# WP3 Post-Monitoring Workshop

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

## About SPARCS

Sustainable energy Positive & zero cARbon CommunitieS demonstrates and validates technically and socioeconomically viable and replicable, innovative solutions for rolling out smart, integrated positive energy systems for the transition to a citizen centred zero carbon & resource efficient economy. SPARCS facilitates the participation of buildings to the energy market enabling new services and a virtual power plant concept, creating VirtualPositiveEnergy communities as energy democratic playground (positive energy districts can exchange energy with energy entities located outside the district). Seven cities will demonstrate 100+ actions turning buildings, blocks, and districts into energy prosumers. Impacts span economic growth, improved quality of life, and environmental benefits towards the EC policy framework for climate and energy, the SET plan and UN Sustainable Development goals. SPARCS co-creation brings together citizens, companies, research organizations, city planning and decision making entities, transforming cities to carbon-free inclusive communities. Lighthouse cities Espoo (FI) and Leipzig (DE) implement large demonstrations. Fellow cities Reykjavik (IS), Maia (PT), Lviv (UA), Kifissia (EL) and Kladno (CZ) prepare replication with hands-on feasibility studies. SPARCS identifies bankable actions to accelerate market uptake, pioneers innovative, exploitable governance and business models boosting the transformation processes, joint procurement procedures and citizen engaging mechanisms in an overarching city planning instrument toward the bold City Vision 2050. SPARCS engages 30 partners from 8 EU Member States (FI, DE, PT, CY, EL, BE, CZ, IT) and 2 non-EU countries (UA, IS), representing key stakeholders within the value chain of urban challenges and smart, sustainable cities bringing together three distinct but also overlapping knowledge areas: (i) City Energy Systems, (ii) ICT and Interoperability, (iii) Business Innovation and Market Knowledge.

## Partners

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## SUMMARY

This report covers the results of SPARCS WP3 Post-Monitoring Workshop, held on 30 August 2023 in Otaniemi, Espoo. The aim of the workshop was to develop strategies for monitoring activities beyond the project's end date in September 2024. In addition to direct monitoring plans, the workshop also examined the scaling up and replication plans of selected Interventions and activities from the post-monitoring perspective.

The organization of the workshop is the last project milestone (MS9) of WP3. The workshop was organized by ESP. Representatives from six WP3 partner organizations participated in the workshop, and for two the canvas – created to act as the basic backbone of the workshop – was sent for remote working after the workshop.

The results show that there is great variety between the different measures and Interventions in relation to post-monitoring activities, and replication and upscaling plans. Some Interventions have already been upscaled and replicated, and the related monitoring processes as well, as they have been proven working concepts for further replication and upscaling. Some Interventions, on the other hand, do not have a clear path after the project defined yet, as the demonstration requires modifications in further iterations.

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# 1. INTRODUCTION

In SPARCS Work Package 3 (WP3) 'Demonstration Lighthouse City Espoo', the aim is to demonstrate solutions for Energy Positive Blocks and Districts that operate as an active part of the local energy systems, including RES integration, smart buildings, smart grid, energy storage, electro mobility and EV charging in three demonstration areas Lippulaiva blocks (Espoonlahti district), Sello blocks (Leppävaara district), and Kera area. The demonstrations provide new solutions – integrated to the built environment – that can help to reduce local emissions and energy use. The demonstrations are monitored as part of the project to ensure their applicability and to gain in-depth knowledge of the different drivers and barriers in their possible upscaling or replication.

This report covers the contents of a Post-Monitoring Strategy workshop, organized on 30 August 2023 in Otaniemi, Espoo by the City of Espoo (ESP) for the local WP3 project partner consortium. The aim of the workshop was to draft strategies for post-monitoring after the project's end date in September 2024, and to examine how the monitoring is connected with the upscaling and replication potential of selected SPARCS solutions. The organization of the workshop is the last project milestone (MS9) of WP3. Representatives from six WP3 partner organizations in total participated in the workshop live. For two organizations, the 'post-monitoring canvas' – created to act as the basic backbone of the workshop – was sent for remote working after the workshop. Inputs from all organizations was gathered.

The report includes a summary of the post-monitoring strategies, and more detailed tables of selected Interventions or other cases from the WP3 demonstrations. The agenda and workflow of the workshop are also presented.

# 2. DESIGN AND PROCESS OF THE POST-MONITORING WORKSHOP

The workshop was organized as a live event on 30 August 2023. The workshop was held in City of Espoo premises in Otaniemi, Espoo. The workshop was planned as a live event to spark discussion and collaboration between the participants. A 'canvas' for the post-monitoring period was crafted by ESP to act as a backbone for the workshop process, including the discussions in small groups. The presented questions can be seen in the partner-specific Tables in section 3. Invitations were sent in advance, and at least one participant from each WP3 partner organization was asked to participate. People from six partner organization participated in the event, totalling to 14 participants. Two workshops organizers from ESP hosted the workshops, gave instructions for the working process, facilitated two small groups, and facilitated the general discussion in the end. ESP was also responsible in leading the process to compile this report after the workshop.

The organization of the workshop is the last project Milestone (MS9) in WP3.

In the beginning of the workshop, the participants each selected a specific Intervention or other type of activity from the project for their own working process (as also instructed beforehand through the invite emails and registration links). The aim was to focus on the

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question of post-monitoring – and replication and upscaling links to monitoring – through practical cases from the project.

Each participant was given the task to fill in the canvas with the predefined questions related to current monitoring, plans for monitoring after the project, utilization of key learnings and dissemination activities on the selected case, and its links to larger impacts and development topics in and beyond the participant's own organization and the project (Figure 1). The canvas was provided both as a physical print-out and as a PowerPoint slide that could be filled in with one's laptop – most participants worked on the digital version of the canvas.

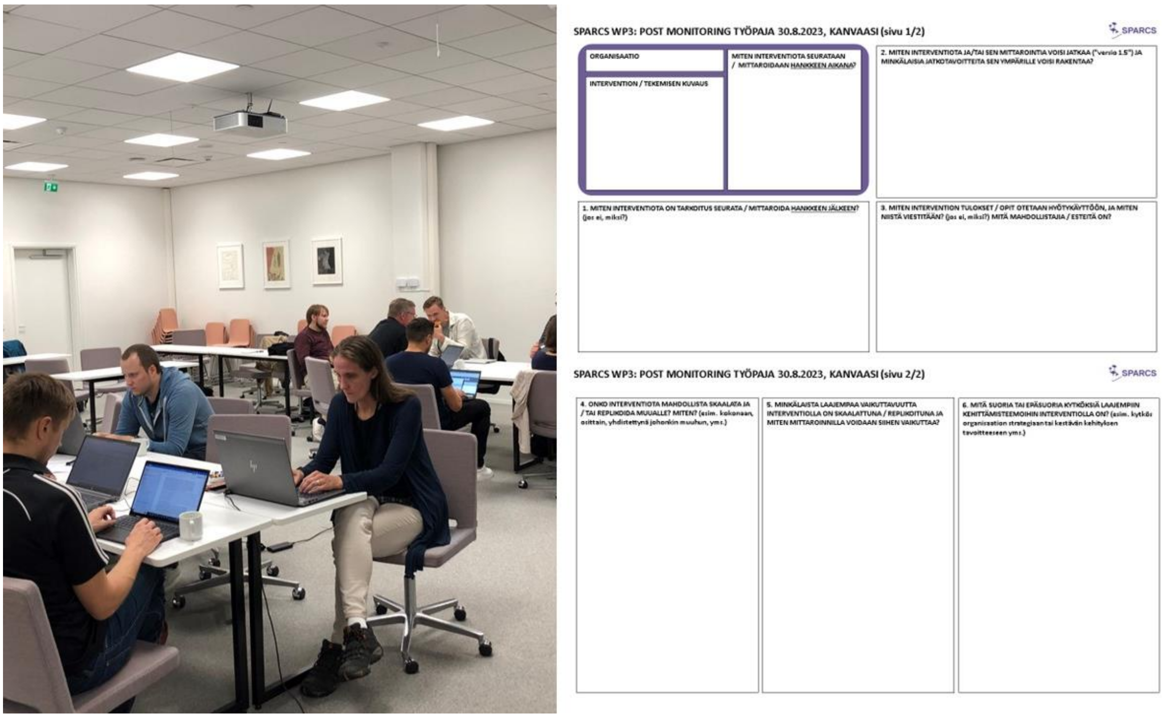


*Figure 1. An online canvas was used in the workshop to gather the inputs and to spark discussions in two two small groups during the workshop*

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The workshop was three hours in total. The program of the workshop is presented below.

**Post-monitoring workshop agenda; 31 August 2023**
**12:00-15:00; Otaniemi, Espoo**

*12:00 Start of the workshop*

*12:15 Briefing: Why we are here today?, and workshop process and materials*

*12:30 Phase I: Working on the canvas in small groups and discussions*

*13:15 Break*

*13:30 Phase II: Working on the canvas in small groups (continued) and discussions*

*14:20 Summary of main results and small group discussions*

*14:45 Final words: Next steps*

*15:00 Workshop ends*

The canvases were gathered together in a digital format after the workshop in VTT Teams (PowerPoint slides or photographs of the manually filled-in print-out versions of the canvas). The participants had some time to finish and update the canvases after the workshop. This report has also been sent to the partners for updates in a later stage. For the two organizations that could not participate in the live workshop due to scheduling conflicts, the digital canvas was sent afterwards together with detailed instructions so that the inputs and perspectives of all WP3 organizations could be included here. A possibility for a one-on-one meeting was also proposed to work on the canvas if needed.

The final inputs from the canvases – the partners' strategies on post-monitoring activities – are presented below.

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## 3. POST-MONITORING STRATEGIES - WORKSHOP RESULTS

The post-monitoring strategies of the WP3 partner organizations are presented below. They are presented through key Interventions and other activities from the project. The Tables covering the relevant topics include plans for post-monitoring activity after the project's timeline, its linkages with possible replication and upscaling activities, and its relation to larger expected impacts on sustainable development and organization-level strategic goals.

### 3.1 General post-monitoring strategies

For most of the activities, the post-project monitoring is rather straight-forward. Monitoring of the activity is possible and easy (often automated) to gather if there is suitable equipment and processes already in place. This is especially relevant for activities that form a basic fundamental part of the local energy system, and have a natural 'life' after the project as well. For research-focused demonstrations, the concepts and learnings continue to build the larger thematic topic on a methodological level. For some, the post-monitoring phase would require re-configuration of the aims and goals, in order to increase the impact, effectiveness and feasibility of the activity. Further additions and changes were identified for all the activities that could improve on the current version of the demonstration as a 'version 1.5' for future iterations, and concurrently also improve the results from the monitoring.

The monitoring is directly linked with knowledge and capacity building, as well as dissemination and generated impact. Many of the project demos have already acted as concrete examples for new similar activities in other areas, and the results have been put into use. Financial issues might be a bottleneck for large-scale further utilization of the demos. Also some of the demonstration require further feasibility studies to localize them to other areas and contexts. Dissemination of the demonstrations and their results are also clearly part of the 'post-project' life of all of the demos presented in the tables, both inside and outside the organization.

### 3.2 Partner level post-monitoring strategies on selected cases

In the next sections, each organization presents 1-5 different key Interventions or other type of activities from the project and their respective post-monitoring canvases. The canvases are presented as tables with the initial questions from the canvas template, and the inputs provided by the respective partner organization. The tables provide plans for post-monitoring activities after the project's timeline – beyond September 2024, the project's expected end date – and the identified connections between the (post-)monitoring and the replication and upscaling potential, and the related linkages to larger themes, including organization level strategies and sustainable development.

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### 3.2.1 Siemens

Two key activities from the project are highlighted below: 1) Peak load management for district heating, and 2) Data Sharing and Interoperability.

*Table 1. Siemens #1*

| **PEAK LOAD MANAGEMENT FOR DISTRICT HEATING**<br>Peak load management for district heating utilizing demand-response mechanisms. | |
|---|---|
| *Monitoring of the activity during the project* | Monitoring based on KPI's on:<br>• Energy monitoring on heating consumption<br>• Fortum Energy Utility forecast on DH network energy demand<br>• Outside and inside temperature |
| *Monitoring plans for the activity after the project ends* | Peak load measurement.<br>Fortum peak load energy price and cost optimization. |
| *Possibilities and further aims of the activity as a "version 1.5" after the project* | Extending the flexibility in the heat consumption by optimizing and increasing storage capacity. |
| *Utilization of the learnings and outcomes of the activity, and their dissemination* | Limit of flexible loads on consumption and extension of heat storage depends on investment funds. Incentives to be agreed with the energy utility.<br>Dissemination of intervention benefits in relevant ecosystem forums. |
| *Plans and possibilities for upscaling or replicating the activity (e.g. fully, partly, in a combination to something etc.), including their further monitoring* | Heating demand in Finland represents a major part of total energy consumption. Introduction of demand-side management could potentially reduce the environmental impact of the energy supply.<br>Replication of SPARCs intervention in other district heating networks and regions and by extending the demand side management in the current network.<br>How? Integration of the heat demand asset (e.g. building) with the network utility and application of relevant business model. |
| *Identified larger impacts of the activity through upscaling and/or replication, and their continued monitoring* | With the demand-side management the heating supply can be optimized and environmental impact can be reduced enabling better utilization of renewable energy resources.<br>20% of global energy demand is consumed in buildings. |

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|---|---|
| | Sector Integration demonstrated by integrating energy consumption from heat, electricity and mobility. |
| *(In)Direct connections to larger development topics (e.g. links to organization's strategy or goals in sustainable development etc.)* | District heating network monopoly need to be disrupted by separating production and distribution. An open business model for Demand-response in district heating could speed up the development.<br>Increasing our contribution to carbon neutral society through customer avoided emissions. |

*Table 2. Siemens #2*

| **DATA SHARING & INTEROPERABILITY**<br>How building data can be shared between participants. Live data from sensors and building drawings etc. | |
|---|---|
| *Monitoring of the activity during the project* | Live monitoring of created integrations and platforms and calculating their uptime. Possibilities of integrating different systems. |
| *Monitoring plans for the activity after the project ends* | Needed integrations and systems are kept live and monitored.<br>Different needs and possibilities for integrations and interoperability are continuously coming and the systems need to be evaluated that they are not slowing down other projects. |
| *Possibilities and further aims of the activity as a "version 1.5" after the project* | More popular standards for data modelling would be needed and evaluated which should be supported by the systems so manual mapping would not be needed and machines could understand and find the relevant data from new buildings as well.<br>Building data from BIM and Laser scans could be used to enhance remote engineering. BIM model good to have one view in different systems and no need to everyone creates their own model. |
| *Utilization of the learnings and outcomes of the activity, and their dissemination* | Different data modelling standards have been evaluated and need has been clear so new platforms do support better data modelling. |
| *Plans and possibilities for upscaling or replicating the activity (e.g. fully, partly, in a combination to something etc.), including their further monitoring* | Integrations are designed to be as scalable as possible and using popular formats that can be used in new buildings / data sources. No popular data modelling standards yet used in buildings, so replicating will need manual effort to find similar points in new building. |

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| *Identified larger impacts of the activity through upscaling and/or replication, and their continued monitoring* | If buildings would be using standardized models then it would allow easier integration of new buildings in the same systems and would allow creating more general programs that could for example allow including smaller buildings that otherwise would not be financially feasible to use manual effort. |
| *(In)Direct connections to larger development topics (e.g. links to organization's strategy or goals in sustainable development etc.)* | If manual effort is decreased then even smaller buildings can benefit for example on the energy saving projects done in bigger projects which would have direct impact on emissions. Also organisation can focus more on creating general solutions and services instead of having to do projects per building / one customer. |

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### 3.2.2 Kone

Majority of actions and demonstrations carried out by KONE within the SPARCS project have related to co-creation, sustainable mobility and smart energy-efficient buildings. The activities related to smart buildings are closest to current business of KONE and thus in detailed scope.

One key activity from the project is highlighted below: Smart energy management.

*Table 3. Kone #1*

| **SMART ENERGY MANAGEMENT**<br><br>As a part of intervention E6 Smart energy management, KONE, in collaboration with Siemens, has developed methods with which elevators, escalators and people flow intelligence solutions could be better integrated with smart building energy management systems. | |
|---|---|
| *Monitoring of the activity during the project* | The solution was evaluated against the Technical Readiness Level (TRL) as it was treated as any other R&D project. |
| *Monitoring plans for the activity after the project ends* | The solution should be re-evaluated against the potential new (pivoted) business case of using the short-term elevator power demand forecaster in emergency power conditions. |
| *Possibilities and further aims of the activity as a "version 1.5" after the project* | Pivoting the solution into emergency power use requires suitable testbed with relevant metrics about the power quality and availability in real off-grid conditions. A separate set of metrics should be formed to evaluate the costs and expected savings. |
| *Utilization of the learnings and outcomes of the activity, and their dissemination* | In case of potential business case, the pivoted solution could be piloted and go through the typical go-to-market processes. |
| *Plans and possibilities for upscaling or replicating the activity (e.g. fully, partly, in a combination to something etc.), including their further monitoring* | Most non-residential buildings have some sort of an emergency power system, thus, the system could be relatively scalable in terms of business opportunity (if proven business case in typical buildings). Partnership model could accelerate the success. |
| *Identified larger impacts of the activity through upscaling and/or replication, and their continued monitoring* | Monitoring the technical performance of the system in pilot buildings and the financial performance projections would support marketing and scaling the solution internationally. |
| *(In)Direct connections to larger development topics (e.g. links to organization's* | KONE's strategy is Sustainable Success with Customers. Optimizing the size and functionality of the emergency power system can be used to reduce the embodied carbon through |

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|---|---|
| *strategy or goals in sustainable development etc.)* | minimizing the backup power capacity, which could also provide financial savings in investments, planning and operation, i.e., throughout the lifecycle. Alternatively, the solution could be used to secure smoother people flow in emergency power conditions, e.g., through more elevators connected to the emergency power supply. |

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### 3.2.3 Citycon

One key activity from the project is highlighted in the table below: Lippulaiva smart energy system / monitoring.

*Table 4. Citycon #1*

| LIPPULAIVA SMART ENERGY SYSTEM / MONITORING | |
|---|---|
| In multipurpose big scale building, that uses several different energy sources for heating and cooling purposes and is energy efficient, it is highly important to understand where and how much building uses each of the energy sources. Within the SPARCS project, we have created several new KPI reports, that hopefully can serve Citycon, in existing buildings as well. | |
| *Monitoring of the activity during the project* | Ongoing data collection for each of the energy sources during the use-phase of Lippulaiva. Ongoing development of the metering, reporting and KPIs. |
| *Monitoring plans for the activity after the project ends* | More or less all the meters that have been installed, are the ones we would have in place even without SPARCS. What makes the difference is the KPIs and other reports that have been created for this purpose.<br>Measurements, metering and KPIs after the project does not differ in any way from measurement during the project. The same data and key figures derived from it will be used for operational purposes even after the project. |
| *Possibilities and further aims of the activity as a "version 1.5" after the project* | So far basis of the metering and reporting development has been SPARCS related KPIs. For company purposes it would be wise to understand which of the created meters and reports can be used in existing other premises.<br>As our company have aim to be carbon neutral before 2030, it is crucial to understand how big percentage of energy is carbon neutral. In assets that have several energy sources like electricity, heating, cooling it may vary between the energy sources which are carbon neutral and which not. By understanding the energy usage in real-time you can evaluate possibilities to effect on energy sources usage. |
| *Utilization of the learnings and outcomes of the activity, and their dissemination* | The learning produced by the project will be used in the company's internal planning of future projects, both for new and existing properties.<br>As with this precise metering format, we have more holistic understanding of energy usage, we can compare ordinary asset energy concept with most modern energy concept. That is crucial information when considering new energy investments and concepts for existing premises. |

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|---|---|
| | As other property owners are having similar kind of plans, we can share the knowledge and knowhow on public and non-public events about the topic. |
| *Plans and possibilities for upscaling or replicating the activity (e.g. fully, partly, in a combination to something etc.), including their further monitoring* | As we have created new reporting format and KPIs those can be copied in other of our assets. As many of the energy sources, meters etc.<br>Replications can be made in completely new assets at least with major parts. To existing assets full replicate is impossible to build on. But still some of the parts can be copied like electricity battery etc. |
| *Identified larger impacts of the activity through upscaling and/or replication, and their continued monitoring* | Because of Lippulaiva's decision to use geoenergy as main heating energy source, some of the neighbourhood buildings will have the same system in use as well. Compared to the model, that each of the users, would have had their own system, this model has already created construction time carbon emissions savings. |
| *(In)Direct connections to larger development topics (e.g. links to organization's strategy or goals in sustainable development etc.)* | As our company and most of the peers are heading to carbon neutral, definitely smart monitoring and use of energy is needed to achieve targets. Always the best way is to use energy as less as possible.<br>As our company sustainability strategy also sets, that all of the assets should produce some part of the energy by themselves, this is setting parameters what kind of investment are usable and what level.<br>To achieve greater results, we need to do the same measurements and actions in all of the assets. |

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### 3.2.4 Adven

One key activity from the project is highlighted below: Development of Lippulaiva energy production control system.

*Table 5. Adven #1*

| DEVELOPMENT OF LIPPULAIVA ENERGY PRODUCTION CONTROL SYSTEM | |
|---|---|
| The continuous development of the Lippulaiva energy production control system (heating, cooling, hot water, use of excess heat, storage of geoenergy), to reach optimal production solutions that take into consideration outdoor temperature and different energy user profiles. | |
| *Monitoring of the activity during the project* | Monitoring of energy consumption by different users on a monthly basis.<br>Monitoring the energy production efficiency on an hourly basis. |
| *Monitoring plans for the activity after the project ends* | The Intervention is monitored after the project as well as it is part of Adven's production unit. |
| *Possibilities and further aims of the activity as a "version 1.5" after the project* | Closer integration of the control system of the secondary side of the shopping center (building technology) into Adven's system. The ventilation control and settings improve/enhance the optimal operation of the Adven system. |
| *Utilization of the learnings and outcomes of the activity, and their dissemination* | Adven has a "continuous improvement" practice in place. The results obtained from the implemented plants are utilized in the planning and dimensioning of new similar plants. |
| *Plans and possibilities for upscaling or replicating the activity (e.g. fully, partly, in a combination to something etc.), including their further monitoring* | Yes, it is possible, and this has already been done in the case of Lippulaiva. The obtained results (e.g. geoenergy storage in bedrock) have been utilized in the planning and implementation of new facilities. |
| *Identified larger impacts of the activity through upscaling and/or replication, and their continued monitoring* | Energy solutions for entire city centres can be implemented competitively and carbon-free in a decentralized manner without traditional district heating. |
| *(In)Direct connections to larger development topics (e.g. links to organization's strategy or goals in sustainable development etc.)* | Decentralized energy implementation per city centre can be implemented carbon-free, following the principles of sustainable development. |

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### 3.2.5 Plugit Finland

One key activity from the project is highlighted below: Public bus charging system, charging as a service.

*Table 6. Plugit Finland #1*

| **LEPÄÄVAARA E-VEHICLE CHARGING SYSTEM** | |
|---|---|
| 1) Shared utilization and 2) optimization of the charging system in Leppävaara. | |
| *Monitoring of the activity during the project* | 1) Shared use possibilities have been limited during the project's timeline. City of Espoo has not accepted to open this area to public use due space limitations.<br>2) Effects of charging peaks (min/hour/day) analysed and cost benefit / feasibility calculations done about shaving the peaks and load management. The contract with HSL limits optimization done in practice. |
| *Monitoring plans for the activity after the project ends* | 1) After the contract ends, HSL will terminate the provided service. Before that some of the chargers will be reinstalled to a different location due Sello shopping centre extension construction.<br>2) Monitoring of market price of electricity and demand charge, and their effects to benefits. Trying to avoid buying too much power from the grid. |
| *Possibilities and further aims of the activity as a "version 1.5" after the project* | 1) Build more cost-effective charging infrastructure, which can be used with multiple stakeholders.<br>2) Has been replicated elsewhere. Utilizing battery storages during high power charging. Effects of the market price of electricity. Limits of the grid interface. |
| *Utilization of the learnings and outcomes of the activity, and their dissemination* | 1) Need to involve more stakeholders with vehicles from the beginning.<br>2) Optimization with public charging is possible, but the system needs to be large enough and have multiple stakeholders. |
| *Plans and possibilities for upscaling or replicating the activity (e.g. fully, partly, in a combination to something etc.), including their further monitoring* | - Shift from public transportation solutions to route and logistics solutions<br>- Public shared use charging systems<br>- Charging as part of urban planning and development<br>- Maximize cost-effective charging solutions |

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|---|---|
| *Identified larger impacts of the activity through upscaling and/or replication, and their continued monitoring* | - Reducing CO2 emissions<br>- Increasing the resiliency of the electricity grid<br>- Minimizing costs |
| *(In)Direct connections to larger development topics (e.g. links to organization's strategy or goals in sustainable development etc.)* | - Support for local carbon neutrality targets<br>- Support for reaching nation / EU-level targets in sustainability |

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### 3.2.6 VTT

Five key activities from the project are highlighted below: 1) Sello virtual twin (case energy); 2) Optimization of EV charging; 3) Lippulaiva energy consumption analysis and energy use case studies; 4) Alliance business models; and 5) Air quality management.

*Table 7. VTT #1*

| **SELLO VIRTUAL TWIN (CASE ENERGY)**<br>This activity includes:<br>• Next-day energy forecast models (electricity, district heating, local PV production, electric car charging).<br>• Prediction model for utilizing Sello's structures as heat storage.<br>• 3D BIM-based model for energy and HVAC data monitoring, analysis and locating possible faults. | |
|---|---|
| *Monitoring of the activity during the project* | The intervention is followed up by KPIs. The number and accuracy (NRMSE) of the next-day energy forecasts for Sello's electricity (total electricity consumption, PV panels' electricity generation) and district heating. |
| *Monitoring plans for the activity after the project ends* | The challenge is that VTT is a research organization which does projects. Related that the intervention can be monitored as it is if Sello data is received in the future and provided that the systems work and their maintenance does not require additional work. But e.g. solving problems or further development requires a follow-up project after the SPARCS project. |
| *Possibilities and further aims of the activity as a “version 1.5” after the project* | Continuation of the measurements: The measurements will be continued at least until the end of the project. After that, the intervention and its measurement can be continued if Sello data is obtained from Siemens and the work is projected in some way.<br>Future goals: Intervention models/basic technical solutions will be utilized in numerous co-financed and commercial research and development (R&D) projects with the data of the buildings and related energy assets under review. Regarding Sello, VTT is open to further discussions. |
| *Utilization of the learnings and outcomes of the activity, and their dissemination* | Results for utilization: Intervention models and related basic technical solutions will be utilized in numerous co-financed and commercial research and development (R&D) projects with the data of the buildings and related energy assets under review. Communication is mostly handled through seminar presentations and possible scientific articles. Solutions are also presented in webinars when needed. |
| *Plans and possibilities for upscaling or replicating* | Sello virtual twin’s three main functions are easy to scale to other buildings as follows. |

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| *the activity (e.g. fully, partly, in a combination to something etc.), including their further monitoring* | • Energy next day forecasting models can be scaled to other buildings or energy assets by changing Sello's measurement points to other building measurement points and teaching the model with that data.<br>• The model of utilizing structures as heat storage can be scaled to other buildings or even regional analysis by changing Sello's measurement points to studied building measurement points and teaching the model with that data.<br>• The monitoring and visualization of other the building energy or HVAC system using the 3D BIM model requires replacing Sello's BIM model and measurement points with the BIM model and measurement points of the studied building and configuring the used BIM & building automation system integration model. |
| *Identified larger impacts of the activity through upscaling and/or replication, and their continued monitoring* | Wider effectiveness by scaling models to other buildings:<br>• Forecast models can be used via easy-to-use REST interfaces as part of a virtual power plant or building demand response solutions or when optimizing the energy efficiency of buildings.<br>• Models for structures as heat storage models can be used in optimizing the energy efficiency of buildings through REST interfaces.<br>• 3D BIM models + energy and HVAC system measurement data: Using this function, faults related to energy and HVAC systems can be visually detected and located with the help of a 3D virtual BIM based application that works in a web browser. |
| *(In)Direct connections to larger development topics (e.g. links to organization's strategy or goals in sustainable development etc.)* | Indirect connections to next VTT's strategies<br>• Smart and sustainable built environment<br>• Carbon-neutral and flexible energy system |

*Table 8. VTT #2*

| **OPTIMIZATION OF EV CHARGING**<br><br>The target of the action was to optimize the integration of EV charging, including all mobility modes. The action was carried out by analysing the mobility demand through simulations and evaluating how the charging could be altered e.g. based on pricing signals to minimize power peaks and costs. | |
|---|---|
| *Monitoring of the activity during the project* | As the action was based on simulations, it is only monitored as done/not done. |

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|---|---|
| *Monitoring plans for the activity after the project ends* | The action was a theoretical study and cannot as such be monitored. |
| *Possibilities and further aims of the activity as a "version 1.5" after the project* | A new approach to analysing the EV charging demand was developed. The simulation methodology is in a relatively immature state and could be further developed. For instance, the usability and flexibility could be improved. A few scenarios were analysed based on a couple of electricity price examples. The analysis could be extended by e.g. clustering the actual electricity price levels and variations during a year. In this way, several realistic price scenarios could be developed for further analysis. |
| *Utilization of the learnings and outcomes of the activity, and their dissemination* | The analysis shows that there is a potential to minimize the charging power without disturbing the usage of EVs. However, the analysis should be extended and refined and the input data should be further validated before the results are utilized in practise. The results could be reported in scientific papers. However, the results would probably need to be refined prior to publication, and currently there are not enough resources to carry out the work. |
| *Plans and possibilities for upscaling or replicating the activity (e.g. fully, partly, in a combination to something etc.), including their further monitoring* | The simulation methodology can be very well used in other areas or scaled up to a larger area. However, this can be the case only if further development is first done. The current version is the very first one, and some further work is needed to make it user friendly. The usage also requires knowledge. The most realistic way of replication is to perform the analysis as a service (VTT provides analysis for a customer). Preparing the simulation tool to be used directly by external users would require much more effort. |
| *Identified larger impacts of the activity through upscaling and/or replication, and their continued monitoring* | Replication of the analysis can provide insights that are relevant to a specific area, this can be important as all results cannot be generalized. |
| *(In)Direct connections to larger development topics (e.g. links to organization's strategy or goals in sustainable development etc.)* | As the share of electric vehicles increase, the need for smart charging schemes will grow. First of all, smart charging can lower power peaks and, hence, minimize the costs (both energy costs and investment costs). Smart charging also has the potential to support the decarbonisation of the energy system as flexibility and demand response can be provided to maximise the usage of renewable energy (e.g. wind, solar). |

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*Table 9. VTT #3*

| LIPPULAIVA ENERGY CONSUMPTION ANALYSIS & ENERGY USE CASE STUDIES<br>Add here a short description of the activity/Intervention | |
|---|---|
| *Monitoring of the activity during the project* | During the project reports of energy consumption figures by different end use consumptions and energy carriers |
| *Monitoring plans for the activity after the project ends* | No monitoring plans for VTTs part, research in the activity was mostly conducted as case studies. |
| *Possibilities and further aims of the activity as a "version 1.5" after the project* | More technical figures on the development of the energy system performance in the long term, for example borehole field temperatures.<br>System level KPI information if in-depth technical figures are not possible.<br>Possible further projects on the utilization of the novel systems. (E.g. Use of the present thermal and electrical energy storages for local energy resilience) |
| *Utilization of the learnings and outcomes of the activity, and their dissemination* | Utilization of learned lessons from the new systems requires information sharing. |
| *Plans and possibilities for upscaling or replicating the activity (e.g. fully, partly, in a combination to something etc.), including their further monitoring* | The intervention (in its successful parts) can be replicated for similar type of energy systems where multiple type of con/prosumers are served with singular energy system with multiple energy carriers. |
| *Identified larger impacts of the activity through upscaling and/or replication, and their continued monitoring* | Information about the operation and KPI development of Lippulaiva energy system is helpful for PED developments including similar components, e.g. energy storage. Learnings from Lippulaiva (e.g. unprofitability of two-way DH connection) can be utilized to other projects in planning stage. |
| *(In)Direct connections to larger development topics (e.g. links to organization's strategy or goals in sustainable development etc.)* | Intervention (efficient management of energy flows within a group of diverse con/prosumers) is instrumental to the development of net zero / net carbon / self-sufficient / resilient districts. |

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*Table 10. VTT #4*

| **ALLIANCE BUSINESS MODEL**<br><br>Alliance Business Model describes the combination of singular business models that form the basis for multi-organizational PED solutions. It aims to illustrate the roles and aims of different actors in SPARCS demo areas, and to show how these work together. It also points out the possible gaps and missing actors. | |
|---|---|
| *Monitoring of the activity during the project* | Alliance Business Models will be formed and further developed during the project, and the progress is reported in relevant deliverables. |
| *Monitoring plans for the activity after the project ends* | The next steps will be defined by the progress of the model. The follow-up in to the SPARCS demo-cases could be viable – however, the aim is to create models for wider application. |
| *Possibilities and further aims of the activity as a "version 1.5" after the project* | The model can be further developed in other PED demonstrations and complex multi-stakeholder and multi-organization business cases. |
| *Utilization of the learnings and outcomes of the activity, and their dissemination* | In depth studies of the subject may lead to scientific publications and / or academic theses. It is possible, that eventually the model appears not to be worthwhile or seems too complicated / complex / laborious for practical use-cases, which could limit its use. |
| *Plans and possibilities for upscaling or replicating the activity (e.g. fully, partly, in a combination to something etc.), including their further monitoring* | Yes, assumably the approach of the model can be applied to different multi-stakeholder – multi-organization business cases. However, each model based on the SPARCS demos is case-specific. |
| *Identified larger impacts of the activity through upscaling and/or replication, and their continued monitoring* | Applying the model should create better understanding over such business cases and increase efficiency in PED development. |
| *(In)Direct connections to larger development topics (e.g. links to organization's strategy or goals in sustainable development etc.)* | Better understanding over the business cases related to PEDs and highlighting the gaps and functional solutions should speed up the green transition and commercialization of novel technologies. |

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*Table 11. VTT #5*

| **AIR QUALITY MEASURING**<br><br>Air quality measuring. Collecting data from HSY and placing an equipment in Lippulaiva to gather data. | |
|---|---|
| *Monitoring of the activity during the project* | The air quality data is collected and loaded in the SPARCS data platform. |
| *Monitoring plans for the activity after the project ends* | HSY will continue monitoring the air quality in Espoo in several locations. The equipment in Lippulaiva is a good question. |
| *Possibilities and further aims of the activity as a "version 1.5" after the project* | It would be great if this would be taken to use by someone who needs the information, for example to plan how the solutions in the Lippulaiva area could be altered to enhance the air quality. |
| *Utilization of the learnings and outcomes of the activity, and their dissemination* | Engage the people from Lippulaiva or Espoo to follow and monitor the air quality. The challenge is that the air quality in Finland is very good generally, so there might be lack of motivation. Maybe we could find a PhD student who could use it? |
| *Plans and possibilities for upscaling or replicating the activity (e.g. fully, partly, in a combination to something etc.), including their further monitoring* | Replication is easy, similar equipment could be used in other places where the outdoor air should be monitored. If the work is to be scaled, this could be done by placing similar equipment in other places. These are good quality equipment and it is possible to compare the results with the measurements done by HSY. |
| *Identified larger impacts of the activity through upscaling and/or replication, and their continued monitoring* | This is not really a question of the built environment, maybe related more to traffic? |
| *(In)Direct connections to larger development topics (e.g. links to organization's strategy or goals in sustainable development etc.)* | n/a |

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### 3.2.7 City of Espoo

In Espoo, the demonstrations have revolved around how new sustainable urban energy and e-mobility solutions can be combined with existing and emerging urban planning and development practices, including land use development, district-level development commitments and agreements, co-creation processes for PEDs and sustainable and smart urban districts, and citizen engagement. The work done in SPARCS is situated in a longer development process line, where the knowledge and capacity building done in the project built upon already existing frameworks of urban development practices and processes in the city, and their related connections with region, nation and EU-level contexts. The City of Espoo's demonstration from SPARCS contribute to the development of new process and increase the capacities of the city to support and facilitate the development of sustainable built environments.

One key activity from the project is highlighted below: Co-creation model for sustainable and smart urban areas.

*Table 12. City of Espoo #1*

| CO-CREATION MODEL FOS SUSTAINABLE AND SMART URBAN AREAS | |
|---|---|
| Co-creation model for smart and sustainable city development. | |
| *Monitoring of the activity during the project* | Model was co-created during SPARCS procurement process and goals were defined in grant agreement.<br>Monitoring during project:<br>• Website activity (model/toolbox in website format)<br>• Number of reached stakeholders during the project |
| *Monitoring plans for the activity after the project ends* | Do we need the new project for the model for further development and updating or is it now easily adapted and utilized in city organization? Who is responsible for keeping the model alive?<br>Are we able to recognize smaller entities or parts or the model that could be easily utilized or at least easier to utilize than the whole model?<br>The goal must be that the model would live happily ever after and it could be developed by the users and their experiences but where could the users share their experiences? |
| *Possibilities and further aims of the activity as a "version 1.5" after the project* | Communications, support inside the city to utilize the tools widely for example by city planning unit or project leaders.<br>How the city and its big strategic goals could be connected to the model? (carbon neutrality, SDGs etc). How could we turn this into a task that helps the units 2 to work towards strategic goals from their own point of view with the help of the Co-creation model?<br>There are plenty of advantages , how could we bring them forward? |

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|---|---|
| | Other cities and areas: district level development paths should be built beginning from the land use planning or zoning. |
| *Utilization of the learnings and outcomes of the activity, and their dissemination* | Main goal for the model is to disseminate and communicate for the utilization widely.<br>We might currently have resources for this work but we need to take into account the time after the project .<br>We might need a new kind of communication and dissemination activities from totally new point of view. |
| *Plans and possibilities for upscaling or replicating the activity (e.g. fully, partly, in a combination to something etc.), including their further monitoring* | • Other districts in Espoo.<br>• Other cities.<br>• Strong links to the strategic goals, for example "this model can help you to reach the strategic goal".<br>• Focus could be more on the current districts that are already built.<br>• Should we link the model or from pieces of it to district level development agreements as kind of base for it (Kera commitment style)?<br>• Connection to the 100 climate neutral and smart cities EU mission.<br>• Eurocities network.<br>• Other networks.<br>• Idea that came up from the group discussion at the workshop: How could we promote the idea for the district heating that the production and distribution could be separated, just like it is for electricity. |
| *Identified larger impacts of the activity through upscaling and/or replication, and their continued monitoring* | • $CO_2$ emission reduction.<br>• Well-being.<br>• Vitality and livelihood.<br>• New jobs.<br>• Capabilities. |
| *(In)Direct connections to larger development topics (e.g. links to organization's strategy or goals in sustainable development etc.)* | In Espoo story or we could connect here all the different development entities including transportation ,<br>energy, circular economy , sustainable city development and nature nearby.<br><br>• Net-zero target.<br>• Carbon neutrality target.<br>• Sustainable development goals.<br><br>Connections to the partner organizations strategies<br>• How to combine that information for the new City Council term beginning at 2025<br>• New projects |

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### 3.2.8 RIL

RIL will continue spreading the information on PED and SPARCS results among civil engineers in Finland. RIL has its own *Rakennustekniikka* magazine and has potential to publish updated SPARCS material in continuous basis.

One key activity from the project is highlighted below: Dissemination about the project and results.

*Table 13. RIL #1*

| **DISSEMINATION ABOUT THE PROJECT AND RESULTS** | |
|---|---|
| RIL informs about the project progress, gained results and insights, and also takes the learnings to RIL events and trainings. | |
| *Monitoring of the activity during the project* | RIL continuously looks for new possibilities for communications. The number and reach of the items is continuously monitored. |
| *Monitoring plans for the activity after the project ends* | RIL is committed to share information about the results also after the project, especially to keep the member of the organization up to date about new solutions and possibilities.<br>The situation stays the same in terms of monitoring but the focus in reporting shifts so that it is more part of the RIL general activity. |
| *Possibilities and further aims of the activity as a "version 1.5" after the project* | RIL organization members generate practical change and transformation in Finland for climate neutrality.<br>It would be important to also share the learnings of Leipzig from SPARCS. The results could also be shared in the Finnish context in some level of detail. |
| *Utilization of the learnings and outcomes of the activity, and their dissemination* | Good results are not enough if nobody knows about them. Usually a hurdle for the development is the lack of knowledge about possibilities or misguided beliefs, for example, about the costs of the solutions.<br>RIL is committed to develop the built environment and its solutions responsibly, treating all aspects of development in a neutral way.<br>RIL requires new material to support this development. SPARCS learnings should be packaged, for example as a guidebook for urban development. |
| *Plans and possibilities for upscaling or replicating the activity (e.g. fully, partly, in a combination to something etc.), including their further monitoring* | Absolutely. The Leipzig's case as reduced or the utilizing the learnings from Espoo for a full district level development elsewhere in Finland.<br>In the rest of Finland, there are no similar examples of a city centre's role as an energy system equalizer.<br>These should be more widely implemented. |

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| | |
|---|---|
| *Identified larger impacts of the activity through upscaling and/or replication, and their continued monitoring* | Even if we were to focus on the results achieved in Espoo, scalability would be a significant opportunity.<br>Eliminating consumption peaks and cutting power peaks, combined with a change in the energy system, would significantly improve the state of the entire country's energy system.<br>Measurement verifies the benefits obtained and also enables the evaluation of the profitability of possible investments. |
| *(In)Direct connections to larger development topics (e.g. links to organization's strategy or goals in sustainable development etc.)* | A revolution in the energy system will come or has already come. SPARCS has developed ways to react to the new normal.<br>The significance is greater than we could even estimate at the beginning of the project.<br>In Espoo alone, the amount of new investments required for district heating production has been significantly reduced.<br>By sharing information and examples, others could be inspired to implement similar innovations again and again. |

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# 4. CONCLUSION

The post-monitoring strategy for the demonstrations has been presented in the document. The overall approach has been presented through key activities and Interventions from the project and from all the demonstration areas (Lippulaiva blocks / Espoonlahti district, Sello blocks & Leppävaara district, Kera district (urban planning and development focus), and city-wide).

Many of the activities are monitored active also beyond the project. These activities are part of the district level solutions, e.g. the heat system in Lippulaiva, or the Virtual Power Plant development in Sello, with clear post-project life-cycles. Monitoring has been integral for the development of the activities and also affect the post-project lifecycle of the demonstrations. For other activities, the monitoring phase has generated important insight to its workings and can act as invaluable element in a possible re-configuration or further development of the activities, concepts and processes.

The different activities and their respective post-monitoring strategies present different kinds of post-project life-cycles, depending on the identified replication and upscaling potential. The most applicable solutions have been replicated already during the project, and the monitoring phase has provided invaluable support for their further development. Some other activities have, on the other hand, proven, through monitoring, less ready or applicable for direct and immediate replication. There is also difference in the *type* of post-project life-cycle : whereas the research and prediction model and simulation model development are building the case for further conceptual, methodological and platform based solutions, other activities are directly comparable to products that have life after the project.

The replication and upscaling planning, which will be the main focus of the final year of the project up to September 2024, will provide possibilities to further link the post-monitoring activities and the possible replication and upscaling of the demonstrations or some of their parts.

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