SPARCS

Sustainable energy Positive & zero cARbon CommunitieS

Sustainable urban mobility in Espoonlahti and Lippulaiva blocks

Examining potentials for increasing sustainable mobility in the area

UPDATED VERSION

Horizon 2020
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SPARCS

Figure 1. Espoonlahti area with the new Lippulaiva center in October 2022. Source: Citycon Oyj.

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SPARCS project, 2022. Updated in 2023.

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SPARCS

SUMMARY

This document examines Espoonlahti area and Lippulaiva blocks as a case for sustainable urban mobility development. The analytical focus is set on the SPARCS project aims regarding electric mobility (e-mobility) development, including the development of electric vehicle charging infrastructure, examining the potentials for shared e-mobility services, and identifying new concepts for e-mobility hub solutions. The document focuses on presenting local demonstration activities from the project set in the Espoonlahti area and Lippulaiva blocks, as well as discussing their initial learnings and results, and their effects for future urban development. The document also describes a workshop process that was conducted to examine and localize these themes.

Urban mobility is changing rapidly as multiple trends are affecting its development, including the electrification of all vehicle types from bicycles to buses and trucks, the global urbanization process and the requirement for equitable mobility and high quality public spaces in dense urban areas, and the increase of different shared mobility services. These trends are closely linked to the acute need for a shift towards sustainable urban mobility and the decrease of transportation related greenhouse gas emission.

Cities play an ever increasing role in reaching both national and global sustainable development targets. The solutions conceived, piloted and put into use locally, can - once replicated, scaled and localized - act as key solutions for areas elsewhere, increasing the carbon *handprint* that individual cities as frontrunners can have.

This report is part of SPARCS Work Package 3, Action E2-3 ’Boosting the uptake of E-mobility’ in Lippulaiva blocks and Espoonlahti area. The paper is a joint effort by the relevant SPARCS partners.

UPDATED VERSION In spring 2023, the document was updated to include figures and details from the recently finished Lippulaiva premises (opened in March 2022) Espoonlahti metro station (opened in Dec 2022) and bus terminal (opened in Feb 2023).

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SPARCS

INTRODUCTION

The on-going global climate change requires swift actions to cut down greenhouse-gas emissions in different sectors. These emission cuts are required to keep global warming under 1.5 degrees in, as defined in the Paris Agreement in 2015 [1] as a global shared target. Mobility plays a major part in the generation of these emissions – in 2017, 27% of the carbon-dioxide emission produced in the EU were caused by transportation alone [2]. Actions on the EU, national and local level have been initiated to answer to this major challenge: for example, the EU Green Deal aims to cut net emissions in the EU to zero by 2050 and to decouple economic growth from resource use, and in Finland, the national Roadmap to fossil-free transport [3] defines actions to eliminate greenhouse gas emissions from transport by 2045.

Cities play an increasingly important roles in the local measures that affect daily life and mobility habits of its citizens. The City of Espoo aims to be carbon neutral by 2030 and achieve this by supporting the development of sustainable and smart solutions in the mobility sector that support walking, bicycling, public transportation use and shared mobility service use. Through local actions, cities can that act as frontrunners in this green transformation can produce a strong global carbon *hand*print of paving the ground for a more sustainable mobility system.

SPARCS project aims to support the development of citizen-centric positive energy districts (or PEDs) (Figure 2) that can guide sustainable urban transformation for the future. Mobility and transportation have a key role here as a major energy consumer on the local level, both in terms of personal transportation and logistics. The effects of transportation to the district are not isolated to energy use alone as it affects the built environment infrastructure, accessibility, and social equitability. Together with (locally) zero-emission technologies, such as electric motors, issues related to the usage, travel experience, availability of services, inclusivity of transport, and perceived quality of public spaces, are all elements that ultimately effect on the popularity and usage of sustainable mobility modes. A holistic and system-based approach is needed to tackle the sustainable urban mobility challenge.

One of the central aims of the SPARCS project is to 'boost' electric mobility, or e-mobility in the project's three demonstration areas of Espoonlahti area/Lippulaiva blocks, Leppävaara area/Sello blocks and Kera area. A shift to electricity over petrol in powertrain technologies can decrease the transportation related carbon-dioxide emissions, as well as contribute to the energy system more broadly as well, including grid stabilization. In SPARCS, EV charging solutions are demonstrated, and

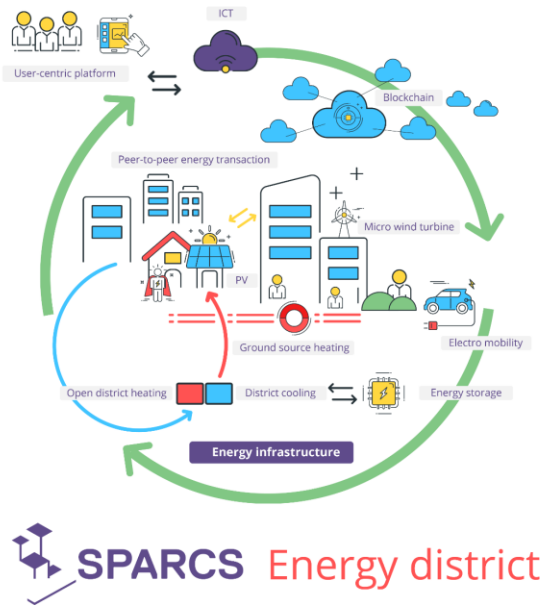

Figure 2. SPARCS project target areas depicted, including 'electro mobility', or e-mobility. Source: SPARCS project.

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their effects to the grid are examined. Further possible charging demand scenarios for the future are also drawn, and new approaches on how we understand the role of energy and mobility solutions in urban settings are studied and co-created with diverse stakeholders, among other activities. E-mobility, the general electrification of all vehicle types (bicycles, buses, logistics, cars) can play an important role in future sustainable urban mobility system – but how will they affect the built environment, daily mobility routines, service models, and even urban architecture?

This document draws insight from the work done in Espoonlahti area and Lippulaiva blocks on e-mobility in the SPARCS demonstrations in order to examine the prospective for further sustainable urban mobility development in the area. The mobility system in the area has been developed strongly recently, the soon-to-be-opened metro line (planned start of operation is in 2023) that runs under the new Lippulaiva shopping centre, being one of the major new investments on sustainable mobility in the area.

This document takes these and other near-future developments of the area into account, together with future mobility trends, and further probes the possibilities of sustainable urban mobility though the SPARCS-related themes, in specific, e-mobility and shared mobility services in a mobility hub setting.

The structure of the document is as follows: The document, first, presents some current key challenges related to sustainable urban mobility in Espoo context. Second, the document presents the Espoonlahti area and the re-developed Lippulaiva blocks as case areas from a (e-)mobility development perspective. The document also here covers the SPARCS activities done in Lippulaiva blocks to boost e-mobility in the area (and beyond). Next, the document presents the insights from an internal workshop that was organized between the SPARCS partners to further probe future e-mobility questions in the area and beyond, including the rapidly increasing growth of shared e-bike and e-car services globally, the emerging e-mobility hub developments and concepts, and the effects of the Covid-19 pandemic to future mobility needs. The document also covers questions related to the future energy demand in Lippulaiva blocks due to increasing e-mobility, an issue that has been examined in detail in one of the SPARCS demonstration areas of Leppävaara area/Sello blocks.

SUSTAINABLE MOBILITY - CHALLENGES AND POSSIBILITIES

Sustainable urban mobility, here, refers to low or zero-carbon mobility modes that are also accessible, safe and inclusive. The transition towards sustainable urban mobility plays a key part in the carbon-neutrality targets which cities and nations have laid out, as well to other sustainable development targets, such as the United Nations Agenda 2030 Sustainable Development Goals (SDGs). Currently, transportation causes one-third of carbon-dioxide (CO2) emission in Europe [4]. Next to developments in energy, construction, biodiversity preservation, circular economy, smart city solutions and sustainable urban lifestyles, we also need a rapid transition towards sustainable urban mobility to achieve the carbon-neutrality targets set locally, nationally and internationally.

This means that we need to rethink how we move in, *and* between, cities. Key solutions might be found in the increased use of mass transportation and shared mobility services, in the increase of walking and biking journeys, and in the rapid electrification (or other alternative renewable energy sources) of all

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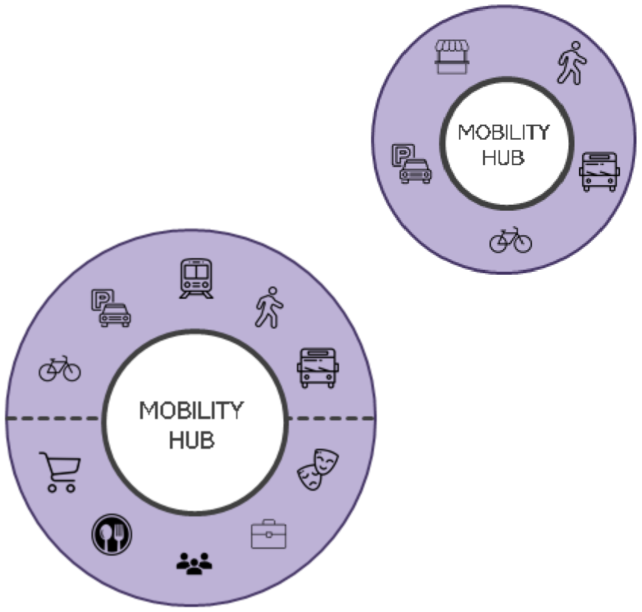

Figure 3. Mobility hubs are sites where mobility modes are changed. Larger mobility hub combines shared mobility services, public transportation and other mobility modes to other day-to-day services, such as stores, workplaces, and residential areas. Figure: authors.

currently petrol-powered vehicle types. Single solutions, though, are not enough: a long-lasting and stable transformation of urban mobility requires a more systematic change in urban structures and lifestyles so that the whole transportation system supports the use and operation of sustainable mobility modes. This probably also mean changes in the *why* and *how often* we move: some of the today's journeys might, for example, be replaced by automation and digital solutions, such as door-to-door parcel deliveries or remote working practices after the Covid-19 pandemic. Whatever the case might be, it is probable that some of these new urban mobility practices will be something that we can predict and foresee, and manage and direct actively, and some will be more completely new and emergent practices that we cannot yet see or predict.

The EU is driving change on urban mobility on different fronts. One major policy related action is the ban of the sale of new petrol and diesel cars in 2035 [5]. The decision puts weight on a shift towards locally zero-emission technologies, both in the private and commercial fleets. This, and other developments in both technology and policy, are driving a rapid transition towards the electrification of all vehicle types in transportation, which seems to happen alongside a general electrification of societies. Simultaneously, light electric vehicles (LEVs), as a relatively new type of urban mobility vehicles, are also gaining increasing foothold, both as privately owned vehicles and through shared services, such as electric bicycles and electric kick-scooters. Additionally, automation technologies are developing and advancing, and first pilots of automated buses and cars have been completed in many cities globally (such as in the SPARCS demonstration site Kera, Espoo in 2019 [6]), although day-to-day operations have yet not begun in any major scale.

The mobility systems of cities are changing rapidly, and they are also swiftly changing the urban landscape. This will have effects also to how we build our cities and buildings to facilitate these new types of mobilities emerging on different fronts, such as the '15 minute city' idea that has recently attracted attention in the wake of the global Covid-19 pandemic [7]. The idea is based on a dense urban area with close by services that are reachable in 15 minutes, decreasing urban sprawl and the need to travel long distances to access services.

Mobility hubs, the nodal points in the urban mobility system that gather different users, vehicle types and (public and private) services 'under one roof',

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have an increasingly important role in such schemes of sustainable urban mobility. They facilitate sustainable urban mobility by acting as key links in sustainable transportation chains, where one mobility mode is changed into another along the route, such as from walking to a bus, from a bicycle to the metro or walking to a shared city bike. They also provide a host of different services from grocery stores to cafés and post services. In addition to being a pass-through kind of a place, they also act as central social spaces, facilitating social meetings and gatherings. The larger hubs also have attached housing and office spaces in the area, forming larger urban cores and a local network of different services.

The general idea and concept of the 'mobility hub' as well as the practical day-to-day operation of it are also continuously transforming and evolving as our modes and habits of travelling in and between cities change. New transportation technologies are emerging, especially on the micromobility sector, which includes electric bicycles and other light electric vehicles. This evolution has been facilitated by the development of digital solutions that enable easy loaning and payment, and real-time monitoring of the trip and use of the vehicle. However, how such new shared vehicles fit to the urban landscape and on the road amongst other traffic, has been learning process in terms of how such new mobility practices and behaviour are managed and directed towards desired outcomes [8].

Additionally, the development of automation technologies in both mass transportation and private mobility are advancing in a rapid pace, introducing further new elements to the urban mobility system. Self-driving vehicles have been tested and piloted in many cities around the world already, even though their day-to-day adaptation is yet to happen – here, the technological issues are not the only hurdle as the policies and social practices and attitudes also play a major role in the possible adaptation of self-driving vehicles [9].

Similarly, *why* we move evolves as well, and the Covid-19 pandemic has sparked, for example, new ways of doing remote work, and multi-local lifestyles, where daily life is no longer tied necessarily to one location (the workplace, home etc.).

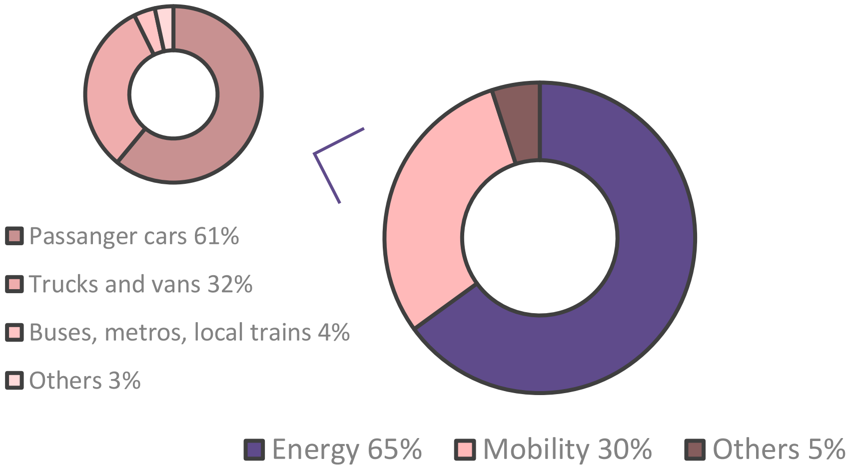

Figure 4. Carbon dioxide (CO2) emission in Espoo by source (on the right), with a further breakdown of the transport-related emissions (on the left). Data source: HSY 2021 [10]. Figure: authors.

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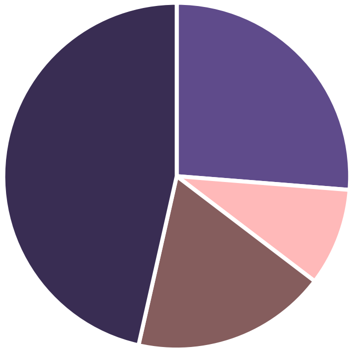

Figure 5. The modal split in Espoo in 2018. Data: Espoon kaupunki 2021 [13]. Figure: authors.

MOBILITY IN ESPOO

In SPARCS project, this simultaneously global *and* local challenge of sustainable urban mobility transition is tackled in the Espoo city context. Espoo is the second largest city in Finland (by population, 290,000 residents), located in the capital Helsinki Metropolitan Area. Espoo aims to be carbon neutral by 2030, and to achieve the UN Agenda 2030 Sustainable Development Goals (SDGs) by 2025. Currently, energy is the largest source of greenhouse gas emissions - 65% in 2019 [10] – but this number is expected to decrease in the near future due to a transition towards greener energy production and consumption methods and practices (Figure 3). For example, the use of coal in heating generation in Espoo area is set to end by 2025 [11].

In 2019, transportation was already responsible of 30% of CO2 emissions in Espoo [12] - this share will only increase when steps into the right direction are taken on other sectors, energy in specific. The challenge with decreasing mobility related emissions is that the sources are multiple, and there are no single major city-wide sources that can affected directly, such as in the case of heating energy production, for example.

The decrease of passenger car and logistics-related emissions are crucial as they currently cover 93% of the transportation related emissions in Espoo. Similarly, 46% of all trips in Espoo, are currently made by private car [13], which means that there is potential for private car use decrease if the other modes of mobility are adequately developed to support their attractiveness in daily life (Figure 4). Espoo, however, has potential for decreasing these emissions as the city is characterized by a 'network' kind of a structure with multiple urban centres that will all be connected with rail-based public transportation in the upcoming years. The investment in rails also means that the future city can be developed alongside these urban corridors, where the nearest station area is not too far away.

The challenge on mobility is not Espoo-specific. In 2016, 28% of all the trips made in Finland by a private car were 3km or less in length (and 40% under 5km) [14]. These relatively short trips are suitable to be replaced by other mobility modes. Electric bicycles and other light electric vehicles might be able to replace private car trips if the infrastructure supports their use, and they are readily available through shared use. The rapid increase of the electric kick scooter use, for example, might give some indication of the potential that urban mobility possesses. The data from Espoo at least shows that the trips replaced by such light electric vehicles are not all walking, bicycling or public transportation trips but private car trips as well.

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This challenge can be tackled by developing new solutions for how we move, for example by strengthening the role of mass transportation through urban planning practices, developing shared mobility services, or utilizing new technologies, such as electric motors in different vehicle types. This has also a direct impact beyond strictly mobility or transportation related issues: what does these new services, and the technological and behavioqural changes related to them, mean for how we live, use spaces and services, and provide services?

ESPOONLAHTI AREA

Espoonlahti area is located in the south-western part of Espoo. The Greater Espoonlahti area is second largest of the seven Greater districts in Espoo, with 55,620 residents (in 2019) and 9,840 work places (in 2017) [15]. The Greater Espoonlahti comprises of multiple smaller areas, including the Espoonlahti centre (approx. 15,000 residents), which is one of the five city centres in Espoo that together form the multi-centre "networked" urban structure of the city (Figure 5). Other areas of interest in the Greater-Espoonlahti area are also Finnoo (a developing new urban area, also one SPARCS replication area), Kaitaa and Kivenlahti.

Espoonlahti is in the process of rapid redevelopment. Multiple active processes are on-going that will affect the area in near-future, the construction of the new metro line being one of the major investments. The metro connection to the area is to be opened in 2023, strengthening the area's public transportation services through a rail-based connection. The metro line is an extension to the first phase metro line in Espoo that opened in 2017 with 6 stations (from Keilaniemi to Matinkylä). The extension, or the second phase, will add 5 new stations to the line (from Matinkylä to Kivenlahti), including the one in Espoonlahti (under Lippulaiva blocks), and others in Finnoo, Kaitaa, Soukka and Kivenlahti that are all part of the Greater-Espoonlahti area.

Figure 6. Main transportation infrastructure and the five urban centres of Espoo depicted (clock-wise): Espoo centre, Leppävaara, Tapiola, Matinkylä and Espoonlahti. Source: City of Espoo.

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The new metro station areas will form important, densely built, urban areas in Espoo, attracting both residents and companies alongside rail-based public transportation. The metro line forms an important development corridor for the urban structure, as stated in the previous city strategy (Espoo Story 2017-2021). New building stock is added alongside the metro line.

The new Lippulaiva shopping centre will form an important mobility hub in Espoonlahti. The bus terminal in Lippulaiva will connect feeder bus traffic to the metro, creating an important point of transferring from one mobility mode to another. The used buses will most likely be electrified at some point in the future as HSL, the local transportation authority, aims to electrify the procured service with a goal of ~30% electric buses used of the total number in 2023 [16], which means that the operators will electrify their bus fleets in the upcoming years to compete in these tendering processes. At some point in the future, also autonomous bus services might be an option.

The mobility hub will probably also attract new 'last mile' service providers to the area in increasing numbers to tackle the journeys to/from the hub locally. Different shared light electric vehicle services have appeared globally in recent years. The electric kick scooters have probably been the most visible additions to the urban mobility system, but also different (e-)bicycle services have been piloted. Dedicated parking facilities/areas and clear codes of conduct in the Lippulaiva premises might be key steps in ensuring a smooth travel experience for the service users as well as other people moving in the area, avoiding some of the negative impacts experienced elsewhere, for example through the unorganized parking practices.

The public shared city bike system in Espoo was introduced in 2017, and currently has 110 docking stations in service. The system is currently located in the eastern and south-eastern areas of the municipality. The city bikes have been popular and used frequently as a 'last mile' solution on the way to metro and train station areas. Different mobility hub station areas thus play a key role as potential areas for city bike docking stations. The city bike system is not currently available in the Espoonlahti area.

Logistics are also currently in a transformation as new types of (automated) services are introduced for the 'last mile' in deliveries, postal services and other logistical services. Automated delivery cabinets are already a common sight in many mobility hubs.

The Lippulaiva blocks are presented in the following pages in more detail.

Figure 7. Espoonlahti, with Lippulaiva blocks highlighted. Satellite image: https://kartat.espoo.fi/ims. Figure: authors.

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CASE LIPPULAIVA BLOCKS

THE OLD SHOPPING CENTRE IS REPLACED WITH AN ENTIRELY NEW URBAN CENTRE

- Demolition of the old Lippulaiva shopping centre (built in 1993) was done in 2017
- Temporary Pikkulaiva shopping centre was opened in 2017 to provide the services during the construction of the new Lippulaiva
- The new Lippulaiva opened in March 2022

Figure 8. The new Lippulaiva center in August 2022. Source: Citycon Oyj.

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CASE LIPPULAIVA BLOCKS

Visit our virtual room!

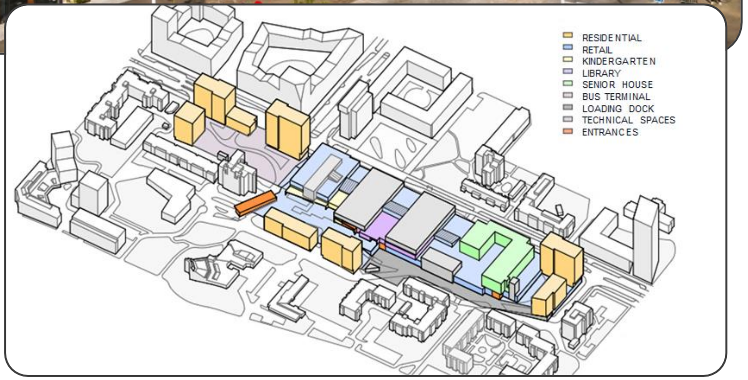

Figure 9. The new Lippulaiva blocks (middle) with different building types highlighted in the visualization (right). The attached QR code (left) leads to a 3D-model showroom of the blocks. Source: Citycon Oyj.

A CENTRE FOR LOCAL SERVICES

- Groceries, restaurants and cafés
  - Over 100 operators
- A Library, a day care centre
- Eight (8) residential blocks (450–500 apartments) and underground parking facilities; 6 residential towers are completed
- Geothermal heat pumps, solar panels
- Green roofs

KEY FIGURES

- Gross floor area: 190,000 m2
- Gross leasable area: 44,000 m2
- Customers/year: 8,000,000

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CASE
LIPPULAIVA
BLOCKS

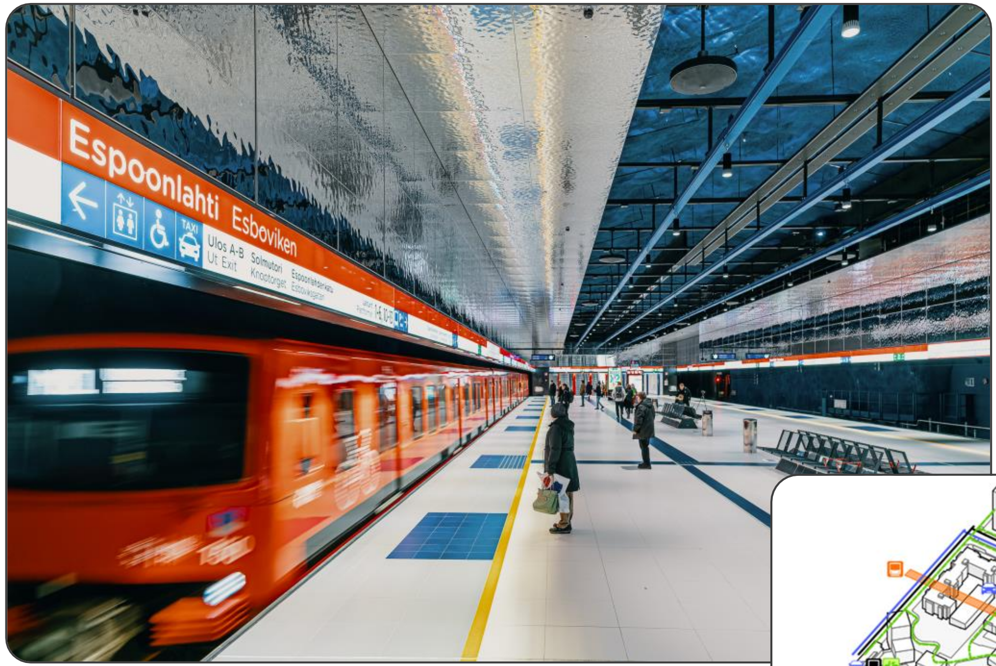

Figure 10 (left). Espoonlahti metro station opened in December 2022. The station's atmosphere is inspired by the nearby swimming centre in its colour tones, lighting and materials', as stated in the Länsimetro website [17]. Source: Citycon Oyj.

A KEY PUBLIC TRANSPORTATION HUB

- Espoonlahti metro station: a new station of the second phase of the western metro extension opened in December 2022
- An estimated 14,000 passengers will use the Espoonlahti metro station daily
- A feeder bus terminal for metro-bus connections opened in February 2023
- Potential for market-based 'last mile' shared mobility services as an active metro station area

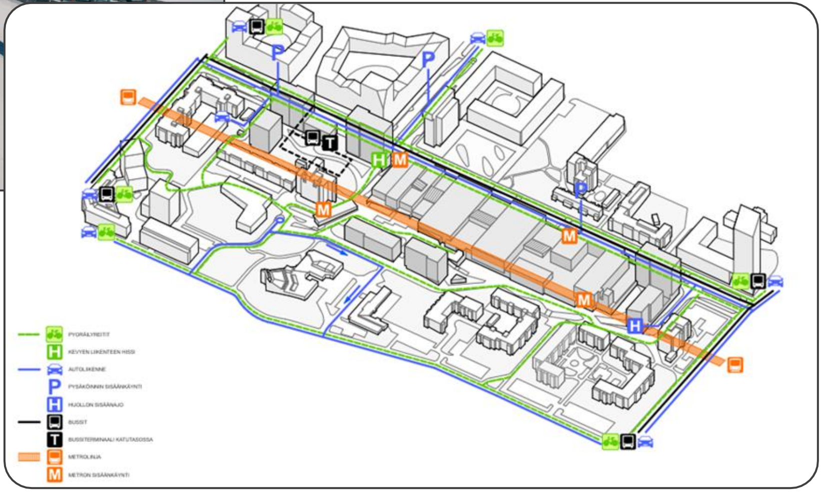

Figure 11 (right). The mobility connections in Lippulaiva blocks. Source: Citycon Oyj.

Figure 12 (left). The bus terminal opened in February 2023. Source: authors.

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CASE LIPPULAIVA BLOCKS

Figure 13. Installed EV chargers in Lippulaiva parking garage. Source: authors.

Figure 14. Bicycle parking in Lippulaiva premises. Source: authors.

EV CHARGING IN LIPPULAIVA

- Lippulaiva has space reservations for all EV modes
- 4 MW charging power reserved for EV charging
- Implemented EV charging infrastructure mostly based on busbar trunking system
  - Includes load management system
- Charging infrastructure ready for 311 charging spots
- 134 charging spots already implemented
  - 134 AC chargers, 22 kW
  - 10 DC charging spots, 87.5 kW

LIPPULAIVA E-BIKE DEVELOPMENT

- Support and enable E-bicycling (parking and charging)
  - Parking for 1,400 bicycles
- Charging opportunity for e-bikes
- Lockable cabinets for batteries
- DIY parking repair facilities for free use

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SUSTAINABLE URBAN MOBILITY WORKSHOP (FEB 9, 2022)

Espoonlahti, as stated above, is one of the main urban centres in Espoo. The area is currently developing on multiple fronts, including the construction of the new Lippulaiva shopping centre with public services and the new metro line extension (the extensions running from Matinkylä to Kivenlahti), to be opened for use in 2023. The metro line will run directly under the Lippulaiva, which, together with a feeder bus terminal, will turn the Lippulaiva blocks into a major mobility hub in the area.

In SPARCS project, next to the technological demonstrations related to charging and its effects to the grid, we also examine what the electrification and increasing service-based approaches to mobility mean in a broader spatial and social sense. How does the new charging infrastructure-related practices and routines of both service providers and service users connected to the existing daily routines and behaviour? What will these mean for Espoonlahti area and the Lippulaiva blocks?

A workshop was planned to address these perspectives. The workshop utilized some of the already conducted surveys, studies and forecasts on transportation during the planning and design phase of the Lippulaiva and the metro extension. These insights were also connected with the initial learnings from the SPARCS project, including previous workshop results on shared vehicles and e-mobility hub development.

Four themes were selected for the workshop, based on the earlier work done in SPARCS. The themes all cover issues related to shared e-mobility in the Espoonlahti area, and the goal of the workshops was to think these notions further and localize them into the Espoonlahti/Lippulaiva practical context.

The themes covered in the workshop were:

1) Shared e-cars – What kind of challenges and possibilities does the Espoonlahti area and Lippulaiva blocks provide for shared e-car use in the future?

2) Shared e-bicycles - What kind of challenges and possibilities does the Espoonlahti area and Lippulaiva blocks provide for shared e-bicycle use in the future?

3) E-mobility hubs –How does the electrification of mobility and the increasing role of shared mobility services in urban mobility affect the Espoonlahti hub in the future?

4) Covid-19 – What are the main effects of the Covid-19 pandemic to the ’new normal’ of urban mobility locally?

WORKSHOP PROCESS

The workshop was organized as an internal event of the Task 3.4 group 5th Feb 2022. ESP was responsible of planning, organizing and facilitating the workshop. Experts from CIT, VTT, PIT and KONE participated in the workshop, providing their expertise on the aforementioned questions related to the future Espoonlahti and Lippulaiva blocks development as a mobility hub. CIT also provided pre-existing data and material for the workshops about the relevant new Lippulaiva shopping centre transportation and freight related plans that had been produced in the various stages of planning and construction of the new shopping centre.

The workshop was held online (1,5 hours), and most of the co-working was conducted on the Miro platform.

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The workshop utilized earlier findings and learnings from other earlier SPARCS workshops. For the sections covering (1) e-cars and (2) e-bicycles (see previous page), the key insight from earlier SWOT (strengths, weaknesses, opportunities, threats) workshops on the themes were used as base-scenarios, which were here contextualized and examined from Espoonlahti and Lippulaiva blocks perspectives. The idea was to indentify key elements affecting the future shared e-car and e-bicycle use in the area. In the section on the Espoonlahti/Lippulaiva e-mobility hub development (3), the base-scenarios were formed on the basis of an earlier workshop series, organized for different stakeholders on the development of future e-mobility hubs. (See SPARCS Deliverable 3.5 for more details and learnings of the mentioned SWOT and e-mobility hub conceptualization workshops). This section examined the possible changes that the electrification of mobility modes on a large front might bring to mobility hub planning and design. The section on (4) Covid-19 identified two scenarios – a positive and a negative one – on post-Covid-19 urban mobility habits and their implications for the area.

In the workshop, the work was conducted in two teams, utilizing the breakout room function of MS Teams. The generated notes and ideas were also discussed together in one big group between the different sessions to exchange ideas.

An online Miro whiteboard was prepared for the workshop (Figure 15). The board provided both background material to orientate the participants into the theme and context, and the actual workflow process for the co-working sessions. The background material utilised the available reports and studies on the area, including statistics of the area (residents, demographics, workplaces etc.). Additionally, Lippulaiva details were presented, including floor plans and forecasts of the future users of the shopping centre from the planning and design phase. The actual workflow was divided into the four themes presented above.

The main insights of the workshop are presented in the following pages (#01-4).

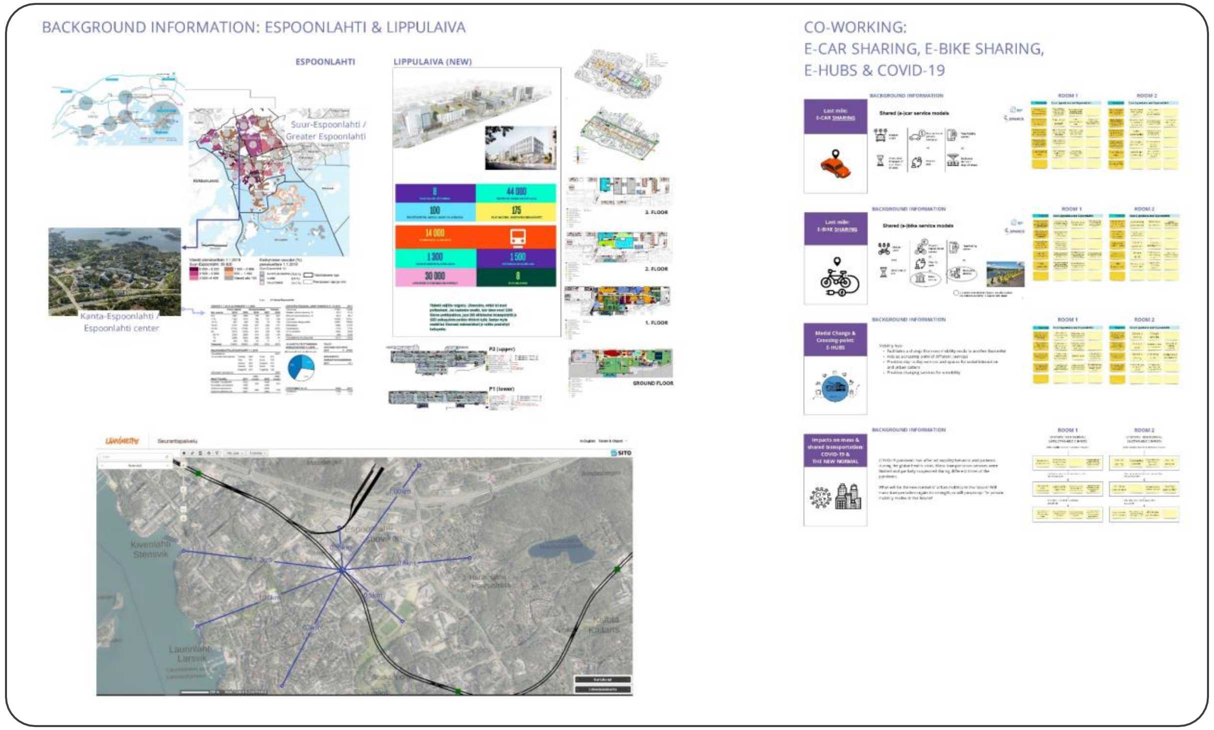

Figure 15. The online Miro whiteboard created for the workshop. Left: background material of the case areas of Espoonlahti and Lippulaiva blocks. Right: the co-working process of the workshop (as filled in during the course of the workshop). Source: authors.

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SPARCS

#01 E-CAR SHARING IN ESPOONLAHTI AND LIPPULAIVA BLOCKS

BACKGROUND Car sharing service, here, refers to a car fleet that is in shared use through a digital app and a related pricing scheme. Usually, these cars are rented for a short time period, the pricing accounting hour-by-hour or even minute-by-minute rates. The system can be fully privately operated (private dedicated car fleet) or peer-to-peer (users renting their own car). The system can be free-floating (park anywhere) or organized around dedicated parking spaces / mobility stations.

INSIGHTS FROM THE WORKSHOP E-car sharing can lead to the decrease of general car use in the area, as only selected trips are made with the shared car, and other trips are conducted with other mobility modes. Less traffic can lead to better quality and safer urban environments. However, if the shared e-cars are readily available at a low cost, the effect can be the opposite, and lead to increased car driving. This can lead to traffic congestions and the decrease of public transportation popularity (which in turn can lead to decreased service level as users and resources are lowered).

Shared e-cars need fast charging infrastructure to work. E-cars need to be charged up when needed. This requires service-based approach and development of the charging infrastructure, as well as the service models related to the charging event (e.g., incentives for users to charge the vehicle, ease of use of the charging infra/apps).

The irregular use of the shared cars makes it difficult to predict local parking space needs and their temporal fluctuations on a daily/weekly level. Parking space requirements could increase in some more popular places and decrease in others. This challenge could be tackled through predictive simulations, and by incentives in the pricing schemes of the service.

The shared car – as a mode of sharing economy – might generate community identity locally, which could be enhanced by a clearly identifiable design of the shared car service.

#01: SHARED E-CARS

FOCUS	CASE ESPOONLAHTI / LIPPULAIVA
Positive impacts: decrease of car driving	– People drive less. Only trips that are difficult to conduct otherwise are made by car. The shared service is more responsive to trip type. – Less car traffic means safer environments and less noise and pollution. – New e-car sharing solutions need to be tested and piloted to get most out of it.
Negative impacts: increase of car driving	– Shared e-car use can lead to an increase of general car use if pricing is low and availability is high. This can have negative consequences, such as increased traffic congestions, decrease of public transportation use and popularity, and the increased need for parking spaces.
Charging infrastructure development	– Shared e-cars require fast charging infrastructure. This challenge can be answered by increasing the number of fast chargers, or potentially providing alternative charging modes for plug-in type solutions, such as wireless charging. – Apps and payment incentives can be used to direct charging behaviour as part of the shared use. – Shared e-cars are likely not a potential candidate for vehicle-to-grid (V2G) solutions or energy system stabilization due to their (expected and targeted) high rate of utilization.
Parking space sizing	– Parking space requirements might decrease due to the increased use of shared vehicles over owned vehicles (decrease of car ownership). This might mean, though, an uneven division of need in popular/less popular areas, which results into the difficulty of estimating appropriate parking space allocation in advance as it is not directly tied e.g. to residency or work places. Simulations, in connection with the set targets for the parking space and car use, need to be made and updated to keep track of the demand.
Social impacts	– Shared e-cars as an element of community building. Strengthened visibility through identifiable logos and colours of the fleet. It could stimulate also other shared uses in the community, such as ride sharing or building tool use and loaning.
Service notes	– Ease of use of the service is important for its popularity. This requires well-designed apps, and service design approaches to be successful and user friendly.

SPARCS

#02: E-BIKE SHARING IN ESPOONLAHTI AND LIPPULAIVA BLOCKS

BACKGROUND E-bike sharing, here, refers to a bike fleet that is in shared use (e.g., through a digital app and related pricing scheme). Usually, these bicycles are rented for a short time period, the pricing accounting hour-by-hour or minute-by-minute rates. The system can be a public service, privately operated, or a peer-to-peer service. The system can be free-floating (park anywhere) or organized around dedicated stations.

In Espoo, a public non-electric city bike system has been in use since 2018, with 110 stations. The service is not currently available in Espoonlahti area, and the service is not available year-round in any part of Espoo.

INSIGHTS FROM THE WORKSHOP E-biking decreases the physical strain through the support of the motor, which can increase the potential user base, and to make it more adjustable to different use contexts. High quality and interconnected bicycle routes are needed to make bicycle use an attractive daily mobility mode. The effects of construction sites in the developing areas needs to be mitigated in advance to ensure smooth bicycle journeys.

The charging infrastructure is relatively easy to integrate to new or existing buildings. No universal charging plugs exist for e-bicycles, which means that the charging infrastructure needs to cater for different technical solutions.

Winter-time bicycling is highly relevant issue in the Nordics. Bicycling needs to be a viable mobility mode for all kinds of trips through-out the year, and in all kinds of weather conditions. This requires maintenance and infrastructural investments in regard to the bicycle routes and parking, as well as in shared service (e.g., winter tires). Safe and weather-proof parking support bicycle use. The location of the parking facilities needs to be favoured in mobility hub planning to ensure quick and easy access between the bicycle parking and services.

City bike systems have been popular so there is proved market for shared bicycling services. E-bicycling can be used to extend the distances travelled, which also requires longer timeframes for the use.

#02: SHARED E-BIKES	
FOCUS	CASE ESPOONLAHTI / LIPPULAIVA
Positive effects to bicycle traffic	– E-bicycles enable bicycling for different user groups. – The e-bikes have a relatively cheap purchase price (in comparison to a car). – The use of cargo-bikes can reduce car trips as groceries and other items can be transported easily.
General infrastructure requirements	– Biking infrastructure is cheaper to build than car infrastructure, providing efficiency benefits for the city. – Biking routes are currently disconnected. A good master plan is required to connect different the routes. – Attention needs to be set on the detailed design of the infrastructure, e.g., providing better design for currently dangerous underpasses for bicycle traffic. – Construction sites often block bicycle paths for long time periods, creating detours and obstacles that decreases its use. This could be mitigated by issuing construction permits only when bicycle traffic is planned well in advance.
Charging infrastructure requirements	– Dedicated charging infrastructure for e-bikes adds to the security and to the upkeep and maintained condition of the equipment. – Charging facilities are relatively easy to add in the construction phase of a building or to already existing buildings. – Robust and easy-to-use chargers are required, with a solid integration to the vehicle sharing station.
Winter-time bicycle traffic	– Encouragement to use shared e-bikes also in winter-time conditions is needed, also during otherwise bad weather. This requires supportive infrastructure and good winter-time maintenance. Winter tires are needed for shared bikes. – Ice and frost might affect the charger and its use. This needs to be taken into consideration in the planning of the charging event. – Better route maintenance during winter-time required to facilitate bicycling year-round.
Parking infrastructure	– Camera systems and overall security is important for safe parking of e-bikes. – Location in the hub needs to be carefully planned to support smooth bicycle use and transition to another mobility mode in the hub.
Service notes	– The city bike system in Espoo has been popular. Long contract periods, though, might make adaptation of the system to new areas, or electrification of the bikes, difficult to do swiftly. – E-bicycles are better for longer trips than non-electric bikes. The timing and pricing of the shared service needs to be flexible to enable longer use times.

SPARCS

#03: E-MOBILITY HUB DEVELOPMENT IN ESPOONLAHTI AND LIPPULAIVA BLOCKS

BACKGROUND E-mobility hubs refer to the electrification of different vehicle types in multimodal mobility nodes. E-mobility hubs provide charging and parking facilities and shared mobility services, including public transportation. E-mobility hubs play a key role in sustainable urban mobility, linking walking and bicycle trips (and other 'first/last mile' trips) to other mobility modes. Larger mobility hubs also incorporate other services – such as stores and restaurants – and mixed-use spaces – such as residential areas and workplaces – to the hub area.

INSIGHTS FROM THE WORKSHOP The core requirement of the hub services is the availability of the shared mobility services. Shared bicycles, for example, need to be actively relocated based on demand and use rate. Through a dynamic pricing strategy, demand can be directed and controlled, tackling both the lows and the peaks of shared service use.

The future hub could benefit from an app that gathers all relevant shared mobility services under it to increase the usability and visibility of all the available options. The location of the mobility services and their interconnections (changing from one mobility mode to another on foot in the hub) needs to be carefully planned and taken into consideration when planning the placement of the services in the hub.

The charging infrastructure for all vehicle types needs to be easy to use and well maintained with a quick customer support to increase their usability. Dynamic pricing schemes can be used to encourage flexibility in travel and charging behaviour.

To accommodate the daily routes of professional drivers (taxis, logistics, deliveries etc.), the charging event needs to be easy to conduct inside the narrow charging windows available during the workday. The chargers need to be located in the same areas where the professional drivers need to be anyway to carry out their related work tasks.

#03: E-MOBILITY HUB DEVELOPMENT	
FOCUS AREA	CASE ESPOONLAHTI / LIPPULAIVA
Mobility services	– Active redistribution of the shared bikes according to need is required to ensure access when and where needed. – Pricing strategy is important for the utilization rate, dynamic pricing might be one solution to direct and control demand.
Service selection	– The placement of dedicated parking for shared cars needs to be close to important hub services. – A shared app for all the different mobility services under the Lippulaiva roof (or beyond) would make it easy for the user to utilize the whole mobility service palette available. – The endpoints of different services need to be close to one another, and walking paths need to be properly designed to facilitate the connections between the different services and mobility modes.
Affecting charging behaviour	– A dynamic pricing scheme in charging: flexibility in charging behaviour could be encouraged through pricing. – Charging infra needs to be easy to use. – The equipment needs to be well maintained, and customer support needs to be prompt to ensure a good user experience.
Professional drivers	– Professional drivers have narrow charging windows – this requires high power output and the availability and reliability of the charging infrastructure. – The chargers need to be located where the drivers would operate anyway as part of their work activities. – The charging event needs to be easy to conduct, and short-term parking with other services (having lunch etc.) can support in making most of the waiting time. – Intelligent load management required.

SPARCS

#04: COVID-19 – WHAT IS THE ’NEW NORMAL’ OF URBAN MOBILITY? CASE ESPOONLAHTI AND LIPPULAIVA BLOCKS

BACKGROUND The Covid-19 pandemic (2019–) has had an enormous effect on societies. From a mobility perspective, mass transportation services experienced a major decrease in both operation and usage during the heights of the pandemic. The various ’social distancing’ measures have also meant the increase of remote working practices (where possible), the increase of online shopping behaviour, and the sprouting up of new logistics and mobility services, catering for personal mobility needs (over mass transportation). The ’new normal’ after the pandemic is difficult to forecast.

INSIGHTS FROM THE WORKSHOP The optimistic post-Covid-19 scenario presents that the importance of bicycling is strongly increased after the pandemic. This will also bode well for shared services, such as the city bike system or other shared (e-)bike services that will see an increase in popularity. Electricity has become ubiquitous in all types of vehicles. Public mass transportation services will also see a growth in its use, partially connected to the increase of bicycling as part of the travel chain as ’first’ and ’last mile’ journeys.

The pessimistic scenario, on the other hand, suggests that people continue to avoid public mass transportation and favour personal mobility modes instead. This can lead to the further decrease of shared and public service availability, which, in turn, can lead to the further decrease of the user base. The increase of personal mobility modes can increase traffic congestion and the requirements for parking facilities, especially in terms of private car use. The increase of online shopping might also decrease the amount of purchases of goods and services locally.

It remains to be seen what short-term and long-term changes the post-Covid-19 world will experience in terms of mobility, the urban environment, and urban lifestyles. Probably the ’new normal’ is ’new’ at least on some fronts, even if we go ’back’ to our previous, pre-pandemic era habits and routines. The ultimate effects of Covid-19 to sustainable urban mobility development, thus, are probably found somewhere between the two utopian/dystopian scenarios presented here.

#04: COVID-19 AND THE ’NEW NORMAL’ OF URBAN MOBILITY	
FOCUS AREA	CASE ESPOONLAHTI / LIPPULAIVA
Positive vision of the ’new normal’	– Major increase of cycling, shared bike and shared car use after the Covid-19 pandemic. Lippulaiva blocks could look like Copenhagen in terms of biking facilities and infrastructure. – E-vehicles are ubiquitous: charging services are found everywhere as part of the green transition of urban mobility. New electric fleet types in public transportation are introduced to cater for new mobility needs and behaviours. – The metro in Espoonlahti gains an important role in the local mobility system and beyond, and sees a major growth in its use, partially due to the increase of bicycling as a ’last mile’ mobility mode.
Negative vision of the ’new normal’	– People avoid public transportation. This leads to fewer users, which in turn leads to lower income from the service for the city. This can pose serious economic challenges for public transportation service providers and the city. – Private car use might increase in the near future, as people still opt to keep social distances and avoid the masses and shared services. Also, the mobility habits favouring private mobility modes, learned during the pandemic, might change slowly. This can increase traffic congestions and lead to future short-sighted urban design solutions that have low efficiency, including the increase of parking spaces for cars. – The decrease of public transportation use can also mean fewer customers at physical shops and other services, decreasing the local spending and the economic viability of services. People might opt to use online shops more often and for a broader selection of services than before the pandemic to keep social distances.

SPARCS

NEXT STEPS FOR DEVELOPING E-MOBILITY SERVICES (#01-04)

WORKSHOP: DISCUSSION AND INSIGHTS

Shared e-mobility services have potential to be central pieces in the local sustainable urban mobility system. Paying only from use is a strong incentive for shared use, and if the services are readily available and affordable, the threshold for their use should be low. The mobility hub, as a ’station’ for different services, plays a here important role in tying together the shared ’last mile’ services and public transportation.

Based on the workshops results presented in the previous pages, some possible next steps can be identified for the further development of the services. These are presented in the Figure 16.

The common guidelines can be distilled to these basic principles:

- The availability of services when needed need to be secured – different methods can be used to direct the demand.
- The placement of the services in the hub and their connections matter in their popularity.
- A balance between shared mobility service use and traditional public transportation needs to be found to make the most out of both
- Construction time mobility connections need to be considered carefully, especially in terms of walking and bicycle traffic (that also affects light electric vehicles).

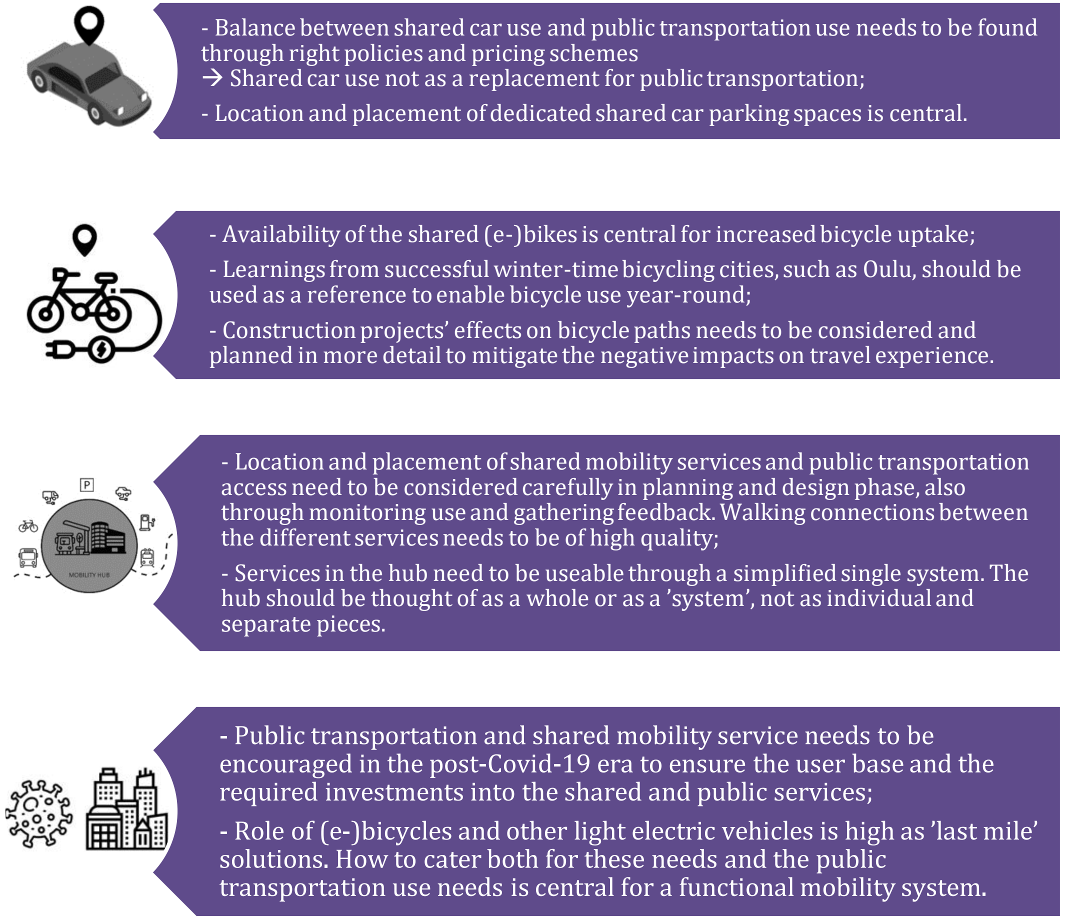

Figure 16. Identified next steps for shared mobility service development. Source: authors.

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SIMULATED ENERGY DEMAND – LEARNINGS FROM LEPPÄVAARA AREA

Background: Lippulaiva is likely going to electrify in significant numbers, but what happens to the grid if there are 100 % electric vehicles? The simplest estimate of the demand could be provided simply based on the emissions data by HSY. Assuming that there is linear relationship between the CO_2 emissions and future electricity demand along with the idea that 1 kg of CO_2 could be replaced with 1.5 kWh of renewable electricity we can have a first estimate – 290,000 people in Espoo produced 292,000 tCO_2 from transportation in 2020 (Source: HSY). Therefore, roughly 440 TWh/a, or 1.2 GWh/day is needed to fully electrify Espoo's daily mobility and logistics.

Calculation: average modern car produces 100 gCO_2/km while consuming 5 litres of fuel per 100 km. A comparable electric car consumes 15 kWh per 100 km. Therefore, 10 $kgCO_2$ are replaced by 15 kWh of renewable energy. Similar calculations would yield more or less similar results for different modes of transport.

Focus on Lippulaiva: Lippulaiva is expecting up to 7,000 new inhabitants. Given the possibility to linearly scale the problem, this would imply about 29 MWh of transport-bound electricity just for the new inhabitants. If all the people had charging habits that would be characterized by immediately charging after coming home from work it could present a significant strain on the grid even while private mobility is only part of this demand. Therefore it is important to identify the possibilities to regulate these behaviours. In a similar study for the Leppävaara hub VTT has deployed a simulation based on vehicle-level optimization of charging price throughout the day. This is a viable approach for studying the temporal variety in demand throughout the day. Applying the patterns we used for Leppävaara and scaling for the right numbers in Lippulaiva we get the following figures:

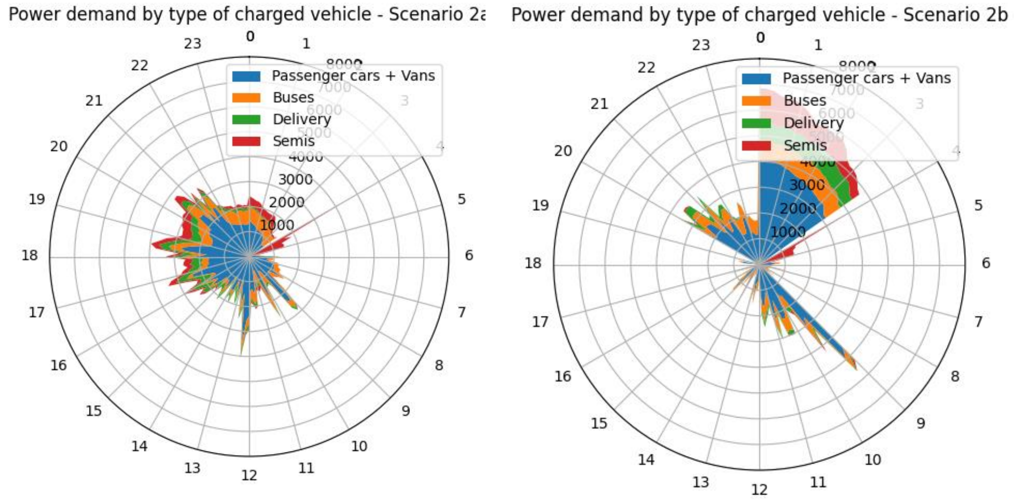

Figure 17. Simulated energy demand scenarios of different vehicle types during a day. Source: authors.

The left figure shows the grid load caused by charging with flat price during the day while the right one shows what happens when there is smart pricing in place. The pricing curve that we used in the right scenario is somewhat amplified reflection of the spot price (the price paid at the electricity stock exchange for electricity in the very moment).

While none of these scenarios exceeded 10 MW in maximum charging power, the smart pricing scenario is loading the grid in times when it is less strained by other loads such as factories and working machines. The grid operators are also charging extra for maximum power used between 7 AM and 10 PM. Therefore, smart pricing scheme would be recommended for future deployments of charging systems.

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CONCLUSION

This document has examined Espoonlahti and Lippulaiva blocks from a sustainable urban mobility perspective. We have here highlighted some key elements of the current development work that have already re-shaped the Espoonlahti area, including the finalization of the new Lippulaiva blocks and the new metro connection (in 2023). We have also presented some new possible approaches on shared mobility services and e-mobility, as presented in the analysis of the workshops results, and the insights provided by the simulations on charging demand scenarios.

The Lippulaiva blocks provide new public transportation, e-car and e-bike services for the Espoonlahti area. The new metro connection together with different charging services have a major impact on how day-to-day travel in the Espoonlahti area (and beyond) can be conducted. The Lippulaiva blocks can be expected to turn into a major mobility hub in the area due to the metro connection opening in the near future. The e-mobility solutions in the district can support the shift towards greener transportation options, by, for example, facilitating travel journeys that incorporate sustainable ’last mile’ solutions and the fast rail-based public transportation use. Additionally, the new Lippulaiva blocks provide both public and private services – shops, services, a city library - and thus acts not only as a transitory mobility hub but as a travel destination as well.

The mobility sector is a major contributor to the greenhouse gas emissions. The urban mobility landscape is currently changing rapidly as electrification of all vehicle types and the increase of shared mobility service availability are progressing. There are still many open questions related to the new practices and service models of new types of mobility behaviours. The organized workshop on the future of sustainable urban mobility in the Espoonlahti are and Lippulaiva blocks identified some key drivers and barriers related to the uptake of shared e-mobility solutions and the specific characteristics of the area that affects its local contextualization. Policy and service model development, location and placement of services in the designated area, and the communication of the strengths of sustainable urban mobility options are some key steps for further development of the local urban mobility system.

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FIGURES

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