/drainage provisions. Also two Road Over Bridges as required Unit costs estimated to be 1 cr l per km	23 km
Four circular routes demand assessment and rationalization of circular bus route operations and express bus services study. 4 month consulting study	4 months
Number of Electric Buses Fleet to be procured for proposed 4 bus routes and also on express electric bus services on Avinashi road. Unit costs estimated to be 2 cr per electric bus	8
Total Cost	**INR 41.25 crores (E**

- Elaboration of a roadmap

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