Post SCC1 Monitoring Strategy

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Dissemination level		
PU	Public	
CO	Confidential, only for members of the consortium (including the Commission Services)	x

Report administration

No & name	**Leipzig Post SCC1 Monitoring Strategy**				
Status	Draft (*Working/Released)*	**Due**	M48	**Date**	2023-09-01
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Description of the related task and the deliverable. Extract from DoA	**T4.7 Replication and exploitation preparation (LPZ, BABLE, WSL, LSW, CEN, SEE, ULEI, SUITE5, CiviESCo) [M1-M60]** All work in the Lighthouse Demonstration City Leipzig aims at developing solutions and services for future energy positive blocks (EPB) and districts to reach the development goals of sustainable Leipzig. Replication and exploitation opportunities is the driver for the actions. SPARCs offers a platform for demonstrating, analysing, evaluating and optimising the solutions as well as collaboration means and community engagement models. The task will: • deliver a Post-SCC01 Monitoring Strategy (M48) [...]				
Participants	LPZ, WSL, LSW, CEN, ULEI				
Comments	The milestone document concentrates on partners with replication actions				

V	Date	Authors	Description
0	11.08.2023	IM	Ready for internal review
0	22.08.2023	NR	commented
0	20.9. 2023	IM	Ready for final internal review
0	day/month/year	WP leader	Deliverable checked by WP leader and released to the Coordinator and the Quality Manager for quality check and subsequent submission to the EC.
1	day/month/year	VTT	Coordinator submits the deliverable to the EC

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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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EXECUTIVE SUMMARY (LPZ)

This strategy documents where data on SPARCS interventions shall be found after the project. The official title is "Post SCC1 Monitoring Strategy", but for clarity, within the document it is called "Post Project Monitoring Strategy", as it refers to monitoring after the end of the SPARCS project.

The document is organised in an introductory part, and sections where partners describe their approach.

A central option to continue monitoring is to display information in the "Leipzig Energy Map" (in German "Energie-Atlas Leipzig"). This is a GIS platform for energy data, unifying different available sources. It is the visualizing part of the Urban Data Platform; maps being complemented by dashboards. Amongst other things, this is described in the introductory part.

In each partner section, to give an overview, all current KPIs are listed in the first section. Here, the partners describe which aim they have with monitoring these specific KPIs. The second part of the partner sections describes how monitoring is organised by the partner currently.
In the third part of the partner sections, the partners check all KPIs for whether they can be displayed on the Leipzig Energy Map. On the Leipzig Energy Map, data will only be displayed if

- they offer benefit
- they can be understood by people external to the project
- and if the effort needed to integrate them seems both doable and reasonable.

In this section, the partners also give an overview where they intend to continue to monitor which data, whether it is on the Leipzig Energy Map, or in partner specific formats. If partners intend to stop monitoring, this will also be explained here.

It does not yet need to be guaranteed that the effort of continued monitoring can be assured. This is a strategy document. Here, the intention to check shall be documented. In some cases, the resources to collect and upload data after the project will not be available. For these cases, this strategy lists where information shall be monitored anyway by the partners in internal systems.

The final section summarizes the post project monitoring plans.

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1. INTRODUCTION: AIM OF THE MONITORING AND POST PROJECT MONITORING (LPZ)

The aim of this strategy is to allow detecting the effects of SPARCS measures after the project, especially those that will be continued after the project's lifetime. For this, this document shall make transparent where information on the interventions can be found after the project, with a focus on those that are continued (current measures and replication measures).

One purpose is to allow for traceability of the effects of SPARCS. A second purpose is to ease energetic planning in Leipzig, by unifying energetic data in one platform, and testing and implementing new data cooperation modes.

The target group are municipalities interested in replicating similar measures searching for information or contact departments; researchers and institutes interested in intervention effects, and anyone interested in the effects of the SPARCS project.

1.1 Link to WP2 activities and deliverables D2.6 and D2.7 (LPZ)

The Post Project Monitoring Strategy builds on the experiences gathered in the monitoring process. Thisaway, it builds on D2.6 and D2.7. For clarity, it does not repeat data given there. Please refer to those documents if you wish to see the data of the project.

The Post Project Monitoring Strategy takes into consideration how difficult it was to guarantee good data. Due to that, it does not underestimate the effort needed for collecting good data. Therefore, we decided to focus.

This strategy sorts out on which interventions it will be interesting to have data even after the project's lifetime, and shows where those data will be monitored after the project. It chooses a pragmatic approach of making transparent where monitoring happens anyway, instead of assuming that data gathering will somehow happen additionally after the project in cases where this is not automated.

The Leipzig Energy Map (see below) is one realisation of L19.1: "Data on the urban data platform". The Leipzig Energy Map displays urban energy data visually in maps and dashboards. Using the Leipzig Energy Map as a central tool of the Post Project Monitoring Strategy, the city of Leipzig intends to further feed the urban data platform, make it a common tool for data sharing, and assure that it is used.

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1.2 How the Post Project Monitoring Strategy was developed (LPZ)

The Leipzig Post Project Monitoring Strategy was developed in workshops with the technical project partners in Leipzig. Originally, one common workshop was planned. However, we wished to incorporate further people with strategic insights of the partner organisations. There were several reasons against one common workshop:

- Partners might be less likely to speak openly about strategic issues due to competitive positions in the market
- The group would have grown so big that the discussion would have been refrained from the sheer group size. Smaller discussion groups often prove to be more fruitful.
- It would be difficult to find one common date

Therefore, we organised individual workshops with each partner including people in strategic positions. In these, we discussed the Post Project Monitoring Strategy, and possible use cases of the Leipzig Energy Map. We held three different workshops between April and July 2023. The results were documented and are further elaborated in this strategy. The strategy was written together subsequently after the workshops in July-August 2023.

1.3 The Leipzig Energy Map (Energie-Atlas Leipzig) (LPZ)

Why an Energy Map? To be able to expand renewable energies, foster energetic refurbishment and build the needed infrastructure, many decisions must be made. Many of them depend on local conditions. What is better under the local conditions?

> *District heating or biogas supply? Considering existing pipes and adjacent heat demands*
>
> *Geo or solar thermal energy supply? Or better heat from electricity generation through solar energy?*

Potentials for each vary, and some of these solutions can be combined, others cannot. To facilitate the decision, an up-to-date database of the status is required. Especially when trying to find solutions by combining electricity, heat and mobility demands and supplies by using each other as storage, it is useful to see all in one place.

At the same time, Leipzig is a city with widespread heritage site protection: almost 20% of its existing houses are protected. In these cases, one can still build renewables, but certain requirements must be met. Therefore, the Leipzig Energy Map allows to display renewable potentials in combination with heritage site protection, and will offer a link with further guidance.

To what extent do local renewable energies cover the demand? Are the electricity grids ready to take up production in new places? Where are further areas for expansion? These questions motivate creating the Leipzig Energy Map.

In its current state, the goal of the Leipzig Energy Map is to show the built renewable energies and the potential for renewable extension, to see whether Leipzig meets the targets of the SECAP (EKSP 2030). For this, the Leipzig Energy Map team integrates various data sources: data need to be accessible and well displayed. Only with a correct

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overview, municipal actors can make sure to take strategic measures in time. Amongst other things, houses need to be refurbished, sufficient renewable energies must be built, and grids extended to be able to stop emitting greenhouse gases.

Figure 1: A view of the Leipzig Energy Map Pilot (Energie-Atlas Leipzig) showing the photovoltaic potential together with heritage site protection. Source: City of Leipzig.

The Leipzig Energy Map is realised by the projects SPARCS and CUT[1] together with the geo data infrastructure unit GDI of the city. Its features are developed in close cooperation with other offices of the city. While activities in SPARCS focus on data collection and display in relation to PED relevant data, the CUT project builds up on that and focuses on analysis and what-if-scenarios. After the SPARCS project, the Leipzig Energy Map will be continued and further developed within the CUT project. A long term continuation will be organised within the Digital City Unit.

The City of Leipzig has given itself a “Digital Agenda” in which it states how it wants to proceed in the digital transformation. The “Digital Agenda” applies also to the municipal companies. It includes guiding principles, action fields and goals. The Leipzig Energy Map contributes to Leipzig’s goals as a city by contributing to guiding principle 2 (Develop the city), 3 (Act transparently) and 6 (Connect and share data for the benefit of the community). The SPARCS project and the Leipzig Energy Map are integrated in the action field “Data - Developing and governing the city sustainably with data”.

[1] Connected Urban Twins, https://www.connectedurbantwins.de/en/

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By unifying energy data in one place, the Leipzig Energy Map shall ease energetic planning in Leipzig. In Leipzig, renewable energies mainly include photovoltaics or wind for electricity, solar or geothermal energy for heat.[2] To become productive, they require sufficient electricity or heat transport connections, and it is easier if production centres are close to demand centres.

To ensure sustainable energy supply in buildings and neighbourhoods, the Leipzig Energy Map will present options and make it easy to compare them. This will enable city departments, and subsequently more actors with access, to make decisions faster, thus making it a little easier to become climate neutral.

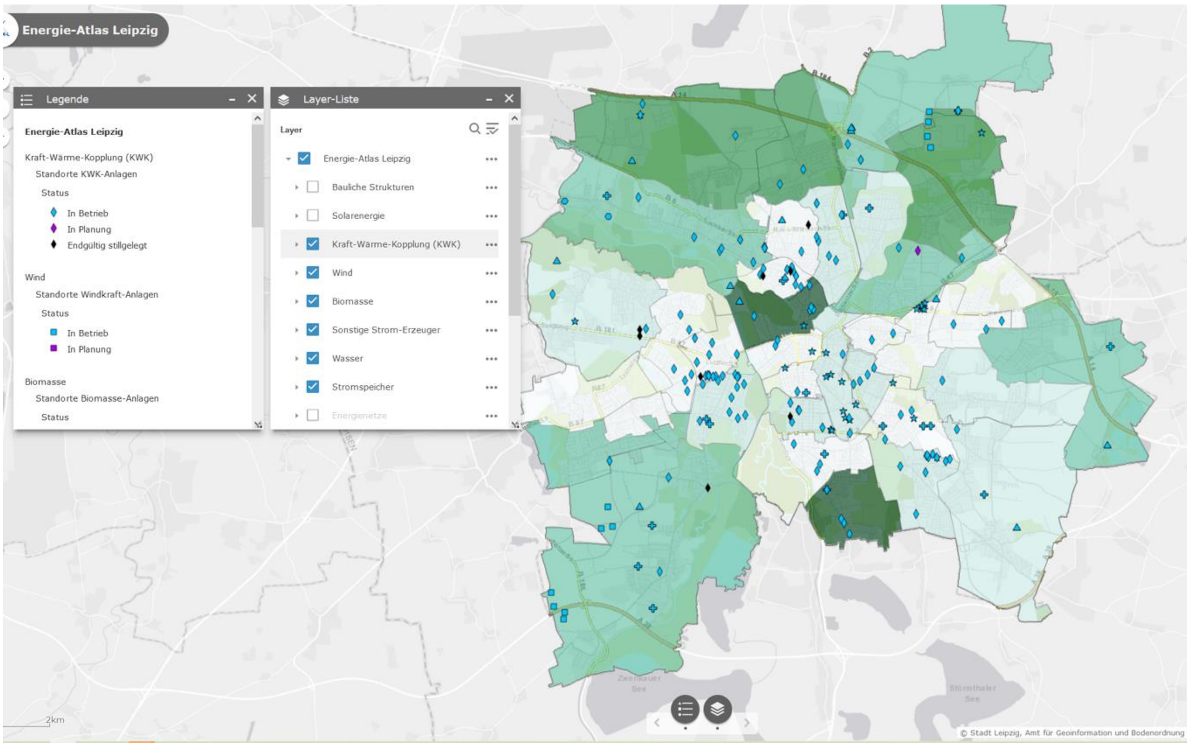

Figure 2: A view of the Leipzig Energy Map Pilot showing all current energy assets, and how much they produce in each postcode area. Source: City of Leipzig.

In the process, data from a wide variety of sources are collected, checked for plausibility and visualized in maps. The city of Leipzig will complement these with dashboards to show data in time series or levels of goal-completion. On this basis, "what-if" scenario tools will later be created within the scope of the CUT project. Data for the Leipzig Energy Map will be stored in or connected via API to the growing Urban Data Platform. In various workshops, the city of Leipzig collected needs of partners, to develop the Leipzig Energy Map into a data cooperation tool for the energy transition within Leipzig.

Currently (summer 2023), the Leipzig Energy Map is in a pilot state, and the first version will be released for internal use. The Energy Map will be edited continuously and also further stakeholders such as the public utilities will be encourage to contribute to and use the Map. Possibly, it could later become a communication tool with the public.

[2] All energy sources such as water power, bio gas, bio mass or combined heat and power are displayed, but they play a minor role in Leipzig.

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For SPARCS, the Leipzig Energy Map is a tool for continuing monitoring after the project. SPARCS is the first use case for displaying district specific energy data; all partners reflect which district data offer value. Through establishing data cooperation, all partners learn how about data integration, data governance and necessary work flows between different partners.

The Leipzig Energy Map will also include data from the municipal heat planning, which is currently under development and will be finalized till mid-2024. It is also checked how the Leipzig Energy Map can support the massive implementation project of decarbonising Leipzigs heating system till 2038.

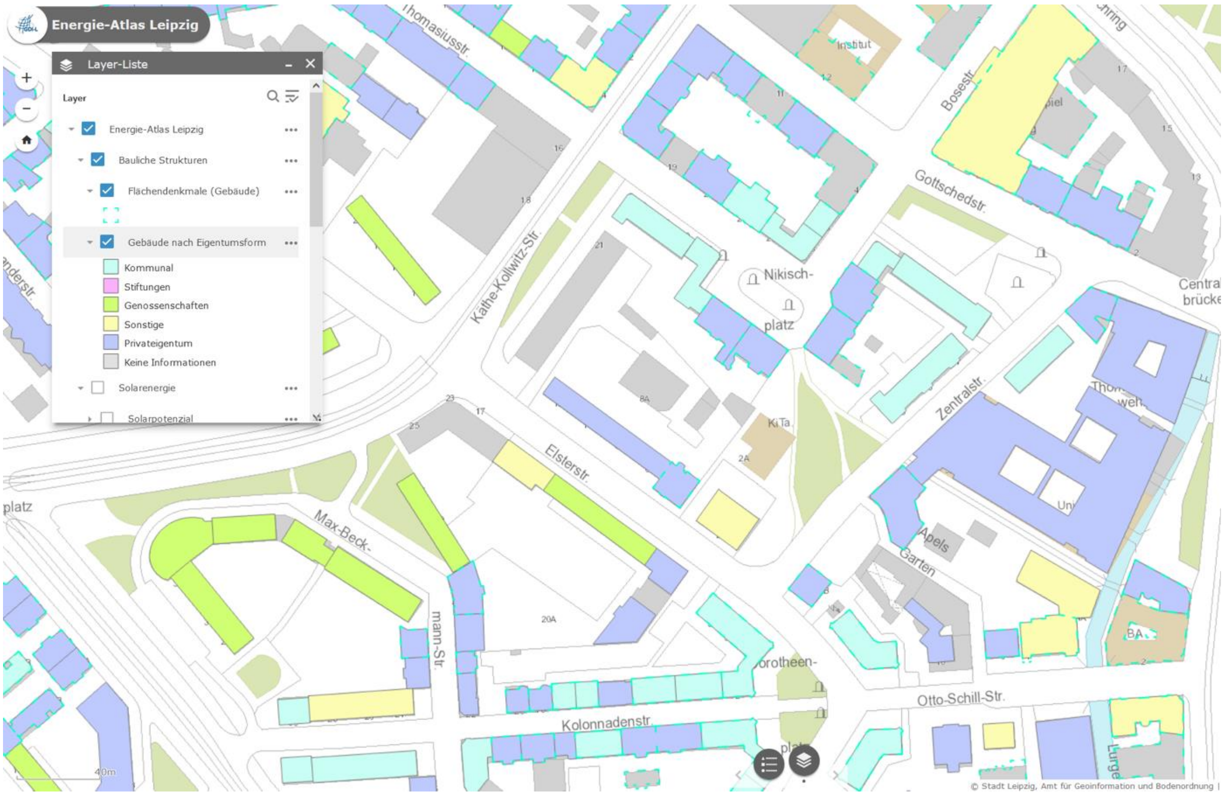

Figure 3: A view of the Leipzig Energy Map Pilot showing the building owner types. Source: City of Leipzig.

What should guide the cooperation for the Leipzig Energy Map? Sharing data for enabling a quick energy transition requires cooperation from all partners. In the "Digital Agenda", applying also to the municipal companies, the City of Leipzig has stated its guiding principles for cooperating in the digital transformation.

All external partners are invited to adhere to these principles:

1. The digital transformation is meant to serve people.
2. We use the digital transformation to collectively and sustainably develop our city.
3. We act autonomously, transparently, and responsibly.
4. We empower individuals to participate in the digital life.
5. We support pioneers of digital development.
6. We collect, connect, and share data for the benefit of the community.
7. We offer our services online, securely, and without barriers.

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2. Post Project Monitoring Strategy by partner

2.1 Leipziger Stadtwerke (LSW)

2.1.1 KPI table & strategic aim

LSW as an innovative electric utility recognizes that monitoring data assets is essential to stay at the forefront of industry advancements. By utilizing real-time and historical data, LSW can not only optimize existing processes but also seize opportunities for transformation and disruption. Embracing innovation in energy management, distribution, and customer engagement is key to remaining competitive, meeting evolving consumer expectations, and contributing to a more sustainable energy future.

Monitoring data from district heating substations allows LSW to optimize the distribution of heat energy. By analysing consumption patterns and temperature differentials, LSW can adjust heat output to match demand accurately, minimizing wasting energy. Real-time monitoring helps to identify substation inefficiencies or malfunctions promptly. This proactive approach allows for timely maintenance or repairs, preventing disruptions and ensuring consistent heat supply to customers. Furthermore, by analysing data from district heating substations, LSW can explore innovative ways to integrate renewable heat sources, implement demand-response strategies, and develop smart heating networks.

Electricity meter data provide valuable insights into consumer consumption patterns. LSW uses them only used on an aggregated level, or with user consent. This information helps customers understand their usage, encourages energy-efficient practices, and enables LSW to optimize load distribution. Data from electricity meters supports load balancing efforts. LSW can identify peak consumption times and redistribute load to prevent grid congestion and improve overall grid stability. By analysing electricity consumption trends, LSW can develop innovative pricing structures, demand-side management programs, and energy efficiency initiatives to align with evolving consumer needs and market dynamics.

Monitoring charging point data allows LSW to manage infrastructure effectively. Real-time information on charging activity and availability ensures a seamless experience for electric vehicle users. By analysing charging patterns, LSW can optimize charging schedules and power allocation. This ensures that charging resources are used efficiently, reducing peak load demands. Charging point data can be leveraged to offer dynamic pricing models, incentivize off-peak charging, contributing to the innovative e-mobility ecosystem.

Sensor data contribute to environmental monitoring efforts. LSW can assess factors such as air quality and noise levels, enabling informed decisions for urban planning and sustainability initiatives. LSW can harness sensor data to develop new services, such as real-time environmental monitoring for city residents, and support emerging technologies like smart city initiatives and internet of things (IoT) based solutions.

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Table 1: LSW KPIs

LSW KPIs	Unit
Intervention L9: Integration of RES	
Renewable electricity generation capacity	MW peak
Annual renewable electricity generation	MWh
Self-consumption PV	MWhr
Number of heating stations in which inefficiencies were identified and optimized by VPP	qty
Reduced energy generation due to VPP heating station optimization	kWh per month
Thermal efficiency in district	System Efficiency Ratio, %
Number of digital platforms used	qty
Number of assets and devices in virtual power plant	qty
Virtual flexibility provided by Microgrid Trade	avg kWh per month
Virtual flexibility capacity provided by smart plugs	W
Virtual flexibility provided by battery storage farm	MWh
Intervention L10: Economically reasonable integration of open and standardized Sensors and Systems	
Number of actively transmitting city sensors	qty
Intervention L11: Establishment of a distributed cloud centric ICT System which enables an intelligent energy management system.	
Number of smart plugs	qty
Number of inquiries for smart plugs	qty
Intervention L15- E-bus charging	
Total number of vehicles in local transportation	qty
Electric vehicles in local transportation	qty
Share of EV in local transportation	qty
Number of E-Bus charging stations	qty
Intervention L16- Load-balanced fleet management	
Number of smart EV charging points	qty
Utilization of EV charging stations	kWh
Number of EVs in fleet management	qty
Financial indicators	
Leipzig Zero: Annual return of value added services	€
L-Fleet management: Annual revenue of grid balancing services	€
District heating: Total Monetary savings due inefficiency reduction	€
Microgrid Trade: Annual Spot market price value of traded energy amounts	€
BMW storage farm: Estimated value of grid balancing services	€
LSW PV panels: Revenue from sold shares of decentralized assets	€

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2.1.2 How monitoring is done currently

District Heating Substations:

- LSW has a network of 8,000 district heating substations located in various buildings and municipalities.
- Telemetry data from these substations is collected using a combination of MUC (Modbus User Command), Ethernet, and powerline communication technologies.
- These data provide insights into heat distribution, consumption patterns, and overall system health.

Electricity Meters:

- LSW's electricity meters employ diverse transmitting processes, including LoRaWAN (Long Range Wide Area Network), for efficient data transmission.
- These data are vital for monitoring electricity consumption, load balancing, and identifying anomalies within the grid.

Charging Points for electric mobility:

- With 455 charging points dedicated to electric vehicles, LSW monitors charging activities and manages infrastructure utilization.
- These data aid in optimizing charging schedules, ensuring availability, and enhancing the user experience for electric vehicle owners.

IoT and Sensor Gateways:

- LSW's IoT and sensor gateways, utilizing technologies like LoRaWAN, enable the transmission of sensor data from various sources to LSW's central servers.
- These data include environmental and equipment sensor readings, contributing to proactive maintenance and resource allocation.

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Data Display and User-Specific Dashboards:

To effectively manage the diverse data streams, and cater to different user groups and use cases, LSW employs a range of information systems and dashboards:

District Heating Operations and Grid Management Control Centre:

- This dashboard provides real-time insights into district heating performance, substation status, and grid health.
- Operators can monitor temperature differentials, energy flow, and manage load balancing to ensure efficient heat distribution.

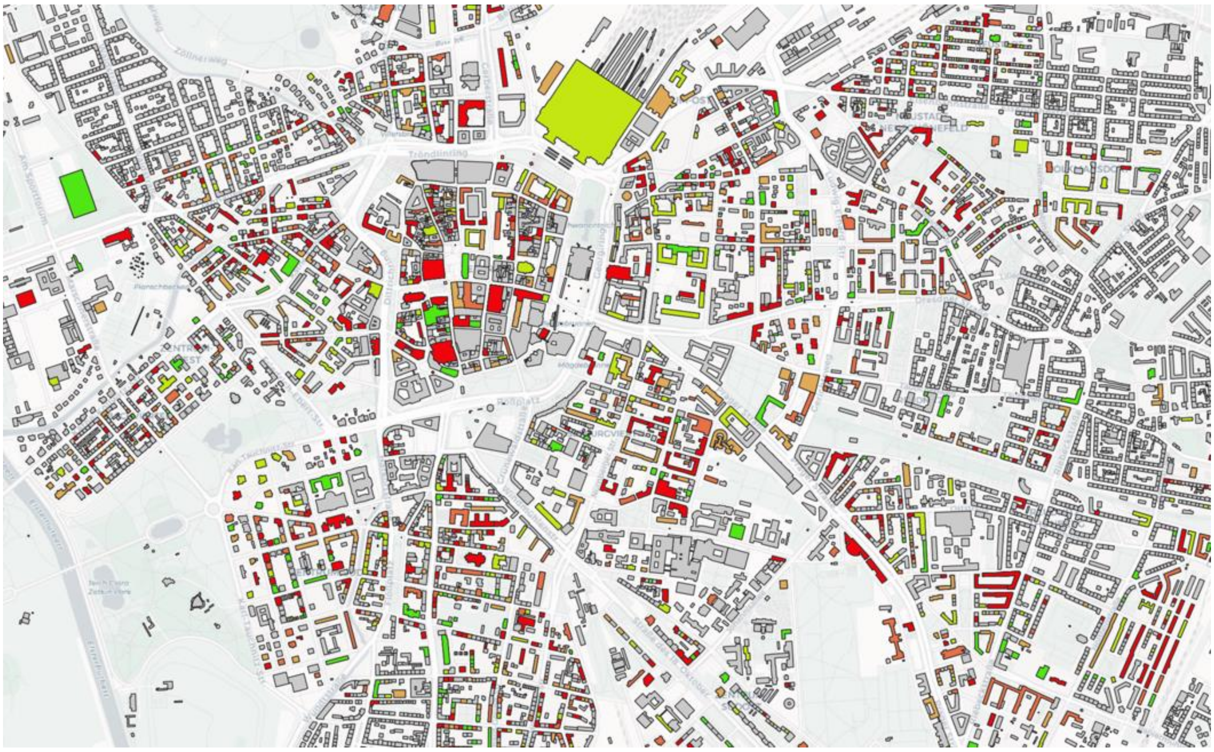

Figure 4: A view of the LSW district heating operations and grid management control system showing energy consumption in buildings. Source: LSW.

Asset Planning and Optimization Software:

- This system uses historical data and predictive analytics to support strategic decision-making regarding asset deployment and replacement.
- It aids in identifying optimal locations for new substations, managing equipment lifecycles, and improving asset utilization.

E-Mobility Technical Operations and Transaction Systems:

- Operators overseeing our electric vehicle charging infrastructure can monitor charging activity, troubleshoot issues, and manage billing through this dashboard.
- It supports smooth operation of charging stations and enhances customer satisfaction.

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Urban Cockpit for IoT and Sensors:

- This dashboard aggregates data from various sensors deployed across the urban landscape, enabling monitoring of environmental factors, such as air quality and noise levels.
- Urban planners and environmental authorities can use this data for city management and policy decisions.

Figure 5: A view of the LSW dashboard for IoT and Sensors. Source: LSW.

SPARCS Dashboard:

- This dashboard developed specifically for SPARCS monitoring offers multiple functionalities:
  - L-Zero Smart Plug Management and Visualization: Monitoring and managing smart plugs in various locations.
  - L-Fleet Management Control Panel: Tracking and optimizing the electric vehicle fleet.
  - PV Data Visualization and Forecasting: Analysing solar panel performance and predicting energy generation.
  - Microgrid Trade Simulation with Baumwollspinnerei: Simulating energy trading scenarios within microgrids.
  - BMW Battery Farm Contribution to Grid Resilience: Assessing the impact of BMW battery storage on grid stability.

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SPARCS

2.1.3 Data that will be displayed on the Leipzig Energy Map, or in other system

Here, we document LSW's assessment of whether its KPIs makes sense to be displayed on the Leipzig Energy Map.

Table 2: Data that will be displayed on the Leipzig Energy Map, or alternative monitoring system (LSW)

KPI	Offers benefit for others after the project?	Understand-able in Leipzig Energy Map for externals?	Options to cover the effort needed to collect and integrate the data?	Hence: Display on Leipzig Energy Map?	Target monitoring system: Leipzig Energy Map and/or partner system	Explanation if KPI will not be monitored
Intervention L9: Integration of RES						
Renewable electricity generation capacity	y	y	y	y	Leipzig Energy Map	
Annual renewable electricity generation	y	y	y	y	Leipzig Energy Map	
Self-consumption PV	y	y	y	y	Leipzig Energy Map	
Number of heating stations in which inefficiencies were identified	n	y	y	?	Internal systems and quarterly reports	Metric not useful for externals

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and optimized by VPP						
Reduced energy generation due to VPP heating station optimization	y	y	y	y	Leipzig Energy Map	
Thermal efficiency in district	n	y	y	?	Internal systems and quarterly reports	Metric not useful for externals
Number of digital platforms used	n	y	y	y	Quarterly reports	Metric not useful for externals
Number of assets and devices in virtual power plant	y	y	y	y	Leipzig Energy Map	
Virtual flexibility provided by Microgrid Trade	y	y	y	y	Leipzig Energy Map	
Virtual flexibility capacity provided by smart plugs	y	y	y	y	Leipzig Energy Map	
Virtual flexibility provided by battery storage farm	y	y	y	y	Leipzig Energy Map	

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Intervention L10: Economically reasonable integration of open and standardized Sensors and Systems						
Number of actively transmitting city sensors	y	y	y	y	Leipzig Energy Map	
Intervention L11: Establishment of a distributed cloud centric ICT System which enables an intelligent energy management system.						
Number of smart plugs	y	y	y	y	Leipzig Energy Map	
Number of inquiries for smart plugs	y	y	y	y	Leipzig Energy Map	
Intervention L15: E-bus charging						
Total number of vehicles in local transportation	y	y	y	y	Leipzig Energy Map	
Electric vehicles in local transportation	y	y	y	y	Leipzig Energy Map	
Share of EV in local transportation	y	y	y	y	Leipzig Energy Map	
Number of E-Bus charging stations	y	y	y	y	Leipzig Energy Map	

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Intervention L16: Load-balanced fleet management						
Number of smart EV charging points	y	y	y	y	Leipzig Energy Map	
Utilization of EV charging stations	y	y	y	y	Leipzig Energy Map	
Number of EVs in fleet management	y	y	y	y	Leipzig Energy Map	
Financial indicators						
Leipzig Zero: Annual return of value added services	n	y	y	?	Quarterly reports	Metric not useful for externals
L-Fleet management: Annual revenue of grid balancing services	n	y	y	?	Quarterly reports	Metric not useful for externals
District heating: Total Monetary savings due inefficiency reduction	y	y	y	y	Quarterly reports	Metric not useful for externals
Microgrid Trade: Annual Spot market price value of traded energy amounts	n	y	y	?	Quarterly reports	Metric not useful for externals

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BMW storage farm: Estimated value of grid balancing services	n	y	y	?	Quarterly reports	Metric not useful for externals
LSW PV panels: Revenue from sold shares of decentralized assets	n	y	y	?	Quarterly reports	Metric not useful for externals

Legend
Y = yes
N = no
? = unclear/debatable

Note: For all assets and buildings where it is legally possible, LSW aims to monitor the KPI data after SPARCS and to provide it for use in the Leipzig Energy Map. The way and granularity how it is being displayed on the energy map must be discussed in detail (e.g., how to display city-level aggregated values on a map visualization).

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2.2 Cenero Energy (CEN)

2.2.1 KPI table & strategic aim

Cenero's aim at the Baumwollspinnerei is to have a holistic overview of the energy flows, to regulate these flows and to optimise the use of on-site generation plants while reducing consumption. Due to its historical nature, the Baumwollspinnerei presents a multitude of challenges. These challenges encompass a range of components, including:

- regulatory considerations arising from historic protection laws,
- structural components involving building statics and insulation,
- network and grid configurations, conditions, positions and resilience, and
- the inherent unreliability of often outdated building and network plans.

CENERO Energy therefore strives to create a certain level of transparency to best evaluate, improve, replace and update the networks, systems and buildings.

E-mobility, in particular intelligent e-mobility, can stabilise the network, reduce emissions from mobility, and lever the amount of self-consumed electricity. Intelligent EVs, when connected to the wallbox, can assist with grid stability. The flow of electricity to the vehicles can be up or down regulated, depending on the supply and demand of the electricity in the microgrid at the Baumwollspinnerei. Furthermore for the bidirectional electric vehicle, electricity can be directed in both directions. That means that the vehicle's battery serves as an electrical storage and can be discharged to alleviate the load on the grid. The load management software regulates how electricity is distributed. The electrical battery storage can thus further enhance the percentage of power used directly from the on site renewable generation plants. In addition to reducing transport emissions, these factors favour the expansion of e-mobility.

To manage the flow of electricity and heating, many remotely readable metering devices are installed across the site. The data collected is incorporated in the data management platform Cenero.one, allowing insight into the consumption and generation behaviour. Cenero can recognise the largest consumer and analyse the optimisation potential. Cenero is able to identify, localise and eliminate losses and insufficiencies and to derive measurable conclusions for optimization.

To reduce the heating demand, an intelligent heating system with an automatic valve system regulates the flow of heat through the heating network. Intelligent thermostats communicate with the valves. When they recognise that there is no longer demand for heating in an area, the valves automatically shut. Energy is consequently saved.

Monitoring the various interventions therefore not only serves to measure their success, but also to actively ensures it. Without the feedback achieved by monitoring and digitalisation, these interventions would not be possible.

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Table 3: CEN KPIs

CEN KPIs	Unit
Intervention L1- Intelligence EV parking and storage	
Energy Storage Type	#
Energy Storage Number of Equipment Increase	#
Energy Storage capacity Increase	kWh
Peak Load Reduction	kW
Reduced System Average Interruption Duration Index (SAIDI)	min
Reduced System Average Interruption Frequency Index (SAIFI)	min
Demand from all EV mobility modes; impact on the grid	kW
Monetary gains for user (charging costs vs flexibility revenues)	ct/kWh
Accuracy of Generation forecasting and storage utilisation	MWh/a
Accuracy of storage utilisation	#
Increase in shared EVs availability	#
Increase of integrated smart EV charging units	#
Increased level of utilisation of EV charging units	kWh/a
Intervention L2- Micro grid inside the public grid	
District self-consumption rate	%
Reduction of the customer energy cost	ct
Intervention L3- Demand oriented heating system and user information	
Total energy demand reduction	MWh/a
Onsite energy ratio OER	%
Peak Load Reduction	MW

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2.2.2 How monitoring is done currently

For technical partners, evaluating the interventions greatly depends on granular data, which is arranged in such a way that it can easily be analysed. CENERO Energy uses the Cenero.one energy monitoring software to seamlessly gather, arrange, store, and evaluate data from the Leipziger Baumwollspinnerei demo district.

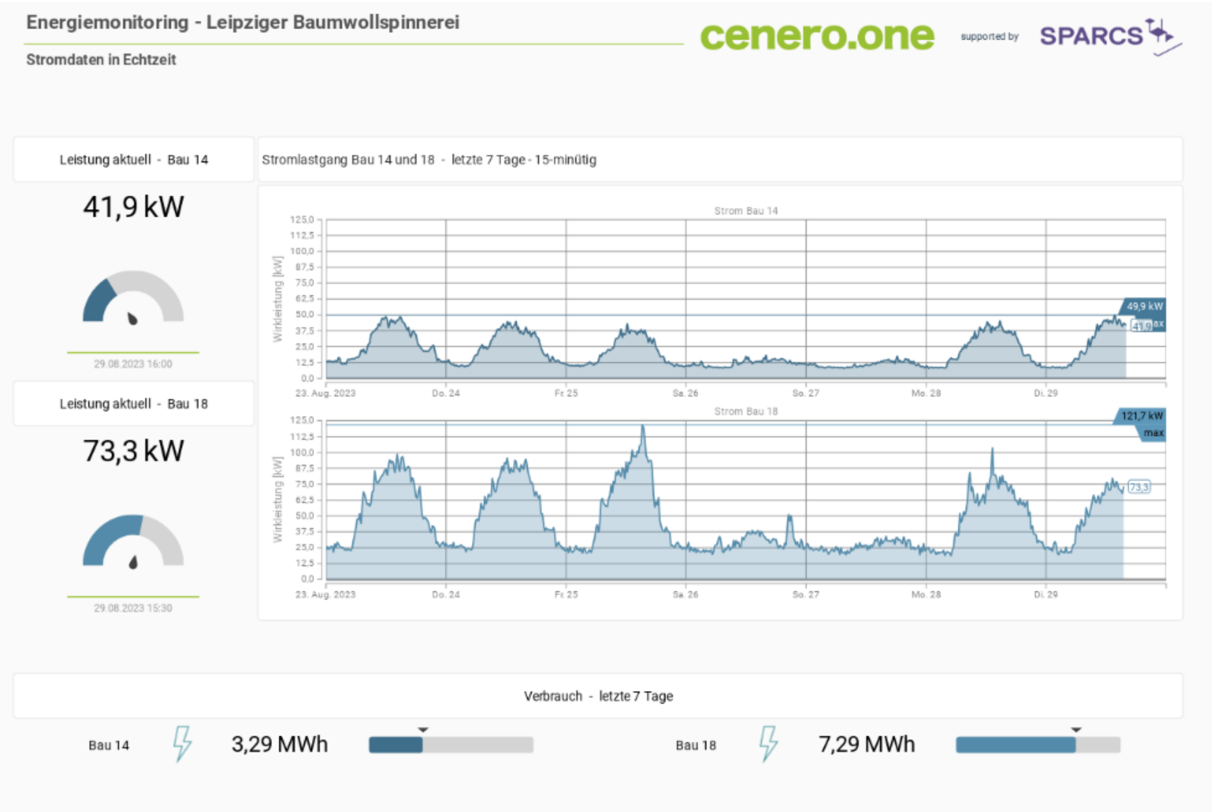

Figure 6: A view of the energy management software Cenero.one showing the load profile over seven days in building 14 and 18. Source: Cenero.one GmbH.

Cenero.one is a cloud-based energy management platform that is designed to process vast amounts of raw data and transform it into structured, visually appealing graphs and charts that are both useful and easy to analyse. Users have the flexibility to retrieve and display the data at their preferred frequency, as frequently as every minute.

For monitoring, Cenero installed numerous remotely readable meters and sensors on the site. These devises track the energy flows and various other parameters and transmit the data via LoRaWAN protocol to Cenero.one, where it can easily be retrieved and displayed on the Cenero.one cloud-based platform. When integrating the data points into the software, the structures need to be concisely lodged to ensures accurate allocation of each measuring point, making it easy to trace and to analyse the energy flows. Furthermore, when linking the data points, meta information such as the location and calibration date of each device are stored and associated with the respective measuring point. These features support managing such large sites, ensuring compliance and a detailed and structured site overview.

Once the data points are set up in the system, and the data is automatically collected, it can be displayed in a variety of different charts and graphs for analysing. Furthermore, automated plausibility checks validate the incoming data, guaranteeing its accuracy and

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consistency. Automatic notifications can also be configured to warn about consumption peaks, irregularities, or non-sufficient circumstances, such as heating systems running while windows are open. Data needs to be reliable, accurate, and granular to be able to daw meaningful conclusions. By obtaining real-time data from remotely readable meters, Cenero ensures that energy usage patterns are captured regularly, facilitating the understanding of energy flows within the demo district.

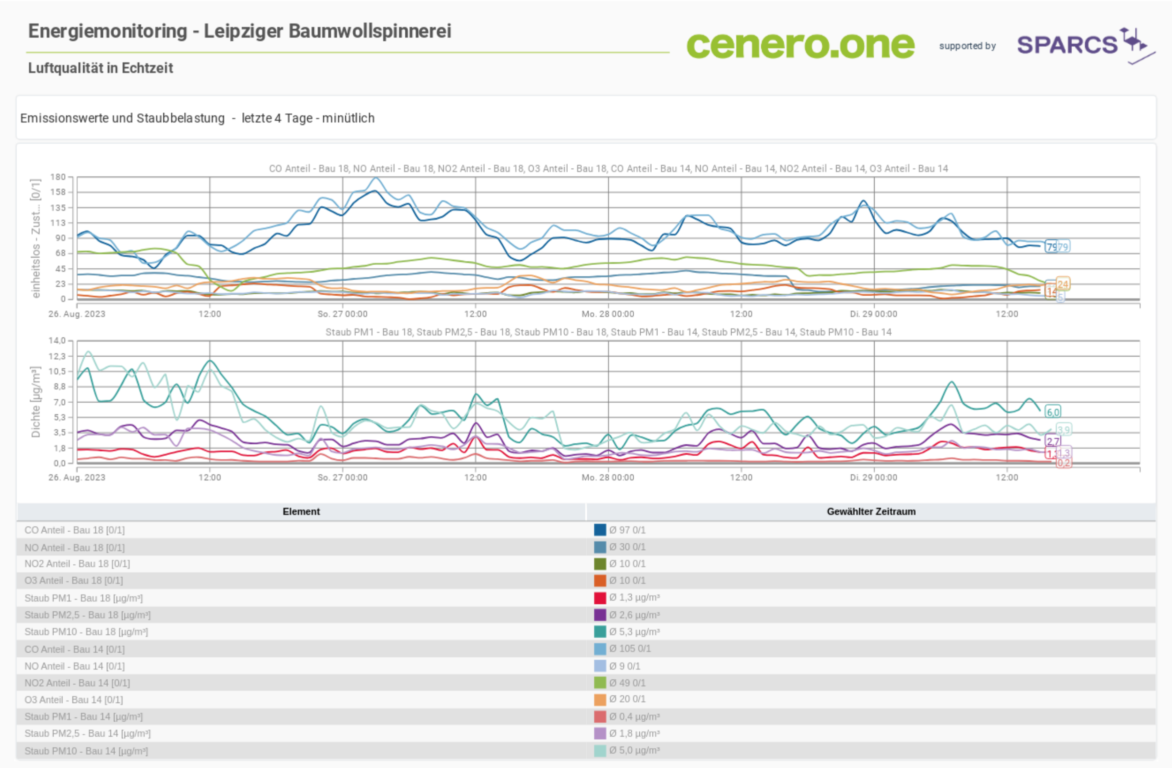

Figure 7: A view of the energy management software Cenero.one showing air quality over seven days at building 14 and 18. Source: Cenero.one GmbH.

At the Baumwollspinnerei, Cenero monitors the consumption of electricity, heating, water, and electrical usage of EVs with the help of Cenero.one. Additionally, the PV plant's electricity generation and the electricity and heating power generated by the combined heat and power plants (CHPs) are closely monitored. Moreover, the system keeps track of the power stored and supplied from the electric storage battery.

Based on the gathered information, Cenero considers further efforts to reduce the site's emissions. One option is to expand the PV plants to other roofs, implement geothermal assets and energetically link adjacent neighbourhoods to efficiently use share otherwise discarded energy.

Cenero will continue to monitor the demonstration interventions at the Baumwollspinnerei even after the SPARCS project's end. Only the bidirectional EV will not be included in post monitoring as the BMW regulations restrict this. Cenero will explore which data can automatically be transferred to the Leipzig Energy Map. The data transfer must adhere to both technical and legal data protection requirements to ensure compliance.

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2.2.3 Data that will be displayed on the Leipzig Energy Map, or in other system

Here, we document the Cenero's assessment of whether its KPIs makes sense to be displayed on the Leipzig Energy Map.

Table 4: Data that will be displayed on the Leipzig Energy Map, or in alternative monitoring system (CEN)

KPI	Offers benefit for others after the project?	Understand-able for externals?	Options to cover the effort needed to collect and integrate the data?	Hence: Leipzig Energy Map (Energie-Atlas Leipzig)?	Target monitoring system: Leipzig Energy Map (Energie-Atlas Leipzig) or partner system	Explanation if KPI will not be monitored
Intervention L1: Intelligence EV parking and storage						
Energy Storage Type	?	Y	Y*	Y*	Cenero.one, Leipzig Energy Map*	-
Energy Storage Number of Equipment Increase	?	Y	Y*	Y*	Cenero.one, Leipzig Energy Map*	-
Energy Storage capacity Increase	?	Y	Y*	Y*	Cenero.one, Leipzig Energy Map*	-
Peak Load Reduction	Y	?	N	N	Cenero.one	

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Demand from all EV mobility modes; impact on the grid	Y	?	Y*	Y*	Cenero.one, Leipzig Energy Map*	-
Monetary gains for user (charging costs vs. flexibility revenues)	Y	Y	N	N	internally	Concerns core business details and might lead to discussions with customers
Accuracy of Generation forecasting and storage utilisation	?	?	Y*	Y*	Cenero.one, Leipzig Energy Map*	-
Accuracy of storage utilisation	Y	Y	Y*	Y*	Cenero.one, Leipzig Energy Map*	-
Increase in shared EVs availability	?	Y	Y*	Y*	Cenero.one, Leipzig Energy Map*	-
Increase of integrated smart EV charging units	?	?	Y*	Y*	Cenero.one, Leipzig Energy Map*	-
Increased level of utilisation of EV charging units	Y	Y	Y*	Y*	Cenero.one, Leipzig Energy Map*	-

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Intervention L2: Micro grid inside the public grid						
District self-consumption rate	Y	?	Y*	Y*	Cenero.one, Leipzig Energy Map*	-
Reduction of the customer energy cost	Y	Y	N	N	internally	Concerns core business details and might lead to discussions with customers.
Intervention L3: Demand oriented heating system and user information						
Total energy demand reduction	Y	Y	Y*	Y*	Cenero.one, Leipzig Energy Map*	-
Onsite energy ratio OER	Y	Y	Y*	Y*	Cenero.one, Leipzig Energy Map*	-
Peak Load Reduction	Y	?	Y*	Y*	Cenero.one, Leipzig Energy Map*	-

Legend

Y = yes

N = no

? = unclear/debatable

**Technically, it is not a problem to continue collecting the data, and to provide them to the Energie Atlas. Cenero will continue to monitor the interventions after the project via the Cenero.one platform (as well as other parameters that are not part of the SPARCS project). Theoretically, the data transfer to the Energie Atlas can be automated via a Cenero.one export. The data captured however is sensitive. Cenero must further examine whether disclosure compromises data privacy and data protection laws. Cenero can therefore not commit itself unconditionally to completely disclose all the data.*

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Much of the information compiled in the above KPIs only become valuable to others with additional information. Without background information of the site, the existing and new systems, the networks and the consumers, no tangible and valuable conclusions can be drawn. Displaying data on a platform therefore only shows that something has been implemented, monitored, and analysed. The viewer will need to contact Cenero for further information.

A further concern of Cenero is that the energy market and industry are complex and competitive. Publicising this data is risky from a business perspective. With limited background information, raw data can cause confusion or misinterpretation. This can result in conflict or dissatisfaction of customers. In some cases, it could give competitors the upper hand in bartering and poaching customers.

Additionally, the Baumwollspinnerei is a historic building which consequently comes with challenges. Energetically comparing this site with a new build may lead people to believe that the Baumwollspinnerei is underperforming energetically and in sustainability aspects. Placing the company and the site in such a light would be disadvantageous. The risk therefor needs to be strategically considered.

The challenge Cenero faces is that making data highly specific, concise, and easily attributable is easy to do and would enhance its comprehensibility and interpretability. However, it would go against the rights of the tenants. At the Baumwollspinnerei, Cenero has many large tenants, which makes it even more difficult to showcase individual buildings.

Hence, it will further be examined which data Cenero can upload to the Leipzig Energy Map, at which aggregation level, in which frequency and to which audience/level of publicity.

The only intervention that will be discontinued after the SPARCS project is the bidirectional EV. This is due to the terms of the lease agreement for the prototype BMWi3 with BMW.

What would be interesting to pursue further?

Cenero Energy is systematically expanding the digitalisation of the energy network on the Baumwollspinnerei. With over 400 remote measuring points already installed, in depth insights of the on-site generation and consumption is already available. Additional measuring points will increase the depth at which Cenero monitors the site digitally. With this, it will be even easier to localise losses or large consumers. Additional to the remote meters, more than a thousand heat cost allocators are planned on the site along with numerous sensors.

All the data will be tracked and monitored via Cenero.one. Tenants and owners can log in to the platform and see their consumption. Cenero aims to upload live charts and dashboards to their website, displaying the energy patterns of the interventions. Cenero will design easy to analyse dashboards that can automatically evaluate and display how an intervention is performing. Cenero will implement this on conclusion of the SPARCS project.

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2.3 WSL Wohnen und Service Leipzig (WSL)

2.3.1 KPI table & strategic aim

WSL will monitor the heating consumption and CO2 emission of the buildings via an internal energy management system. Thanks to this system, WSL will be able to monitor and analyse the thermal energy consumption and energy efficiency of each building and thermal system and determine the CO2 emissions. With this system, WSL will optimize the heating station controller and monitor the results. The strategic aim is optimizing all buildings and thermal systems to efficient operation.

The PV systems will be included in the internal geo information system (GIS) and the energy management system.

WSL will use the SPARCS application only during the SPARCS project. Considering user numbers and costs WSL concludes that a standalone application like the SPARCS application is difficult to place and even harder to refinance. In contrast, the “Meine LWB App” covers many rental topics. It will be roll out in the whole housing stock, and it allows to deliver data to the tenants as required by law. Due to data protection laws, it cannot be displayed unprocessed.

As the WSL KPIs for L4 and L5 were similar, just on different spatial scales, they can be summarised in three KPIs. WSL uses them in this form for the Post Project Monitoring Strategy and the further actions.

Table 5: WSL KPIs

WSL KPIs	Unit
Intervention L4, L5: Energy consumption of areas	
Reduction of thermal energy consumption	MWh
Reduction of CO2 emission by thermal energy	t CO2
Increase of self consumption rate / share of RES	kWh %

2.3.2 How monitoring is done currently

Additional to monitor for SPARCS, WLS monitors its whole housing stock. This encompasses several steps:

- WSL collects energy data from the buildings and integrates the data into a data and device platform.
- From here, WSL exports data to other tools to calculate the energy consumption, energy efficiency and CO2 emissions.
- Finally, WSL presents the results in annual sustainability reports.

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2.3.3 Data that will be displayed on the Leipzig Energy Map, or in other system

Here, we document WSL's assessment of whether its KPIs makes sense to be displayed on the Leipzig Energy Map.

Table 6: Data that will be displayed on the Leipzig Energy Map, or alternative monitoring system (WSL)

KPI	Offers benefit for others after the project?	Understand-able for externals?	Options to cover the effort needed to collect and integrate the data? *	Hence: Leipzig Energy Map (Energie-Atlas Leipzig) ?	Target monitoring system: Leipzig Energy Map (Energie-Atlas Leipzig) or partner system	Explanation if KPI will not be monitored
Reduction of thermal energy consumption	Not really, but the thermal consumption would be interesting to show in the Leipzig Energy Map	Y	Covered by internal monitoring and sustainability report. Possibility to share	N	internal monitoring and sustainability report	
Reduction of CO2 emission by thermal energy	Not really, but the CO2 emission would be interesting to show in the Leipzig Energy Map	Y	Covered by internal monitoring and sustainability report. Possibility to share	N	internal monitoring and sustainability report	

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Increase of self-consumption / share of RES	Not really, but the electricity production of RES would be interesting to show in the Leipzig Energy Map	Y	Covered by internal monitoring and sustainability report. Possibility to share	Y – PV plants (location, power, usage, annual electricity production)		

Legend

Y = yes

N = no

? = unclear/debatable

WSL can integrate data of its photovoltaic plants into the Leipzig Energy Map. This data can include the location, the power and the calculated annual electricity production.

Furthermore, it may be useful to integrate location and primary energy, power and main data of the heating stations. Possibly this could even be linked to the virtual power platform by LSW.

This way, the data could be compared with other data in the Leipzig Energy Map. In combination with information about the district heating energy source or the electricity grid, WSL could detect potentials for new heating sources such as heat pumps.

What would be interesting to pursue further?

It will be interesting to pursue how the buildings evolve and become more energy efficient. For this, WSL will use its planned energy management and optimization system. WSL will present the results in the annual sustainability reports and in the internal monitoring system.

Furthermore, the PV roll out will be interesting to share. WSL will present this in the annual sustainability reports, the internal GIS and the energy management system. WSL can integrate this also into the Leipzig Energy Map, showing energetic potential and implementation.

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2.4 University of Leipzig (ULEI)

2.4.1 KPI table & strategic aim

The KPIs of the University of Leipzig, Institute for Infrastructure and Resource Management, focus on Intervention L18, the "Integration of Community Energy Storage (CES) and Community Demand Response (CDR)". This subtask analyses the behaviour of the energy community. Integrating the planned "community energy storage" (CES) and "community demand response" (CDR) reliably are possible business cases for successfully transforming the system at the municipal level. This is evaluated with the help of a model. In addition, the University of Leipzig measures how the participants behave with data from the Smart Plugs.

Rolling out the Smart Plugs is still ongoing, as can be seen in intervention L11. Therefore, data of the households that will be a part of the CDR is not yet available.

Hence, data are modelled. The modelling uses the tool IRPopt. The model generates data based on assumptions. Assumptions are made for

- the total residential load
- and load shifting parameters for the model year 2025.

A more detailed description of the modelling approach can be found in Report L18-3. The KPIs are exclusively modelled with the approach outlined before. For definition and calculation methods of the KPIs, please refer to deliverable report D2.7.

Table 7: KPIs of ULEI for L18

ULEI KPIs	Unit
Intervention L18: Integration of Community Energy Storage (CES) and Community Demand Response (CDR)	
Increase of integrated systems share	Green sockets available (#)
Total flexibility available increase	MWh/h
Flexibility increase (%) of normal load in kW	%

2.4.2 How monitoring is done currently

As described in Chapter 2.4.1, the University of Leipzig currently calculates the KPIs for this intervention based on a model. They are not monitored as there is no data yet to be monitored. Hence, the monitoring process is not yet final. It will likely be designed like this:

- The Smart Plugs will measure electricity demand and the reaction to the request signals and send them to the ZERO app's backend.
- From there, LSW has access to the data.
- Based on this data, the University of Leipzig can calculate the respective KPIs and use them for the SPARCS project, and/or upload them to the Leipzig Energy Map.
- Since the University of Leipzig does not have direct access to the data, the procedure must be coordinated with the LSW.

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2.4.3 Data that will be displayed on the Leipzig Energy Map, or in other system

Here, we document the University of Leipzig's assessment of whether its KPIs makes sense to be displayed on the Leipzig Energy Map.

Table 8: Data that will be displayed on the Leipzig Energy Map, or in alternative monitoring system (ULEI)

KPI	Offers benefit for others after the project?	Understand-able for externals?	Options to cover the effort needed to collect and integrate the data? *	Hence: Leipzig Energy Map (Energie-Atlas Leipzig)?	Target monitoring system: Leipzig Energy Map (Energie-Atlas Leipzig) or partner system	Explanation if KPI will not be monitored
Increase of integrated systems share	N, only relevant for project progress	Y	?, has to be cleared up with LSW	?	LSW: ZERO app backend	
Total flexibility available increase	?, strong project relation	Y	?, has to be cleared up with LSW	?	LSW: ZERO app backend	The KPI itself will not directly be monitored, but the data it is based on
Flexibility increase (%) of normal load in kW	?, strong project relation	Y	?, has to be cleared up with LSW	? Need to be aggregated for anonymization ->effort needed.	LSW: ZERO app backend	The KPI itself will not directly be monitored, but the data it is based on

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				Result: value debatable.		

Legend
Y = yes
N = no
? = unclear/debatable

As described, the data for the KPIs will mostly be monitored and stored via the backend of the ZERO App. Since the University of Leipzig does not have direct access to the data, the specific procedure must be coordinated with the LSW. Theoretically, LSW or the University of Leipzig could implement an API to stream the data from the application's backend to the Leipzig Energy Map. Possibly, they must also implement an anonymization process so that no sensitive electricity demand data is shared publicly on the Leipzig Energy Map.

What would be interesting to pursue further?

To support the Smart Plug rollout, a socio-economic research project has been kicked off in cooperation with LSW. In this project, 100 Smart Plugs will be distributed to 100 households, and resulting electricity demand data will be gathered.

The research will focus on the willingness of households to shift their loads and their willingness to interact with an app that enables load shifting. To what extent are households willing to change how they use electricity according to the grid situation? Do they prefer automated control by the utility or home automation? Under what circumstances?

The research project is still in its design phase, so the exact measures taken and values monitored are not yet clear. Potentially, members of the institute will publish the results of this project so that they would be publicly accessible. Furthermore, students will likely write bachelor or master theses on residential demand response using data from this project, or applying the model mentioned above.

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2.5 City of Leipzig, Digital City Unit (LPZ)

2.5.1 KPI table & strategic aim

Most KPIs stem from official municipal sources. They are collected continually. When defining them, it was the target to assure that they are available. Only some are project specific data, or are collected specifically for the SPARCS project.

Whether official data will be displayed in the Leipzig Energy Map will depend on whether visualising them or integrating them in dashboards offers an additional insights.

The number of citizens gives an overall indication of the development of the city, important for the energy demand, but also for economic tendencies.

The energy indicators allow seeing how demand and production develop in both electricity and heating. They also allow comparing the effects of the demo districts to the overall city.

The air quality indicators allow seeing trends in air quality, in order to ponder whether SPARCS had an impact on them. Currently, the data for SPARCS come from that official air quality metering station that is closest to the demo districts Baumwollspinnerei and Duncker District. It is 1,7km and 2km respectively away from the demo districts. Currently, data from the SPARCS sensors within the demo district will also be integrated in the air quality dashboard, allowing for finer conclusions.

The transport indicators allow an assessment of the development of electric vehicle expansion, important for grid needs. As the goal of the mobility transition is not to expand electric mobility, but to reduce combustion mobility, also cycling mobility and public transport trends are monitored. This allows an impression of the overall transport development.

The general project indicators shall monitor effects of SPARCS that have not been caught by other indicators.

The financial indicators shall allow seeing the financial effects, and whether EU funding triggered further funding. Unfortunately, the only available municipal database for this however is incomplete and does not support a detailed analysis.

The indicators of the Leipzig interventions shall monitor how they proceed: whether the urban data platform is expanding, and whether a standard model is supported by easily accessible documents.

Table 9: Leipzig KPIs

Leipzig KPIs	Unit
Background indicator	
Total number of citizens	#
Energy indicators	
Electricity Demand	MWh

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Net installed capacity Renewable electricity	MWp
Heat Demand	MWh
Net installed capacity Renewable heating	MWp
Maximum daily peak demand of all days (electricity) per year	MW
Maximum daily peak demand of all days (heating) per year	MW
Air quality indicators	
O3	$\mu g/m^3$
NOx	$\mu g/m^3$
Small particulates - pm10	$\mu g/m^3$
Transport indicators	
Vehicle stock - total number of motor vehicles	#
Total number of EV cars	#
Number of shared EVs at LSW, LAS, Netz Leipzig	#
Total number of vehicles in local transportation	#
Electric Busses in local transportation	#
Yearly overall count of bicycles at counting stations operating since 1.1.2021	#
citizens going to work using a personal combustion vehicle	%
citizens going to work using public transport	%
number of public or semi-public EV charging points	#
number of smart EV charging points	#
number of bidirectional EV charging points	#
General project indicators	
number of jobs created by SPARCS	#
Life expectancy at birth	years
Financial indicators	
Money spent without EU contribution	€
Money spent with EU contribution	€
Benefit incl. Cost saving at partner	€
Benefit incl. Cost saving at 3rd party	€
L19 Integrating energy and building data into the Urban Data Platform	
Number of energy and building datasets necessary for creating district refurbishment concepts integrated in the Urban Data Platform (GIS)	#

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How much has the project benefitted from, contributed to and follows the strategic documents of the city?	#
How many city units have been involved in planning?	#
L20 Standard model for smart cities	
Check lists / maps available	#
Number of Workshops with city units	#

2.5.2 How monitoring is done currently

Most indicators stem from official municipal publications. Currently, the monitoring relies on manual actualisation of the indicators. Many of the indicators stem from municipal statistics. They can be found in various statistical documents:

- The statistical yearbook
- The climate city status report
- The municipal citizen enquiry

Furthermore, data can be found online at:

- Statistik.leipzig.de
- Opendata.leipzig.de

The SPARCS team retrieve some of the indicators retrieved from urban dashboards, such as the air quality indicators. The air quality dashboard can be found here:

- https://geoportal.leipzig.de/arcgis/apps/experiencebuilder/experience/?id=9a13182739c74c228ff27a0ec8fb7202&page=page_0

In the case of the cycling data, the indicator was developed especially for SPARCS, based on the available data from bicycle counting stations. The cycling counting station dashboard is here:

- https://geoportal.leipzig.de/arcgis/apps/experiencebuilder/experience/?id=4fd2c688fa754d55903dcb8acf9dafa7&page=page_0

The city of Leipzig SPARCS team collects some indicators itself. This is the case for financial indicators, the number of bidirectional charging stations, or the jobs created by SPARCS. As they refer specifically to the project, they will not be monitored after the project.

Other indicators are collected by individual communication with partners. This is the case for peak loads, the overall number of charging stations, electric busses, or the number of EVs available for sharing.

Currently, the Leipzig team updates the data are manually for each deliverable, and uploads them.

The Leipzig Energy Map will centralise some of the monitoring, especially on renewable and non-renewable energy production and charging stations.

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2.5.3 Data that will be displayed on the Leipzig Energy Map, or in other system

Here, we document the city of Leipzig's assessment of whether its KPIs makes sense to be displayed on the Leipzig Energy Map.

Table 10: Data that will be displayed on the Leipzig Energy Map, or in alternative monitoring system (LPZ)

KPI	Offers benefit for others after the project?	Understand-able for externals?	Options to cover the effort needed to collect and integrate the data?	Hence: Leipzig Energy Map (Energie-Atlas Leipzig)?	Target monitoring system: Leipzig Energy Map (Energie-Atlas Leipzig) or partner system	Explanation if KPI will not be monitored
Background						
Total number of citizens	Y	y	?	y	Leipzig Energy Map	
Energy Indicators						
Electricity Demand	Y	Y	?	Y, to be improved	Leipzig Energy Map	
Net installed capacity Renewable electricity	Y	Y	Y	y	Leipzig Energy Map	
Heat Demand	Y	y	?	Y, to be improved	Leipzig Energy Map	

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Net installed capacity Renewable heating	y	y	y	y	Leipzig Energy Map	
Maximum daily peak demand of all days (electricity) per year	?	?	?	?	Leipzig Energy Map, if doable	
Maximum daily peak demand of all days (heating) per year	?	?	?	?	Leipzig Energy Map, if doable	
Air quality Indicators						
O3	y	y	y	y	Air quality dashboard	
NOx	y	y	y	y	Air quality dashboard	
Small particulates - pm10	y	y	y	y	Air quality dashboard	

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SPARCS

Transport indicators						
Vehicle stock - total number of motor vehicles	? Results from workshop with VTA	y	?	?	Leipzig Energy Map	If proves useful for transport unit
Total number of Ev cars	? Results from workshop with VTA	y	?	?	Leipzig Energy Map	If proves useful for transport unit
Number of shared EVs at LSW, LAS, Netz Leipzig	n	n	-	No. (No permit yet to be publicised)		No, because the baseline will be unclear to most people, and it is not a substantial indicator for the general city development.
Total number of vehicles in local transportation	? Results from workshop with VTA	y	?	?	Leipzig Energy Map	If proves useful for transport unit
Electric Busses	y	y	Y ?	?	Yes, if doable	
Yearly overall count of bicycles at counting stations operating since 1.1.2021	Y - Results from workshop with VTA	y	?	?	Leipzig Energy Map	If proves useful for transport unit

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citizens going to work using a personal combustion vehicle	? Results from workshop with VTA	y	?	?	Leipzig Energy Map	If proves useful for transport unit
citizens going to work using public transport	? Results from workshop with VTA	y	?	?	Leipzig Energy Map	If proves useful for transport unit
number of public or semi public EV charging points public	y	y	?	y	Leipzig Energy Map	
number of smart EV charging points	Y	y	n	y	Leipzig Energy Map	
number of bidirectional EV charging points	?	y	n	y	Leipzig Energy Map	

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General project indicators						
number of jobs created by SPARCS	y	y	n	n		Difficult to assess after SPARCS
Life expectancy at birth	n	n	y	n	monitored in yearbook	No direct value because no direct attributability
Life satisfaction	?	y	?	n	Monitored in municipal citizen enquiry	No direct value because no direct attributability
Financial indicators						
Money spent without EU contribution	After the project's end, these project indicators do not change any more and hence do not offer any value.	n	n	n		No further EU contribution after SPARCS ending
Money spent with EU contribution	No value after the project	n	n	n		No further EU contribution after SPARCS ending
Benefit incl. Cost saving at partner	No value after the project	n	n	n		Benefits are difficult to assess in Euro

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Benefit incl. Cost saving at 3rd party	No value after the project	n	n	n		Benefits are difficult to assess in Euro
Intervention L19: Integrating energy and building data into the Urban Data Platform						
Number of energy and building datasets necessary for creating district refurbishment concepts integrated in the Urban Data Platform (GIS)	Y	y	Y – CUT	Y, as background data	Leipzig Energy Map – as meta data	
How much has the project benefitted from, contributed to and follows the strategic documents of the city?	n	n	n	n		No useful information after SPARCS
How many city units have been involved in planning?	n	y	y	n		Task is completed after SPARCS

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Intervention L20: Standard model for smart cities						
Check lists/ maps available	y	n	n	N		Even if LZP continues work on the standard model after SPARCS, this number will not make sense in a map environment
Number of Workshops with city units	n	n	y	n		The number of SPARCS based workshops will not increase after SPARCS

Legend
Y = yes
N = no
? = unclear/debatable

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3. RESUMÉ

Partners intend to continue monitoring most KPIs – minimally internally, but for many of them, displaying them on the Leipzig Energy Map is an option. For some of them, specific procedures and work flows still need to be checked and established; this is a little difficult in advance.

LSW is willing to share the vast majority of the SPARCS KPIs in the Leipzig Energy Map after the project. How exactly LSW will transfer data will be agreed upon later. A cooperation contract, including SPARCS KPIs, is currently being arranged within the CUT project. Besides that, LSW will continue to monitor numerous indicators, and consider further cooperation.

Cenero will continue to monitor the energy flows in the Baumwollspinnerei Demo District and will try to make as much information available to the public as possible. Cenero will also try to disseminate the information in a way that is useful to people outside the SPARCS project. In addition, for future projects, consideration will be given to discussing data protection with tenants at an early stage and trying to reach agreements with the respective tenants on the use of the data. This could help to increase the transparency of the collected data in such projects and increase its value for replication.

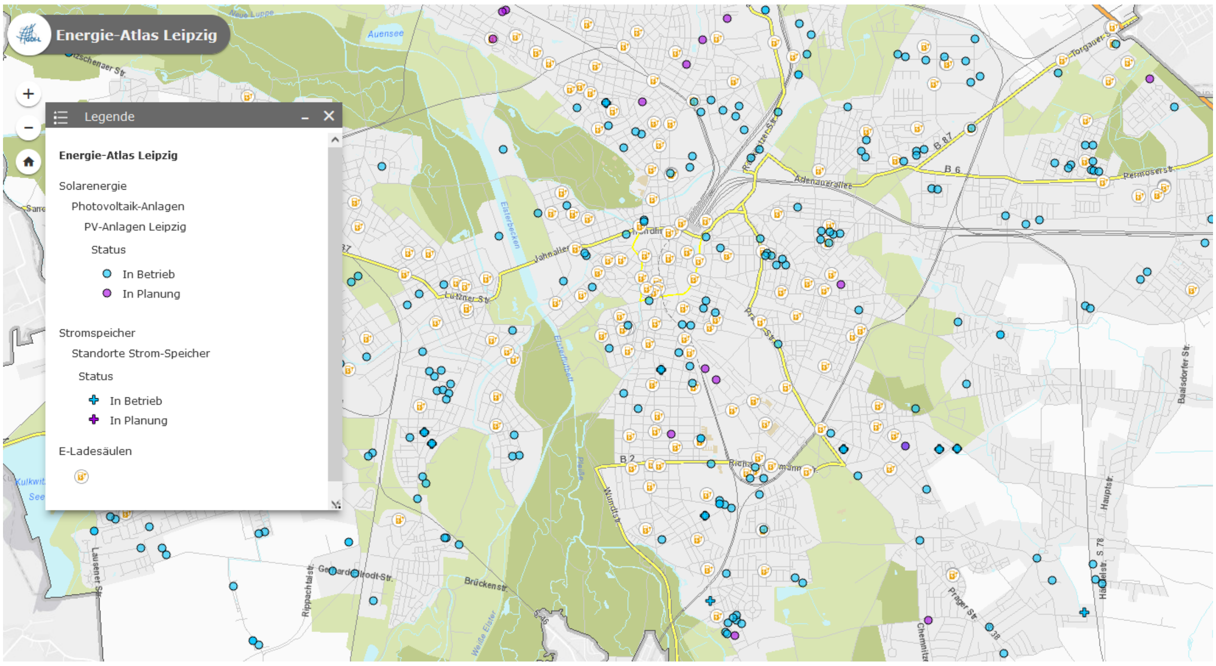

Figure 8: A view of the Leipzig Energy Map Pilot showing whether charging stations, solar plants and electricity storages are close-by. Source: City of Leipzig.

WSL will provide data for energy consumption at spatial scales that do not disclose individual's consumptions. PV roll out data will also be integrated into the Leipzig Energy Map; as the mother company's geo information system is compatible to Leipzig's GIS system, this will be easy. Additionally, as LWB is a municipal company, they see themselves as role models for data sharing. WSL belongs to LWB, so this applies.

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The University of Leipzig will further develop the modelling toolbox IRPopt. The development strategy is to integrate new technologies, and the regulatory framework. Moreover, the Institute for Infrastructure and Resource Management will permanently update the model data based on desktop research and exchange with LSW. Latest results and findings of the model application are the basis for scientific publications and part of the lectures at the university.

The city of Leipzig is aiming to continue the development of Leipzig Energy Map (Energie-Atlas Leipzig) after the SPARCS project's ending and is currently checking opportunities of subsequent funding projects as well as funding from cities own budget. For now, the Leipzig Energy Map development can be continued within the framework of the Connected Urban Twins (CUT) project, which aims at basing scenarios on available data. Within this context, also SPARCS KPIs can be monitored further and integrated as necessary.

Overall, the Leipzig Energy Map seems to be an option for continued collective monitoring. Questions arose as to whether data will be completely public, or available only to restricted user groups. There was a clear demand for access management from some technical partners.

All in all, it also became apparent that not all KPIs can usefully be integrated into the Leipzig Energy Map – may this be due to a lack of understandability outside the SPARCS context; may this be because collecting them is laboursome in some cases, and it is sometimes already now clear that the resources will not be available. It was worth checking so clarity could be reached, and a concentration on the most insightful KPIs is possible.

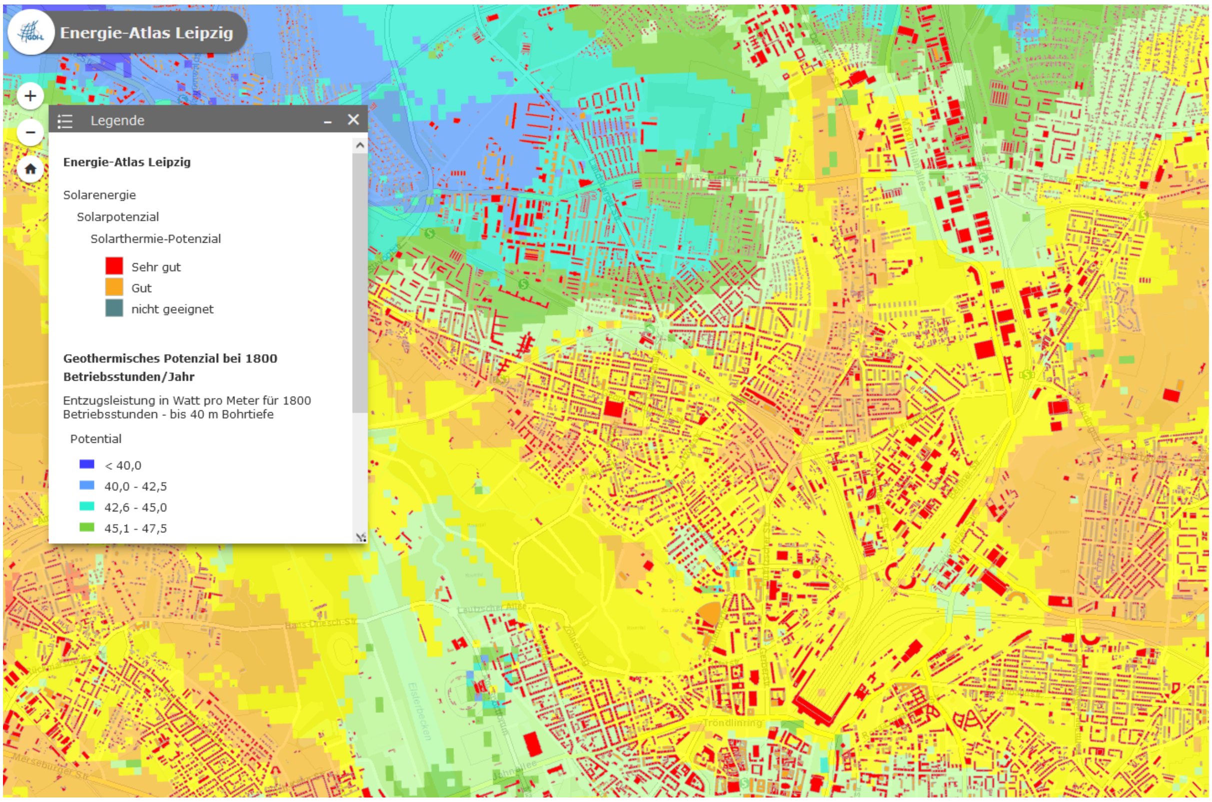

Figure 9: A view of the Leipzig Energy Map Pilot showing the solar thermal potential of roofs, and the geothermal potential of the ground. Source: City of Leipzig.

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4. Appendix

4.1 List of tables

4.2 List of figures

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