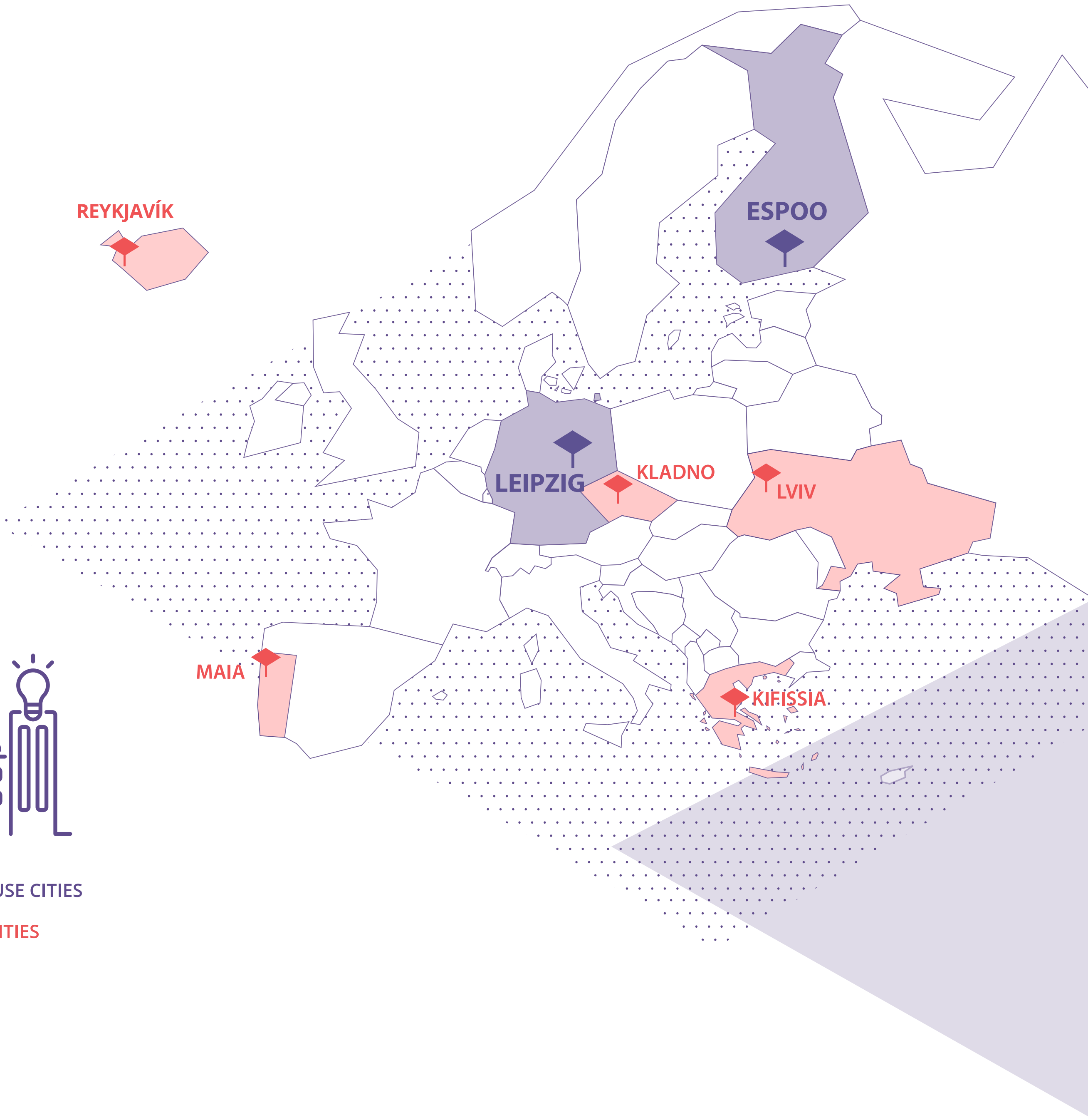
SPARCS

Finnoo Playbook – Lessons and Application Opportunities for the Finnoo area from SPARCS

Horizon 2020
European Union funding
for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 864242. Topic: LC-SC3-SCC-1-2018-2019-2020: Smart Cities and Communities. The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.

ESPOO
ESBO



LIGHTHOUSE CITIES

FELLOW CITIES

Abstract

Combating climate change requires sustainable urban areas and solutions. In urban environments, sustainable energy and mobility solutions in particular take centre stage when looking at the key factors of carbon neutral, accessible and functional built environments.

The Horizon 2020 SPARCS (**Sustainable energy Positive & zero cARbon CommunitieS**, 2019–2024) project aims to support the transformation and change of sustainable urban environments. The project has developed and demonstrated various smart and sustainable solutions integrated into urban environments from the perspective of positive energy districts in particular. Positive energy districts (PEDs) are areas where more renewable energy is produced locally than it is consumed. In particular, solutions for energy efficiency, smart systems, flexibility solutions, the production and storage of renewable energy and electric mobility are essential. Co-creation with various actors, especially the residents, helps develop solutions that are sustainable over time. The solutions developed in the project and research can be utilised locally and globally.

This document brings together the key highlights and insights from energy and mobility demonstrations conducted in the SPARCS project in Espoo to support the development of the new Finnoo area in particular. Finnoo is a rapidly developing new area in southern Espoo on the Baltic Sea coast, where housing for more than 17,000 new residents has been planned. The content compiled in this document may also be used in other urban areas, particularly those that are currently being built and further developed.

Table of contents

Texts: Joni Mäkinen, Jani Tartia, Iina Turunen, Nelli Vasse, Elina Wanne; City of Espoo
Photos and figures: City of Espoo
Solution icons retrieved from Flaticon.com

1 Introduction

To combat climate change, greenhouse gas emissions must be reduced rapidly. Cities and urban areas are significant sources of emissions, and therefore different urban solutions play a central role in the generation of these emissions. Energy (electricity, heating) and traffic currently account for the most significant proportion of greenhouse gas emissions in cities – in Espoo, when combined they constitute the majority of total emissions.[1] The generation of emissions can be influenced with smart and sustainable solutions.

Energy, electric mobility and resident inclusion solutions have been developed as a part of positive energy districts (PED) in the Horizon2020 SPARCS (**Sustainable energy Positive & zero cARbon CommunitieS, 2019–2024**)[2] project. The solutions developed in the project and research can be utilised both locally as well as more broadly in other cities. This document brings together key highlights from the development areas of the SPARCS project in Espoo (the Leppävaara Sello block, the Espoonlahti Lippulaiva block, and the new developing area in Kera) that are inspiring and encouraging the development of pioneering solutions in the project replication area in Finnoo.

Finnoo is a new developing district for 17,000 residents. In the development of Finnoo, attention has been paid from the outset to sustainable development goals, and the construction has been steered according to specific criteria that guide the energy solutions of buildings in the area. The centre of Finnoo is built around the newly completed metro station.[3]

The text is based on thematic reports of the project that describe the methods, challenges and successes of the demonstrations carried out in the project.[4] In addition, this text has utilised other documents created during the project, as well as other key links and references outside the project. The energy and mobility solutions that support the Kera project demonstration area have similarly been compiled into separate playbooks[5] on which this Finnoo playbook is also based, partially utilising the same content. The work is part of the project's WP3 Espoo Lighthouse Demonstrations work package and E20-1 FINNOO REPLICATION.

1 https://www.hsy.fi/en/air-quality-and-climate/greenhouse-gas-emissions/
2 www.sparcs.info
3 https://www.espoo.fi/en/housing-and-building/finnoo
4 Deliverable D3.4 Interoperability of holistic energy systems in Espoo
https://sparcs.info/en/deliverables/d3-04-interoperability-of-holistic-energy-systems-in-espoo;
Deliverable D3.5 EV mobility integration and its impacts in Espoo
https://sparcs.info/en/deliverables/d3-05-ev-mobility-integration-and-its-impacts-in-espoo/
5 Kera's Energy Playbook & Kera's Mobility Playbook; Kera energy and e-mobility playbooks are out - Sparcs

2 Positive energy districts

Abandoning fossil fuels in the energy sector is one of the biggest carbon neutrality measures to achieve Espoo's carbon neutrality objective. This will result in a widespread transformation of the entire sector as renewable and carbon neutral energy solutions, along with the energy efficiency and flexibility solutions that enable them, increase and transform the entire energy system. This transformation will also have a wider impact on urban planning and inclusion work, for example. Energy solutions will form an increasingly important theme in the cityscape when new solutions, such as solar panels or heat and cold production based on heat pumps, are adopted in an urban environment. At the same time, the opportunities of traditional consumers will also increase when, in addition to purchasing energy, they can produce energy for their own needs increasingly easily and sell any excess they produce to the power grid. To harness the full potential of this energy transformation, a wide range of technologies, operating models and concepts have been highlighted, including the so-called positive energy districts (PEDs).

Positive energy districts refer to energy-efficient and flexible urban areas that produce sustainable energy beyond the area's own needs and are as low-emission as possible. The European Union (EU) aims to have 100 positive energy districts in Europe by 2025; a working group was established in 2018 to achieve this goal, and several development projects, such as SPARCS, have been launched to support innovation, research and implementation. The development and piloting of positive energy districts can promote regional energy measures as well as the consideration and processing of regional energy solutions, whether they are energy efficiency, production, distribution or flexibility solutions. In connection with this, local residents can be brought closer to the energy measures to be taken and their views can also be highlighted as part of decision-making. At the same time, the residents will become more aware of energy as a topic and their own opportunities.

The examination of positive energy districts is not limited to energy issues; mobility issues are also central to the study. Positive energy districts are linked to these issues, especially from the perspective of local energy infrastructure, fuel, flexibility and a service-oriented approach to mobility. Transport hubs in particular have a major role in the integration of the energy and mobility sectors, because these hubs are usually also urban centres important to energy issues.

The City of Espoo, together with its project partners, has demonstrated positive energy districts in the Nordic context as part of the SPARCS project. The Sello and Lippulaiva blocks have acted as demonstration areas of the project, with the addition of the Kera area from the point of view of the planning of positive energy districts. The Finnoo area acts as a replication area in the project, i.e. the replication of the solutions in the project to the Finnoo area will be studied during the project. This playbook functions as part of the replication process.

3 Case Finnoo

Finnoo is a rapidly developing maritime area in southern Espoo. An ecological district of 17,000 inhabitants where services are close and mobility is easy is being planned for the area. Construction in the area began in 2020 and the first residents moved there in 2021. Finnoo is a pioneer of sustainable urban construction, in which those involved are committed to sustainable development measures. Sustainable urban construction is guided by low-emission and sustainable solutions, and developers, for example, are required to commit to energy-efficient solutions. Sustainable energy solutions have been implemented in the region, such as the geothermal local heating network, and the existing district heating and district cooling systems in the area will be extended further as construction progresses.

The master plan for the Finnoo area has been prepared in two parts, of which the component master plan for Finnoo (covering the master plan for the northern areas) entered into force in 2018. One of the main local detailed plans for the area is the local detailed plan partially approved for the centre of Finnoo in 2023. The planning area of the centre of Finnoo is part of the wider development of the Finnoo-Kaitaa area. The planning area is located in Finnoo and covers the northern areas of the wastewater treatment plant that will be removed in the near future as well as the Finnoviken wetland with valuable birdlife and its surroundings. The planning area includes the Finnoonlaakso recreational area from the wetland to the edge of Länsiväylä. A new centre supported by the metro with residential, business, employment and service blocks and recreational areas will be planned for the area. Additionally, energy efficiency and sustainable development goals will be taken into account comprehensively. The aim is to create a unique urban environment that utilises its maritime setting and proximity to nature. The largest landowner in the area is the City of Espoo. The southern master plan for Finnoo has been called the component master plan for Finnoosatama, and it is currently at the proposal stage. The plan includes complementary construction (homes, services and recreational use) for the Finnoo Harbour area, among other things, and the operations of the marina will be reorganised. A local detailed plan for Finnoo Harbour will be prepared as a whole with the local detailed plan for Merikorttelit, in which the Suomenoja water treatment plant area will be converted into a residential area.

At present, there are homes in Finnoo for about a thousand residents. The area is growing rapidly and homes for approximately 2,000 residents are currently being built. The construction of the district will continue throughout the 2020s and 2030s, and the whole Finnoo area will be mostly ready in the 2030s.

Finnoo is one of the replication sites of the SPARCS project, where lessons learned from the project are being used. As a rapidly developing area, Finnoo offers a good platform for the replication of sustainable solutions.

3.1 SUSTAINABLE ENERGY IN FINNOO

The goal of the development work in Finnoo is to create a district to serve as a new model area of sustainable development. As part of this goal, local developers will be steered towards and committed to the implementation of more sustainable energy solutions. The area is part of the Espoo district heating network. The City of Espoo and Fortum have committed to carbon-neutral district heating production in the area of Espoo, Kirkkonummi and Kauniainen during the 2020s, enabling carbon-neutral district heating in the Finnoo area, too. Cooling, in turn, can be produced in a centralised and carbon-neutral manner, using the district cooling network that will extend to the area. The area also includes a significant energy supply block area, where many carbon-neutral district heating production measures have been implemented. The permitted building volume of the area has been increased to facilitate the development of activities.

At the core of the energy system's sustainability are solutions related to energy efficiency and sustainable energy consumption. The main goal in an area being planned should always be to minimise energy consumption before processing production. In Finnoo, the steering to promote energy efficiency takes place as part of land transfer, which obliges builders to comply with the specified sustainable development criteria. In addition to energy efficiency solutions, operators can promote sustainable energy in Finnoo by increasing the local production of renewable energy. Production can be increased either by integrating renewable energy sources into local buildings and their immediate surroundings or by investing in renewable production outside the area, either independently or collectively. The plan descriptions for the Finnoo area give consideration to the integration of solar power into the area's buildings, among other things, and it is possible to implement different types of local electricity or heat production to meet the area's sustainable development criteria.

Since renewable energy sources are partially irregular in production and waste heat sources often do not align perfectly with consumption, realising the full potential of sustainable energy requires smart consumption control and development of storage solutions. Through flexible solutions for electricity and heat, it is possible to balance consumption peaks, shift consumption closer to hours when production is higher and provide financial benefits to the residents and stakeholders in the area. Storage solutions enable better utilisation of renewable forms of energy and waste heat by balancing differences between supply and demand. The sustainable development criteria for the Finnoo area have incorporated considerations for the option of piloting services that enable a smart energy system, such as demand flexibility pertaining to electricity and heat, in the area.

The number of electric vehicles has increased significantly in Finland in recent times, which has also had an effect on the power system. The rising number of electric cars has been particularly significant in Espoo, which has historically ranked amongst the leading municipalities for electric cars in Finland. The proliferation of electric cars and their charging units means that electricity consumption is increasing while simultaneously providing additional opportunities for flexibility and storage. By optimising charging points, it is possible to transfer charging needs from peaks to lower consumption hours, and the Vehicle-to-Grid (V2G) technology, i.e. two-way charging, makes it possible to use electric car batteries to store electricity. When increasing the number of solutions based on electric vehicles, the Finnoo area's reliance on efficient public transport, walking and cycling must be considered.

3.2 SUSTAINABLE MOBILITY IN FINNOO

Sustainable mobility in an urban environment means the use of active forms of mobility – walking, cycling – public transport and various shared mobility services. Sustainable modes of transport reduce emissions, make it possible to allocate public space to purposes other than transport, offer health benefits and are accessible to various types of users.[6]

The new Finnoo area is built around the new metro station (opened for transport in 2022). The fast rail connection to the other parts of Espoo and outside it enable the use of public transport in everyday life. The attractiveness of the metro station has been enhanced through cooperation between architecture and art, where Finnoo Station communicates its maritime setting and proximity to nature, reinforcing its local identity. Park-and-ride parking in connection with the metro, for cars and bicycles, encourages sustainable travel chains. The surroundings of the station area are gradually being constructed. In the future, the surroundings of the metro station will form a centre for the area and its services. The dense urban structure of the area supports the use of sustainable modes of transport, and the attractiveness of the metro is increased by creating smooth connections to the station. Pedestrian connections within the area, as well as cycling infrastructure connections both inside and outside the area, are essential for supporting the use of public transport as a primary choice and reducing the need for cars. The metro station is an important transport hub in the area and a place for various services and social encounters. The living centre increases the vitality of the Finnoo area and the comfort and well-being of the residents.

The conditions for walking and cycling are supported by creating clear, pleasant and safe connections. The Länsibaana route in the network of cycling routes planned for Espoo passes through the Finnoo area, improving cycling connections to its neighbouring urban centres, among other things.

The valuable wetland in the Finnoo area also offers residents an opportunity for recreational use. The 1.6-kilometre-long nature trail goes around the wetland, allowing the residents to enjoy the nearby nature.

6 Banister, D. 2008. The sustainable mobility paradigm. Transport Policy 15(2): 73–80.

3.3 CRITERIA FOR SUSTAINABLE DEVELOPMENT IN FINNOO

The City of Espoo aims to develop Finnoo into a model area for sustainable development. Energy efficiency and sustainable development will be taken into account in the development of Finnoo from land use planning to the construction and use phase. In order to ensure that this objective is achieved, developers selected in the region are required to commit to energy-efficient solutions for the buildings. Because the Finnoo area includes plenty of land owned by the City, the commitment of the developers has been arranged through sustainable development criteria in connection with the terms of land transfer. Sustainable development criteria can steer actors in the area towards more sustainable solutions and promote the introduction of new innovations in the area.

The criteria used in Finnoo are divided into mandatory and optional sections. Among other things, the mandatory energy criteria create an obligation to use an energy designer and draw up an energy design, and they set a minimum level of energy efficiency. The optional criteria are divided into the following themes: general energy efficiency, building automation and power management, renewable energy and energy efficiency innovations, indoor temperature management and other criteria for sustainable development. Operators must reach a minimum number of points in the optional section by selecting their desired measures. The optional criteria are scored in relation to their effectiveness. The operators can focus on themes of their choice or score points in all of the categories. The optional criteria that complement the mandatory ones steer the energy efficiency of construction and sustainable development to well above the average level. The sustainable development criteria are one of the city's steering tools for promoting sustainability in area development.

Positive energy districts at the centre of the SPARCS project are linked to sustainable development issues, especially from the perspective of local energy and mobility. During the project, it was found that the lessons learned and know-how from the project could also be included in the further development of the Finnoo criteria. In this way, the Finnoo sustainable development criteria were assessed through cooperation between the City and VTT as part of the SPARCS project. The review focused on criteria related to the energy theme and positive energy districts in particular. The results of the review are reported separately as part of the project's reporting.

TABLE 1 - EXCERPT FROM THE FINNOO'S CRITERIA

OPTIONAL REQUIREMENTS				
GENERAL ENERGY EFFICIENCY				Rev B / 01.04.04
	Value point		**Authentication method**	**Authentication phase**
V1	**1**	The E-number of the building is at least 10% lower than the minimum level of the legislation	Descriptions of method solutions in the energy plan + energy certificate	Building permit phase + review in the commissioning phase
V2	**2**	The E-number of the building is at least 15% lower than the minimum level of the legislation	Descriptions of method solutions in the energy plan + energy certificate	Building permit phase + review in the commissioning phase
V3	**3**	The E-number of the building is at least 20% lower than the minimum level of the legislation	Descriptions of method solutions in the energy plan + energy certificate	Building permit phase + review in the commissioning phase
V4	**4**	The object's heat distribution is implemented by a fluid-circulating underfloor heating system or by other low-temperature method. A low temperature system refers to dimensioning value level of <50 degrees.	Descriptions of method solutions in the energy plan, HVAC drawings in the commissioning phase	Building permit phase + review in the commissioning phase

4 SPARCS: Sustainable and smart urban solutions

The following pages describe sustainable energy and mobility solutions developed, demonstrated and studied in the SPARCS project. They illustrate the key lessons and observations highlighted as part of the solution description. Additionally, each solution has been examined through 'the lens of Finnoo,' meaning that key observations have been highlighted on how the solutions can be applied to a new developing area like Finnoo. In the analysis, special attention has been paid to the area's long-term development, specific conditions and requirements during construction, the goals determined for Finnoo in the urban planning and envisioning work, as well as the current typology of the area.

The solutions have been divided into three themes:

1 **technologies,**
2 **concepts, and**
3 **participation and urban development.**

Each theme presents fundamental perspectives on sustainable energy and mobility, ranging from technical solutions to new co-created concepts, as well as factors that influence behaviour and design solutions. The total number of solutions presented is eighteen (18).

Information about the solutions and their demonstrations during the project in the blocks of Lippulaiva in Espoonlahti and Sello in Leppävaara can be found in the publicly available project report, focused on energy and mobility solutions, on which this document is also mostly based: *D3.4 Interoperability of holistic energy systems in Espoo and Deliverable D3.5 EV mobility integration and its impacts in Espoo*. Some of the descriptions also include QR code links to online materials, including a database maintained by the project partner BABLE of the project's use cases for future utilisation. The SPARCS project's results will also be published as scientific, peer-reviewed articles.

TECHNOLOGIES

- Demand flexibility for electricity and a virtual power plant
- Electricity storage and battery solutions
- Heat storage
- Utilisation of waste heat
- Charging electric vehiclesat transport hubs
- Charging points for electric bicyclesat transport hubs
- Vehicle-to-Grid

CONCEPTS

- Energy communities – energy community internal to a property
- Energy communities – property-crossing energy community
- Energy communities – decentralised energy community
- Electric mobility service hub
- Opportunities and obstacles pertaining to electric bicycles in urban transport
- Opportunities and obstacles pertaining to electric car sharing services in urban transport

PARTICIPATION AND URBAN DEVELOPMENT

- Engaging residents
- Engaging housing companies
- Electric mobility test runs
- 3D model as part of energy planning and local optimisation
- Co-creation model as a tool

Further information

The SPARCS project report D3.5 «EV mobility integration and its impacts in Espoo»

List of articles published on the project results

The SPARCS project report D3.4 «Interoperability of holistic energy systems in Espoo»

4.1 SOLUTIONS I: TECHNOLOGIES

Demand flexibility for electricity and a virtual power plant

SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

Realising the full potential of renewable energy also requires smart consumption control so that the energy system can balance energy supply and demand in a cost-effective and reliable manner, as necessary. Furthermore, demand flexibility will play a role in balancing the electricity grid in the future because the increasing adoption of sustainable solutions in the energy sector, industry and transport will require an increase in the grid's capacity. By leveraging their own flexible energy loads, energy consumers can optimise their consumption and shift it to times of more cost-effective power production, thus reducing consumption peaks. Additionally, consumers will be able to operate as part of Fingrid's reserve market, providing themselves with monetary value and opportunities to further optimise the power system. The requirements for joining the reserve market will depend on the chosen market. Demand flexibility benefits building owners, energy providers and the entire society.

Participation in flexibility markets requires meeting the capacity requirements of the specific market in question. For large-scale consumers and big landowners, these requirements may be straightforward, but small-scale operators might need to form alliances to meet the requirements. Aggregator services enable consumers to collaborate as flexibility providers through a service provider. By making use of these services and with the support of local collaboration, it is possible to join reserve markets collectively. Virtual power plants are a technological solution for controlling multiple distributed energy production or consumption sources as a unified entity, acting as a single virtual power plant. They can include production sites, but they can also focus on directing and aggregating flexible consumption.

During the SPARCS project, the potential of a virtual power plant service was studied in 100 buildings directly owned by the City that had the highest electricity consumption. Although the flexibility potential of an individual public building may not be sufficient to participate in the demand flexibility markets, the flexible loads of multiple municipally-owned properties can be combined through a virtual power plant. The potential of connecting a building to a virtual power plant is site-specific and depends on the total power of the loads, their controllability and external influences. For example, ventilation is a typical load with potential for flexibility if the building's automation system allows external control. Short-term adjustment of ventilation is usually possible without deteriorating the indoor air conditions. A potential future source of increased flexibility is electric vehicle charging points, whose usability as part of a virtual power plant service was demonstrated during the SPARCS project.

CASE FINNOO

Through electricity demand flexibility solutions, it is possible to promote sustainable energy consumption and energy saving in the Finnoo area by offering local operators a solution for optimising their consumption and generating value together. By enabling or using flexibility solutions, it is also possible to score points to meet the area's sustainable development criteria. A virtual power plant is a service that can simplify the utilisation of flexibility and facilitate participation in electricity reserve markets.

In order to understand the potential for demand flexibility in the area, it is necessary to assess the demand flexibility potential of Finnoo's building stock during the area's development. Based on the area's consumption profile and building types, the most relevant sites can be prioritised for the virtual power plant service. However, a more detailed study would require a building-specific review and an understanding of their loads and automation system capabilities, to name a few elements. Improving future buildings' readiness in Finnoo for electricity demand flexibility could be significantly enhanced by taking it into account from the planning phase onwards, even if the solutions are not implemented immediately. This would mean, among other things, the readiness of automation systems for remote control of loads or, alternatively, the readiness of building automation to measure the grid frequency, allowing flexibility to be offered independently without outside control. Additionally, enabling flexibility solutions may require factoring them in when designing a building's metering. The sustainable development criteria in the area act as a steering method to achieve this, and their impact so far should be assessed. For more information on the possibilities created by flexibility and the need to adopt it, see the «How to turn your property into a virtual power plant» guide (in Finnish) produced by the Energy Wise Cities project.

The increase in electric vehicle numbers can highlight a new source of flexibility offering great potential in the Finnoo area. Furthermore, the use of flexibility solutions can reduce the need to increase electrical connection capacity when building charging points for electric cars in the area. Using charging points as sources of flexibility should be assessed when making procurement decisions.

Further information

Description of a virtual power plant in the BABLE database

How to turn your property into a virtual power plant (in Finnish)

4.1 SOLUTIONS I: TECHNOLOGIES

Electricity storage and battery solutions

SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

Electricity production and consumption levels must be balanced at all times. As renewable energy production increases, maintaining this balance becomes increasingly difficult because these production methods often vary according to the weather. Thus, renewable electricity production does not always align with consumption in a timely manner and not all production can be effectively utilised. This variation in production also increases the fluctuation in price and affects the power balance in the grid. The relationship between electricity production and consumption can be improved with regulating power (such as hydroelectric power), flexible consumption and storage solutions. By utilising electricity storage solutions, such as batteries, customer-specific electricity costs can be affected by shifting procurement towards the low-cost hours, which also contributes to the stability of the power grid.

Short-term storage of electricity can mean intraday storage that is already feasible through battery solutions, to name one option. Battery storage is a increasingly common and cost-effective form of short-term storage that can be used for both electricity storage, and maintaining grid stability and electricity distribution in the event of disruptions, depending on the operator. Battery storage enables a connection to electricity reserve markets similarly to demand flexibility, allowing the charging and discharging of batteries to be adjusted based on the grid frequency, which provides additional income for the battery owner.

So far, investments in Finland have included both separate and property-specific battery solutions. Property-specific battery solutions have been piloted, for example, at the shopping centres Sello and Lippulaiva, which also serve as demonstration sites in the SPARCS project. Small residential buildings can also invest in solar panels, for example, which also include a battery solution for storing electricity and serving as a backup system. The energy stored in batteries can either be used in the building itself or, if necessary, sold to the electricity grid. However, battery pilots are seldom run in small residential buildings or blocks of flats in Finland. Currently, the main obstacle to buying battery systems for homes and other lower-consumption sites is the cost of these systems and the long payback period compared to high-consumption sites. Additionally, the capacity of batteries suitable for small-scale household use is often insufficient for connecting to Fingrid's reserve market due to the capacity requirements of the market.

During the SPARCS project, the possibility of including a battery solution when acquiring charging points for electric cars in blocks of flats was also examined. Based on the research, a comprehensive solution that includes car charging points, solar panels and a battery storage system can increase the opportunities for households to build charging points with shorter payback periods.

CASE FINNOO

Through electricity storage solutions, it is possible to promote sustainable energy objectives in the Finnoo area and to support flexible electricity consumption, among other things. Electricity storage has also been mentioned in the sustainable development criteria for the area as one possible energy efficiency innovation. These solutions make it possible to save on energy costs and optimise local electricity production, and they allow local operators to create value together.

Property-specific battery storage can be used in the Finnoo area to optimise renewable electricity production. Efforts will be made to bring renewable electricity production to the area by promoting the introduction of solar panels in particular. Additionally, batteries can be used at properties to shift electricity consumption more to the cheaper hours of the day. Separate battery solutions, on the other hand, may be unsuitable for the area due to its upcoming city centre-like building stock. Battery solutions are rarer still in buildings such as blocks of flats, offices and service buildings, but the increasing use of renewable electricity and electric cars while the cost of batteries decreases may boost interest in such locations as well, shortening the payback periods for the systems. At the moment, however, the price of battery systems may still be an obstacle to many of Finnoo's operators.

Further information

Description of energy storage in the BABLE database

4.1 SOLUTIONS I: TECHNOLOGIES

Heat storage

SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

The aim of heat storage is to ensure a better balance between heat production and consumption by storing produced heat, waste heat or solar energy passively in the summer, for example. Heat can be stored either in the short or long term. Currently, the most common form of heat storage is the so-called sensible thermal storage, which involves storing heat by changing the temperature of a substance, usually water. In this way, heat can be stored in the ground and structures as well. In addition to traditional storage solutions, various other storage methods are being piloted. They are based on new types of storage materials, such as sand or salt, changes in the state of matter and thermochemical reactions.

Short-term heat storage refers to the daily balancing of heat production and consumption. For example, hot water tanks on a small scale and heat storage tanks connected to district heating networks on a larger scale are common solutions for short-term heat storage. For instance, the water tank of a district heating battery can be heated with electricity during times of low consumption to meet the needs of consumption peaks, which reduces heat production costs and replaces fossil fuels in production.

Further information

[Description of energy storage in the BABLE database]

The aim of long-term or seasonal heat storage is to smooth out seasonal variation between heat production and consumption. For example, waste heat generated in the summer could be better utilised through long-term storage during the highest heat consumption period in the winter. Long-term heat storage in Finland is still limited, and it typically involves underground locations. For example, thermal wells (so-called regenerative thermal wells) or energy piles can also be used for storing heat during summer. Alternatively, heat can be stored in underground water basins, as long as the size and insulation of the basin allow for storage with minimal heat loss.

Heat energy storage is used at sites such as the urban centre of Lippulaiva, which is also participating in SPARCS. The waste heat from the area is utilised as efficiently as possible as part of the centre's energy system by using regenerative thermal wells. Over 50 km of thermal wells have been drilled under the shopping centre, and they are loaded with thermal energy from the condensation heat of the centre's supermarkets, for example.

CASE FINNOO

It is important to assess the role of short and long-term heat storage in Finnoo as part of the area as a whole. The energy review of the centre of Finnoo highlights the utilisation of hot water tanks and underfloor heating with water circulation and heat storage among property-based heat storage and power management measures. Most of the buildings in the Finnoo area will be connected to the district heating network, in which case the domestic hot water will be heated with district heating. This means that the storage solutions implemented in the network will also support the objectives of sustainable development in Finnoo.

If potential for storing the energy flows generated is found in the area, the stored heat can be used, for example, on a site-specific basis or, where possible, as part of wider heating networks. New opportunities for storing excess heat generated in the summer can facilitate the use of waste heat in the area significantly.

4.1 SOLUTIONS I: TECHNOLOGIES

Utilisation of waste heat

SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

Use of excess heat, known as waste heat, aims to reduce the amount of energy lost in activities by taking advantage of it on site or in the district heating network, for example. Large amounts of waste heat is generated, for example, in energy-intensive industries, but through technological advances, the number of available waste heat sources for utilisation is also increasing. According to the Ministry of Economic Affairs and Employment, some 130 TWh of waste heat is estimated to be generated in Finland, which is significantly more than, for example, the total use of district heating in the whole country (34 TWh in 2022). About 35 TWh of the waste heat is estimated to be recoverable, of which roughly 3 TWh has so far been utilised in district heating networks. So, at present, about 8.5% of the waste heat potential is being used. However, there are still risks related to the economic viability associated with the remaining utilisable portion. These are likely to diminish as technology advances, especially as the temperatures in the district heating networks decrease in accordance with the updated regulations of Finnish Energy. Potential waste heat sites in urban areas such as Espoo include industrial properties, data centres, commercial properties, office buildings that use cooling systems, indoor ice skating rinks and waste water. However, this potential must always be assessed on a location-specific basis.

Waste heat is already being used in Espoo, both in individual buildings and the district heating network. Individual buildings take advantage of their own excess heat sources, such as condensation heat in supermarkets and ice skating halls, to minimise their own heat consumption. Meanwhile heat is produced for the district heating network from excess heat sources such as wastewater, data centres and hospitals.

CASE FINNOO

The Finnoo area is part of the Espoo district heating network. The local district heating network is open, i.e. the operators in the area can sell their waste heat to the district heating company for use in the network. If selling the waste heat to the district heating network is not economically sensible in comparison to the costs, it can also be used on a site- or block-specific basis. The operators in the area should identify the potential for use and costs of the waste heat sources, if such sources are identified in the area. Even if the utilisation of waste heat does not prove economically sensible at the moment, the situation may change quickly as technology develops. In the future, a significant source of waste heat in Finnoo may be the cooling of buildings and the utilisation of waste heat in the district cooling network. Waste heat may also be generated in future commercial services or other service and commercial premises in the area.

4.1 SOLUTIONS I: TECHNOLOGIES

Charging electric vehicles at transport hubs

SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

The project installed new electric car charging points in the blocks of Lippulaiva in Espoonlahti, studied and further developed the electric bus charging system in Leppävaara in the blocks of the shopping centre Sello, and examined the integration of vehicle charging into a smart energy system.

The growing number of electric cars means increased charging needs. A charging service for private consumers' electric cars can be created in a centralised way as a larger entity that includes as many as hundreds of charging points (e.g. as part of a car park or shopping centre) or a smaller solution of a few charging points, factoring in the space requirements of the equipment. Locations that drivers would visit anyway are often suitable for charging electric vehicles too. Charging points for professional traffic (e.g. logistics vehicles, taxis) can also be placed in the same areas, or a solution can be built at depots or other segregated locations. When deciding on the charging point capacity, the genuine demand and its future trends should be assessed, taking into account its temporal variation (e.g. hourly, daily or weekly charging profiles) and effects on other use of the space/area (e.g. attractiveness of an urban space).

Charging can be arranged as a monthly subscription service (CaaS, Charging-as-a-Service), where a single operator is responsible for hardware maintenance, consumer billing and application implementation, for instance, on behalf of the service provider in a specific area. The charging process can be initiated, for example, through remote identification or an application. Charging events generate real-time data on the use of charging points, allowing the demand trends to be anticipated over a longer period, for example.

CASE FINNOO

The transport objective in Finnoo is to rely on public transport, walking and cycling and reduce the need to use cars. A centralised parking solution is sought in the planning of parking in the area, thus making parking more efficient and freeing up street space for other uses. The area's charging solutions will probably be located at these facilities, where they can serve not only resident parking but also the needs of car-sharing users and professional transport (taxis, logistics vehicles). Car-sharing services can reduce the number of private cars and daily car journeys locally, thereby also reducing the charging needs. A parking area for car sharing has been allocated to the West Metro Finnoo area, and there is currently one multi-storey car park in the area. The multi-storey car park has 391 parking spaces and six charging points for electric cars. As the area will be built over several decades, the charging demand will increase progressively. It is advisable to make the necessary technical preparations for the charging points in parking facilities, allowing for a gradual increase in the number of actual charging points with less effort as demand and need grow.

Further information

Description of the charging system for electric buses in the BABLE database

4.1 SOLUTIONS I: TECHNOLOGIES

Charging points for electric bicycles at transport hubs

SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

The project developed electric bicycle infrastructure through an electric bicycle battery charging cabinet solution, indoor and outdoor bicycle parking and a DIY bicycle maintenance point in the blocks of Lippulaiva in Espoonlahti.

The number of electric bicycles is rising rapidly. In 2020, as many as 17% of new bicycles sold in the EU were electrically assisted, and both the Covid-19 pandemic and advances in battery technology have accelerated this trend.[7] At the same time, the appreciation for bicycles as a sustainable mobility mode has been on the rise.[8] Electric bicycles enable independent urban mobility and as an active mobility mode are beneficial for human health. Electric bicycles also allow users to travel longer distances without excessive physical effort. However, the purchase price of electric bicycles is currently relatively high.

An increase in the use of (electric) bicycles can be promoted with local infrastructure. Covered and heated bicycle parking facilities that allow bikes to be securely locked support the daily use of bicycles, including park and ride traffic, as part of sustainable travel chains and public transport. Furthermore, DIY bicycle maintenance points promote cycling. An electric bicycle battery charging cabinet allows cyclists to charge their batteries while shopping or working, for example. Unlike electric cars, electric bicycles do not have standardised charging cables, but they can be charged flexibly through traditional sockets. However, the range of modern bicycle batteries and the ability to charge them at home reduce the demand for on-site charging, for example in public places. For shared bicycles, such as electrified city bikes in the future, the charging needs may be high during the day. Instead of charging cabinet solutions, batteries that can be swapped or other charging solutions may be explored.

CASE FINNOO

Sustainable modes of transport such as walking, cycling and public transport will be promoted in Finnoo. Investing in cycling also promotes the use of electric bicycles. Bike routes, parking, and other infrastructure and spatial planning that enhance bicycle traffic typically also support the use of electric bicycles. The need for secure bicycle parking is growing due to the high price of bicycles and batteries. Local bicycle charging services are a valuable addition, but seem not to be a critical aspect in the use of electric bicycles, as charging mostly takes place at home or work and the battery's range is often sufficient for a day's use. The Finnoo metro station is a natural hub linked to the use of electric bicycles in the area, but services must also be available elsewhere in the district. The use of electric bicycles as part of a shared mobility service (or future city bikes) is also possible and worth exploring.

7 European Mobility Atlas 2021
8 Fishman, E. 2016. Introduction: Cycling as transport. Transport Reviews 36(1): 1–8

Further information

Report on the SPARCS project on the current state of electric bicycles in Espoo

Description in the BABLE database

4.1 SOLUTIONS I: TECHNOLOGIES

Vehicle-to-Grid

SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

The project involved a literature review of two-way charging, i.e. Vehicle-to-Grid.

The term Vehicle-to-Grid, or V2G, refers to a two-way charging event where energy can be transferred from a vehicle battery back to the power grid. V2G can be used as part of a wider «smart charging» solution, where the charging time can be adjusted automatically to suitable times, avoiding various negative effects pertaining to the energy system, such as network overload during peak times (mornings and afternoons are usually the busiest times). Two-way charging allows a car battery to be used for energy storage, meaning that energy can be temporarily stored in the car battery and fed back into the grid later, as necessary (or depending on the price level). As regards renewable energy sources, the importance of energy storage is high because renewable energy production and consumption do not always match, for example due to weather (no wind, cloudy). The impact of a single car battery as an energy storage component in the overall system is small, given that their capacity (20–100 kWh) is relatively modest in the big picture, but the potential effects of a broader combination of multiple vehicles on the system is more significant.

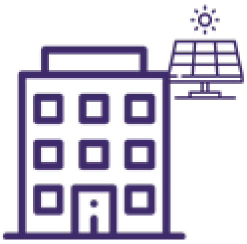
For individual consumers and operators, V2G gives an opportunity to participate in the energy market through charging, storage and selling energy back to the grid, but the effects of two-way charging on the lifespan of car batteries are still largely unknown. Private cars are parked most of the time, which technically creates a significant timeframe for usage cases that can benefit from V2G. However, in addition to actual charging points (charge & drive), the active use of the V2G solution would require charging points for long-term charging as part of the parking solutions (allowing energy to be charged to or discharged from cars when it is most beneficial for the grid or the user [price of energy]), which increases the amount of resources needed for the infrastructure. Similarly, vehicles remaining stationary for extended periods are not desirable in terms of local resource efficiency and sustainable mobility, and the high cost of electric cars also restricts many consumers from adopting them.

CASE FINNOO

In Finnoo, the aim is to concentrate parking places at centralised parking facilities instead of plot-specific parking. Multi-storey car parks could facilitate V2G-based solutions, particularly if a large proportion of vehicles are connected to the grid for long periods of time, but the real economic benefit of this approach may be limited, and it might not be an optimal option in terms of transport resources (parked vs. moving cars). For electric car-sharing vehicles, exploring the (V2G) solution, including its role in the economic viability of the service, for example, is advisable. The aim in Finnoo is to promote sustainable mobility services, one key example of which is car-sharing. Housing company cars and publicly available rental shared-use cars form a natural reserve for V2G functions.

4.2 SOLUTIONS II: CONCEPTS

Energy communities – energy community internal to a property



SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

Solar power is one rapidly growing method of generating electricity locally in urban areas and increasing personal production. This is evident in factors such as the number of solar power systems in the Espoo area, which, according to the latest statistics, are increasing at a considerable rate. Under Finnish legislation, it is now possible to better utilise self-produced electricity among residents, taking into account any legal restrictions, by leveraging so-called energy communities. An energy community refers to a community of operators that utilises its own energy production and shares energy between the community members. It can be, for example, internal to a property, transboundary across properties, or geographically distributed. More information on energy communities can be obtained from a study produced during the SPARCS project (see next page*). This playbook examines the feasibility of energy communities in Kera within the framework of the latest regulations. The Ministry of Economic Affairs and Employment has continued to investigate the need to further develop regulations by appointing a working group in autumn 2022, particularly pertaining to the expansion of the energy community definition and use of separate lines. The working group published its report on the development needs in spring 2023.

An energy community internal to a property is one that shares electricity generated at the property amongst the residents. The sharing can be done, for example, through reimbursement calculations, where locally produced solar power is shared amongst the housing company residents based on a chosen allocation. This model has been available for housing companies since the start of 2021, depending on the local distribution system operator (DSO), and since early 2023 throughout the country, when the calculations were transferred to the transmission system operator (TSO) Fingrid. An energy community can also be established through so-called back metering, where the property owner is responsible for metering and distributing the financial benefits amongst the shareholders.

Further information on creating an internal energy community and adopting reimbursement calculations can be obtained from Motiva and local distribution network companies, among other sources. Additionally, HSY offers a course on solar power-based energy communities in housing companies and how to establish these communities.

CASE FINNOO

Local renewable energy production is central to the sustainable development goals of Finnoo, and by introducing renewable production it is possible to meet the goals of the sustainable development criteria in the area. Energy communities provide local operators with an opportunity to invest in local production and gain more value from it within their own community.

In Finnoo, the ratio between the building area and floor area is not favourable for solar power production. Nevertheless, in an area dominated by blocks of flats, energy communities internal to properties offer residents new opportunities to use renewable energy. This type of energy community is the easiest form of energy sharing offered by the legal amendments, and local operators are already able to take advantage of it. Examples of these communities can be found in Espoo, enabling an assessment of the benefits and drawbacks of this model for housing companies. Additionally, many information packages and training materials produced by various operators are available to the area's housing companies on forming energy communities, such as the materials provided by HSY (below).

Further information

The training package 'Solar electricity energy community in a housing company' by HSY (in Finnish)

Energy communities – property-crossing energy community

SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

Under current legislation, energy communities can produce electricity at a separate site and connect it to the usage location with a separate line. In this case, the value distribution and community operation function in practice the same way as if the production took place within the same property, similarly to the internal community model. At the moment, it is not possible to form energy communities that cross property boundaries in Finland, except through this separate line. A separate line cannot connect consumption locations to one another, and is not connected to the distribution network. Otherwise, the activities of an energy community would be considered licensed distribution network operations. This type of activity would require, for example, a closed distribution network operator's electricity grid licence from the Energy Authority, and obtaining a licence is limited to geographically defined industrial, business or other service areas where electricity is not supplied to consumers.

CASE FINNOO

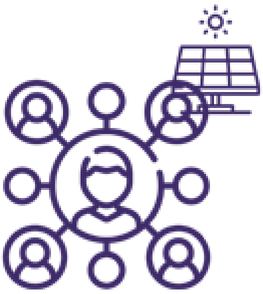
Forming a property-crossing energy community by using the separate line model requires a separate space for the production unit in the area, which may be challenging in the densely built Finnoo that mainly consists of blocks of flats. For instance, the roofs of parking facilities could be used to increase the solar power consumption of the surrounding residential buildings, but in this case, there are still some open questions concerning the use of electricity at the parking facility itself, for instance. In practice, the current legislation limits these types of energy communities to situations where roof-mounted solar panels are replaced with ones installed on a separate plot. Otherwise, an energy community would require an electricity grid licence, which cannot be obtained for an area such as Finnoo.

Further information

Energy community report on the SPARCS website

4.2 SOLUTIONS II: CONCEPTS

Energy communities – decentralised energy community



SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

It is also possible to form an energy community in a decentralised manner as a so-called virtual energy community. This model allows the production and consumption to be anywhere in Finland in relation to one another. One example of a virtual energy community is a situation in which a consumer wants to utilize the production of their summer house's solar panels at home outside of their summer leave period. In this case, the energy community has to pay network fees and taxes as usual but saves on energy costs when their summer house's production is subtracted from the customer's energy consumption. The community's revenue will naturally decrease compared to other models with similar production sites. However, this type of energy community allows for larger investments in production facilities when local operators make joint purchases, such as a solar panel array or wind turbine. Production resources can also be leased, if necessary.

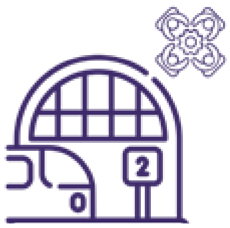
Based on research, the legal issues surrounding participation in a virtual energy community or a service model formed around it are still partially unresolved. The constraints also include evolving practices in implementing this energy community model and questions about the monetary value to be gained. As a result, services for virtual energy communities remain limited.

CASE FINNOO

In addition to property-specific energy communities, a virtual energy community is the simplest and most functional way to implement communal energy activities in Finnoo, because it allows the production site to be placed outside the area, if needed, and consumers to be involved seamlessly in the operations without major physical arrangements. For local energy communities, the virtual model is the solution that offers the most potential for the area under existing legislation. However, this type of solution will serve as a pilot if adopted in the area, which is why there is still little information about the value it creates for stakeholders and the most suitable operating models. The activities will require engaging local consumers, whether housing companies or other entities, in addition to contacting the local grid company and choosing an electricity supplier to ensure the energy community's functionality, among other steps. Forming a community would also require a suitable production facility or plot to be found, either in Espoo or elsewhere in Finland.

4.2 SOLUTIONS II: CONCEPTS

Electric mobility service hub



SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

The project examined the key elements of the electric mobility hub through workshops arranged for various stakeholders. The workshops focused particularly on the identified needs of users and mobility service providers.

From the user's perspective, the key elements are connected to the availability of mobility services, up-to-date and real-time information on this availability, guidance and general information on the service provision. Up-to-date passenger information throughout the journey is an integral part of a smooth-functioning and high-quality passenger experience. Similarly, high-quality walking and cycling environments, secure bicycle parking solutions, benches and other solutions for hub users, as well as factors that affect the experience of a hub's social safety (lighting, cleanliness, design, monitoring), have been highlighted as important elements for users.

Spaces allocated for services, in terms of usability, accessibility and optimal utilisation of charging solutions, were identified as the key elements for mobility service providers. Operating methods that enable CaaS (Charging-as-a-Service), shared services and interfaces amongst service providers, and up-to-date information on the use of chargers and other mobility services, help optimise different functions as a whole. A fast response support service for users must be secured through the design of the hub's solutions. Short-term parking for maintenance is also important. The role of drones in future logistics as part of automation and robotisation should also be taken into account when designing the hub.

CASE FINNOO

The surroundings of the Finnoo metro station area provide a natural testing and piloting platform for new sustainable mobility and shared-use mobility service solutions. The station and its surroundings can be extensively utilised for various pilots, such as in the development of new modes of mobility, the walking environment, (bicycle) parking solutions, guidance, and digital and augmented reality applications, in a real environment with real users. The metro station surroundings also facilitate temporary and pop-up type solutions in the station's immediate vicinity. In addition to mobility services, these spaces could serve as facilities for other types of services and social interaction or as cultural spaces, which could enhance the area's evolving identity and functions. The attractiveness of the Finnoo metro area is increased by creating smooth connections to the station and car and bicycle spaces for park-and-ride parking.

In future Finnoo, public transport will be supported by a dense urban structure. The growing local population will also make the mobility hub busier and allow commercial services to establish themselves there after the pilots. All services must take the local level and Finnoo's goals into account, as well as any disruptions to functioning mobility during construction.

Further information

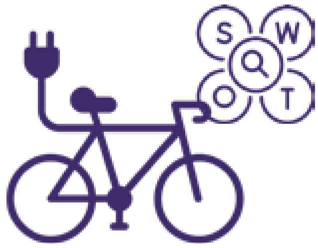
Report on the SPARCS project on the current state of transport hubs in Espoo

Report on the SPARCS project on sustainable mobility in Espoonlahti

SPARCS ESPOO ESBO

4.2 SOLUTIONS II: CONCEPTS

Opportunities and obstacles pertaining to electric bicycles in urban transport



SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

The project identified the existing strengths, weaknesses, opportunities and threats (SWOT analysis) of the development of electric bicycle traffic through workshops arranged for experts.

The recognised strengths of electric cycling include the fact that it makes cycling and personal mobility possible for a wider user group than conventional bicycles, thanks to the assistance of an electric motor. Electric bicycles utilise the same infrastructure as conventional non-motorised bicycles, which makes them easier to adopt. Electric bicycles can enable sustainable travel chains, such as being part of the use of public transport, and function as a shared-use mobility service as a last-mile solution in urban transport. Many car journeys taken in the city at the moment are relatively short (under 5 km) and could be partially replaced by electric bicycle journeys. Electric cycling is also an active mobility mode, despite being electrically assisted, which supports physical health.

The identified obstacles are related to the currently suboptimal level of bicycle parking and the lack of secure parking solutions. Furthermore, common design problems related to cycling (lack of infrastructure and routes, fragmented route networks) are directly linked to the use of electric bicycles too. Electric bicycles are expensive to buy, which excludes some potential users. Likewise, inadequate winter maintenance of cycling routes does not facilitate year-round cycling. Also, the lifecycle emissions of electric bicycles, including the production of the battery minerals, should be increasingly considered as the number of electric bicycles rises. In addition to the development of the physical space and infrastructure, the growth of cycling requires a change of mindsets and attitudes.

CASE FINNOO

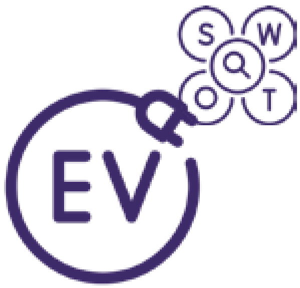
Functional walking, cycling and public transport will be promoted in Finnoo by placing the residential, workplace and service functions in easily accessible locations. The above opportunities and obstacles can be addressed in Finnoo's transport network design, spatial planning and mobility service pilots. The workshops identified the following concrete measures as potential actions that could also be taken in Finnoo: a) development of the cycling network, the district's level of and connections to areas outside of it; b) year-round maintenance of cycling routes, with particular emphasis on promoting winter cycling; c) solutions for secure bicycle parking; d) electric bicycles as part of the public city bike system; e) taking cargo bikes into account in infrastructure development (routes, parking); f) opportunities to test electric bicycles. The traffic planning of the Finnoo area takes the development of cycling into account, and the aim is also to implement a quality cycling route across the area as well as other main routes that promote cycling.

Further information

Report on the SPARCS project on the current state of electric bicycles in Espoo

4.2 SOLUTIONS II: CONCEPTS

Opportunities and obstacles pertaining to electric car sharing services in urban transport



SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

The project identified the existing strengths, weaknesses, opportunities and threats (SWOT analysis) of the development of shared-use electric car services through workshops arranged for experts.

The identified benefits and opportunities of shared-use electric cars and these mobility services are related, in particular, to themes such as reducing car ownership and supporting the use of public transport. Shared-use electric cars can provide an occasional solution to promoting sustainable transport habits as part of a diverse range of local mobility services. Private cars are parked and unused most of the time, which is why car-sharing can optimise the daily use of an individual car and, for example, reduce parking needs in a densely built urban area. A reduction in car numbers also has a positive effect on the appeal and attractiveness of the urban environment. At the moment, as many as one third of Espoo's households do not own a car. Car-sharing services can be targeted at areas where public transport services are scarce. The general interest in shared services has been on the rise lately, for example due to the lower usage costs compared to ownership. Also, the city organisation's own electric vehicles can be one way to implement a shared electric car service, but its practical implementation requires more detailed reviews of the area and specific usage cases, as well as assessments of various service models.

The currently identified barriers and threats to shared cars are related to a strong culture of car ownership, which can be challenging to overcome. Access to the service at the right time in the right place is important for its attractiveness and a transition from ownership to usage. The general lack of awareness of the services and real-time data on availability can also prevent the use of services. There may also be inequalities in the use of services between areas. Pricing is an important factor in car-sharing: a low price guarantees wider accessibility, but a price that is too low may increase the use of shared cars at the expense of public transport, which may further increase the amount of car traffic instead of reducing it.

CASE FINNOO

The development of shared electric mobility services supports the objectives of an efficient transport system in the Finnoo area. Finnoo as a developing area that is being rebuilt offers a chance to focus, in particular, on various building and street-specific spatial solutions that support car-sharing. For instance, parking solutions can be examined primarily in the context of shared services as part of centralised parking facilities. The metro area is also an important usage location for car-sharing as part of sustainable travel chains. The city organisation's own electric vehicles can also be a way to implement a shared electric car service in Finnoo. A car park for car-sharing has already been allocated in the West Metro Finnoo area.

4.3 PARTICIPATION AND URBAN DEVELOPMENT

Engaging residents

SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

Residents have been a part of urban planning measures for decades, and consulting them at certain stages of planning is a legally mandated part of a city's operations. However, it is important to view residents not only as part of the daily work, but also as a resource in urban development, as future residents will have the closest interaction with the future residential areas. Therefore, Espoo has produced a participation model with a vision that states: «All Espoo residents can participate and influence the development of their home city.» This vision is also being implemented in the City's sustainable development work, including projects focusing on Kera and other parts of Espoo. Many participatory solutions have been implemented in Espoo's projects, including buddy class activities, workshops and resident groups. In addition to this, participatory work has been carried out city-wide, such as in Espoo's master plan for 2060, the Our Espoo 20X0 event series and the My Espoo survey. All of these serve as examples of potential participatory work in Kera, now and in the future.

Engagement of residents has become more prominent under the energy theme, particularly due to the changes caused and enabled by the energy transition. New energy solutions, operating models and goals will provide residents with new opportunities to live sustainably, while being increasingly economically sustainable options. As the use of renewable solutions has increased, energy production has moved closer to cities and their residents. And as solar power investments, for example, have become easier, residents are more able to invest in renewable production. Furthermore, residents can produce and commercialise flexibility for the energy system, depending on the potential. For instance, the increased use of electric cars enables flexible charging and ultimately also the use of electric car batteries for electricity storage.

The SPARCS project has trialled various resident engagement and communication measures, both within and beyond the energy theme, including activities such as buddy classes, the Following the Carbon Footprint ("Hiilijalanjäljillä") event series, sustainable mobility test runs and 1.5-degree workshops for residents. The inclusion of young people in the project activities has been a particular focus during the work.

CASE FINNOO

Finnoo will evolve over the years, even decades, and currently only a fraction of the ultimate population live in the area. The lessons of the participatory work can be used continuously throughout the development, taking into account the target groups and latest best practices.

Although the role and opportunities of young people under the energy theme will be limited in their near future, it is important to keep the area's long lifecycle and young people as future residents in mind. Young people's increased awareness of the energy theme and their role will benefit young people themselves, the City and the local operators. The sponsor class activities of the SPARCS project provide a replicable concept for engaging young people in sustainable development as part of their school activities.

Further information

Description of resident engagement in the BABLE database

Espoo's participation model on the City's website (in Finnish)

4.3 PARTICIPATION AND URBAN DEVELOPMENT

Engaging housing companies

SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

In addition to energy production and distribution, energy efficiency plays a vital role in promoting sustainable energy. As the new building stock is already highly energy efficient, the most significant potential for reducing energy consumption is in existing buildings. By investing in energy efficiency measures both environmental and economic benefits are possible, because a more energy-efficient building is also a more cost-effective building. When it comes to improving the energy efficiency of the existing building stock, the housing companies play a key role as bodies deciding on their investments and energy renovation projects. During energy renovations, housing companies can also examine and introduce other solutions, such as solar power production, alongside the promotion of energy efficiency.

As the competence of housing companies is dependent on the abilities and interest of the board members and building managers, collaboration, advice and support mechanisms can help with the implementation of measures. One possibility, also piloted in Espoo, to enhance the implementation of energy efficiency measures, and other guidance and collaboration is to establish local housing company networks. As housing companies vary in size and available funds, the network can provide advice, but also create opportunities for joint procurement and scaled investments. The City's goal is to create an operating model that guides housing company boards towards systematic maintenance and introduction of energy efficiency measures. Housing company networks are currently being piloted in Matinkylä, Espoo.

CASE FINNOO

As Finnoo is mostly a re-developing area of housing and workplaces, the energy efficiency of its building stock and other implemented energy solutions are, as expected, more advanced compared to Espoo's districts that have older buildings. During the construction phase, the developer will hold the decision-making authority regarding implemented solutions, but the authority will shift to the residents during the transfer of administration. However, housing companies will be important actors in the area as the housing construction progresses and will make decisions as the need for energy renovations becomes topical in the future. Systematic maintenance throughout the entire lifecycle of the area, and thus also the advice and engagement of the housing companies, is important from the start. Housing company forums can facilitate local networking and a sense of unity, ensuring an easier adoption of sustainable solutions, going forward. Information distribution and cooperation between housing companies should be promoted according to the interests of the local residents.

Further information

[Description of energy renovations and an energy-efficient renovation in the BABLE database]

4.3 PARTICIPATION AND URBAN DEVELOPMENT

Electric mobility test runs

SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

The project involved a test run for electric vehicles in the blocks of Lippulaiva in Espoonlahti as part of the Espoo Day in August 2022.

Personal experiences with electric vehicles can increase their appeal and interest in them while reducing negative preconceptions associated with them. At the same time, the barrier to using shared mobility services may decrease when the vehicle is familiar. A test run in a controlled and restricted place, where discussions are possible and the sector's operators and experts can be asked questions on the topic, is one way to facilitate this. On the test run day, 26 August 2022, during the project, the participants could try out electric bicycles, city bikes and electric scooters. Additionally, information was available on electric cars and their charging solutions. The event was held in the blocks of Lippulaiva in Espoonlahti.

A survey on electric mobility modes (N = 59) was also carried out on the event day. The respondents used shared mobility services only seldomly due to their inaccessibility and location far from home. The respondents felt that to promote sustainable mobility, the availability of mobility services must be increased (including geographically), their cost reduced, cycling infrastructure improved and residents' influence enhanced, for example.

CASE FINNOO

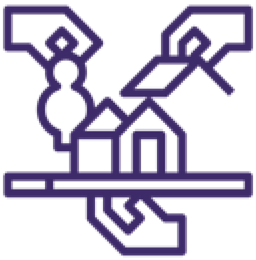
It is possible to influence the various profiles of mobility mode users and mobility in Finnoo from the early stages of area development onwards. Positive progress should be supported, for example by identifying different user groups and their needs. Test runs and similar events can support nudging towards sustainable mobility habits, a concept familiar from the field of service design. The metro area can serve as a natural venue and a living lab for new solutions. However, it is important to ensure the accessibility and supply of sustainable mobility modes, without which their use in everyday life will not be achieved as intended. It is vital to take action to guarantee the accessibility of sustainable mobility modes, both physically and financially, as the purchase prices of electronic mobility equipment are usually high in comparison to non-electric alternatives.

Further information

News article on the event at espoo.fi (language versions: FIN, SWE, ENG)

4.3 PARTICIPATION AND URBAN DEVELOPMENT

3D model as part of energy planning and local optimisation



SOLUTION DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

3D city information models, where a city's geometry is combined with various forms of information, depending on the model, are increasingly common applications used in city planning and visualisation. A 3D model alone refers to the digital modelling of the geometry of urban elements, such as buildings, infrastructure, vegetation or terrain. A 3D model can remain at this visual level or information can be included in the objects it contains, boosting the model's usefulness to the City's employees, other stakeholders and residents. This turns a simple geometric model into a more comprehensive city information model.

City information models are already in use in Espoo, both at city level and locally, but the applications used may vary according to area. The City of Espoo's 3D city model is also openly available via an interface, and it can be viewed in the Espoo map service. The main goal of SPARCS has been to assess the city model's role in energy planning.

More information on the use of 3D models in local energy planning can be obtained from a study produced during the SPARCS project (see below).

CASE FINNOO

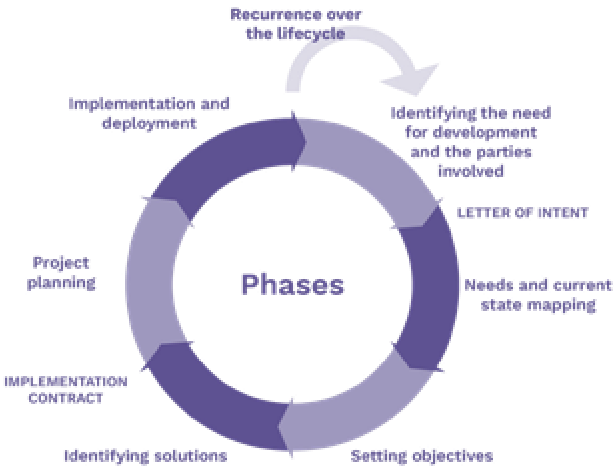
Piloting related to city information models has been carried out in the Finnoo area in the past, and the theme is interesting for the future development of the area. The opportunities afforded by the city information model for energy and transport planning are particularly interesting for the lessons learned from the SPARCS project as well as future work. Any review and piloting needs should be identified in these themes with the area's developers. For example, a visualisation of the solar power potential could promote the adoption of renewable energy solutions in the area.

In area development, city information models also offer a possible channel for visualising and communicating the progress made in the area, both amongst the developers and towards the residents. The long lifecycle of the development work in Finnoo and the major change in the urban landscape require new applications for communicating the outcome of the area development to current and future residents.

Further information

Report on the role of 3D models in energy planning on the SPARCS website

Co-creation model as a tool



DESCRIPTION AND LESSONS LEARNT FROM THE PROJECT

The project has developed a co-creation model for sustainable and smart urban areas to support multi-stakeholder collaboration towards sustainable solutions and development. The model itself has been further improved through co-creation with various stakeholders and gathering project examples. The co-creation model developed in the project is freely available in virtual format: https://co-creatingsparcs.fi/en/model/

The existing land-use planning system is unable to adequately address the current requirements concerning ecological, social and economic sustainability, the reformation and digitalisation of systemic operational models or the implementation of other new technologies and practices. Additionally, societal developments have become less predictableand the number of disruptions has increased. Area development requires new means to achieve sustainability goals and mobilise wide groups of stakeholders involved in systemic changes in the social structures to take part in this work.

Co-creation can achieve not only ecologically sustainable and smart urban areas, but also communal and incentivising environments. Co-creation helps develop a user-centred, lifecycle-flexible urban structure that can better withstand environmental challenges and services that best support the daily lives of residents. Moreover, through co-creation, resources from both the public and private sectors can be optimised, and the development of solutions catalysed by providing test environments for innovations.

CASE FINNOO

The development of Finnoo is based on the objective of an ecological district where services are close to residents and employees and where movement to/within/from the area is easy as the centre of the area is built around the new metro station. In addition to this, the construction of the area is guided by low-emission and sustainable solutions, and the natural values of the area have been recognised as important. Each of these areas (and others not mentioned here) constitutes a system in itself, and together the whole forms a multidimensional and intricate network of systems. Co-creation tools and networks can support the development of the area in the desired and intended direction through a multi-professional developer network. Co-creation can be applied, for example, as part of planning or implementation processes, clarifying the shared vision of the area, defining common objectives and indicators and planning joint measures.

Further information

The model's website (open access) (language versions:FIN, ENG)

Description in the BABLE database

For example, in order to support the objective of sustainable mobility in Finnoo, particular attention should be paid to public transport and metro traffic in the area as a whole. The area will be built over several decades, and the mobility needs will also develop progressively. The availability and accessibility of services is important for supporting the establishment of routines and habits for sustainable mobility from the early stages to the completion of the construction of the area in the late 2030s and beyond. In particular, temporary solutions as part of the construction processes – transport routes, services, accessibility, safety – must be taken into account at every stage together with the entire network of actors involved in the development.

Here below, the steps in the co-creation process have been examined in more detail as part of the development of the transport system.

CO-CREATION MODEL – CASE SUSTAINABLE MOBILITY IN FINNOO

CO-CREATION PROCESS START

IDENTIFYING NEEDS AND ACTORS

Metro started operation in Dec 2022

First new residents moved to the area in autumn 2021

The Finnoo central area is developed around the metro station area

Need for sustainable mobility; Carbon Neutral Espoo by 2030

Stakeholders: HSL, mobility service operators, city (urban planning, traffic planning, Finnoo district Project manager), residents, employers, workers, developers and construction companies

NEEDS AND CURRENT STATE MAPPING

Understand the **context of the area** from as many perspectives as possible

Organise workshops and conduct interviews and surveys on current and potential residents, workers, employers and other companies in the area **to find leverage points** for sustainable mobility

Identify interested project developers and their views

Collect and utilise movement data from the area

SETTING OBJECTIVES

Organise workshops with relevant stakeholders to define goals for sustainable mobility in the area for **shared commitment**

Define relevant KPIs for measuring and assessing the development (e.g. modal share, utilisation of station area)

Define also relevant milestones for suitable intervals

Focus on the station area development to foster sustainable travel chains

NOTES

- Identifying needs and actors: Identify stakeholders that are relevant to the are both **during** and **after** the area's main building phase
- Needs and current state mapping: Movement data can be e.g. cellular connection data
- Needs and current state mapping: Workshops processes can be resource intensive, which needs to be considered in the overall planning and timing of the process
- Setting objectives: Treat the station area as a complex **system**, where all aspects (transport, logistics, social interaction, user experience) interconnect and influence one another

IDENTIFYING OPPORTUNITIES FOR ACTION

Benchmark existing solutions (local, regional, national, global examples)

Organize workshops for relevant stakeholders to identify practical opportunities and possible bottlenecks

Pay specific attention to **resident** (both current and future residents) **engagement process**, including marginalised groups

Plan tests and pilots; **utilise combination of different tests and pilots** where possible for increased impact

Utilise the metro station area as a test-bed as it is a natural **nodal point** of people, activities and goods

PROJECT PLANNING

Develop initial plans of the district level solutions, including the upcoming test and pilots

Set up (digital) measuring and feedback collection tools and processes (for continuous evaluation) for the use of all stakeholders

Set up tools for visualisation of the actions and their measured and assessed effects

Be prepared to re-assess the actions and the tests/pilots depending on the emerging overall picture of the development work

PERIOD OF USE AND LIFECYCLE

Implement actions and tests/pilots

Continuous impact assessment and feedback collection

Analyse results and share learning with relevant stakeholders and other actors (e.g. other cities and/or districts)

Identify needs for further change and development in the area (e.g. in relation to the development of the station area)

Remember the system level linkages between different actions on the district level

CO-CREATION PROCESS END / NEW START

SPARCS Project Partners

@SPARCSeu

sparcs.info

Horizon 2020
European Union funding
for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 864242. Topic: LC-SC3-SCC-1-2018-2019-2020: Smart Cities and Communities. The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.

ESPOO
ESBO