Technical, Economic and Regulatory barriers for PEDs

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About SPARCS

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

Partners

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

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EXECUTIVE SUMMARY

Positive Energy Districts (PEDs) are a new concept to city planners, citizens, businesses, and investors. PEDs can be defined as energy-efficient and energy-flexible urban areas or neighbourhoods which produce net zero greenhouse gas emissions and actively manage an annual local or regional surplus production of renewable energy. PEDs are not only seen as a promising pathway towards sustainable urban areas, but also is their development crucial for the transition towards climate-neutral cities. PED-related developments help to achieve the UN Sustainable Development Goals, European Green Deal objectives, and also the Mission on Carbon-Neutral and Smart Cities. Several cities have already taken up such developments, and forces were joined between European countries to achieve 100 PEDs until 2025 through a comprehensive research and innovation program.

This document includes an overview of the Finnish energy system and effective policies and regulatory frameworks. Furthermore, identified regulatory, economic, as well as technical barriers for the development of PEDs in Finland are presented in this document. This report also includes the results of a short questionnaire about the barriers and prerequisites for the development of Positive Energy Districts, which was conducted in fall 2021.

This report is a result of the activities within the SPARCS project. The identification of barriers in piloting innovative PED solutions is explicitly stated as an activity within the SPARCS project.

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1. INTRODUCTION

Europe aims to be a global role model in energy transition and in the reduction of its carbon footprint. To contribute to these targets, the European Strategic Energy Technology Plan (SET-Plan) introduced the concept of Positive Energy District (PED) and Neighbourhoods. The SET-Plan is a key stepping-stone to boost the transition towards a climate-neutral energy system through the development of low-carbon technologies in a fast and cost-competitive way.

In June 2018, the Temporary Working Group of the SET-Plan on Action 3.2 "Smart Cities and Communities" published an Implementation Plan, which aims to support the planning, deployment and replication of 100 'Positive Energy Districts' by 2025 for sustainable urbanisation. The planning, deployment and replication of 100 Positive Energy Neighbourhoods by 2025 is supported by JPI Urban Europe with the Programme "Positive Energy Districts and Neighbourhoods for Sustainable Urban Development" (JPI Urban Europe, Positive Energy Districts (PED), 2020). JPI Urban Europe is a Joint Programming Initiative of the European Commission, which engages 20 European countries, of which 14 are members.

PEDs must overcome significant hurdles to persuade citizens, residents, city officials, media and businesses that such districts offer compelling benefits compared to business as usual. As a rapidly growing city, Espoo is constantly developing greenfield and brownfield sites to host new residents and businesses. As urbanisation is widely accepted to be a driving megatrend globally, city planning functions must prepare to create an enabling environment for citizens, housing companies, real estate developers and businesses to form city districts with sustainable energy solutions, and PEDs will serve as flagships (or perhaps more appropriately, Lighthouses) in this process.

This document analyses the hurdles which can be categorised as Technical, Economic or Regulatory. A more comprehensive analysis should also look at social and cultural issues, but this is beyond the scope of this document.

2. DEFINITION OF A POSITIVE ENERGY DISTRICT

The Positive Energy District concept represents the transfer of the concept of climate-neutral buildings to districts. JPI Urban Europe defines positive energy districts as *"energy-efficient and energy-flexible urban areas or groups of connected buildings which produce net zero greenhouse gas emissions and actively manage an annual local or regional surplus production of renewable energy"* [1].

The white paper on "Reference Framework for Positive Energy Districts and Neighbourhoods" [2] advocates, that a definition for a PED should not be just an algorithm for calculating the input and output of energy, but rather a framework, which outlines the three most important functions of urban areas in the context of their urban and regional energy systems. PEDs should ultimately rely on renewable energy only (energy production function), which is one of the main contributions towards climate neutrality. Secondly, they should make energy efficiency as one of their priorities to best utilise the renewable energies available (energy efficiency function). Thirdly, as urban areas are bound to be among the largest consumers of energy, PEDs need to make sure that they act in a way which is optimally beneficial for the energy system (energy flexibility function). The target is to optimise these three functions (aspects) of PEDs by taking into account

the guiding principles quality of life, inclusiveness and sustainability. The three key aspects of a PED are shown in Figure 1.

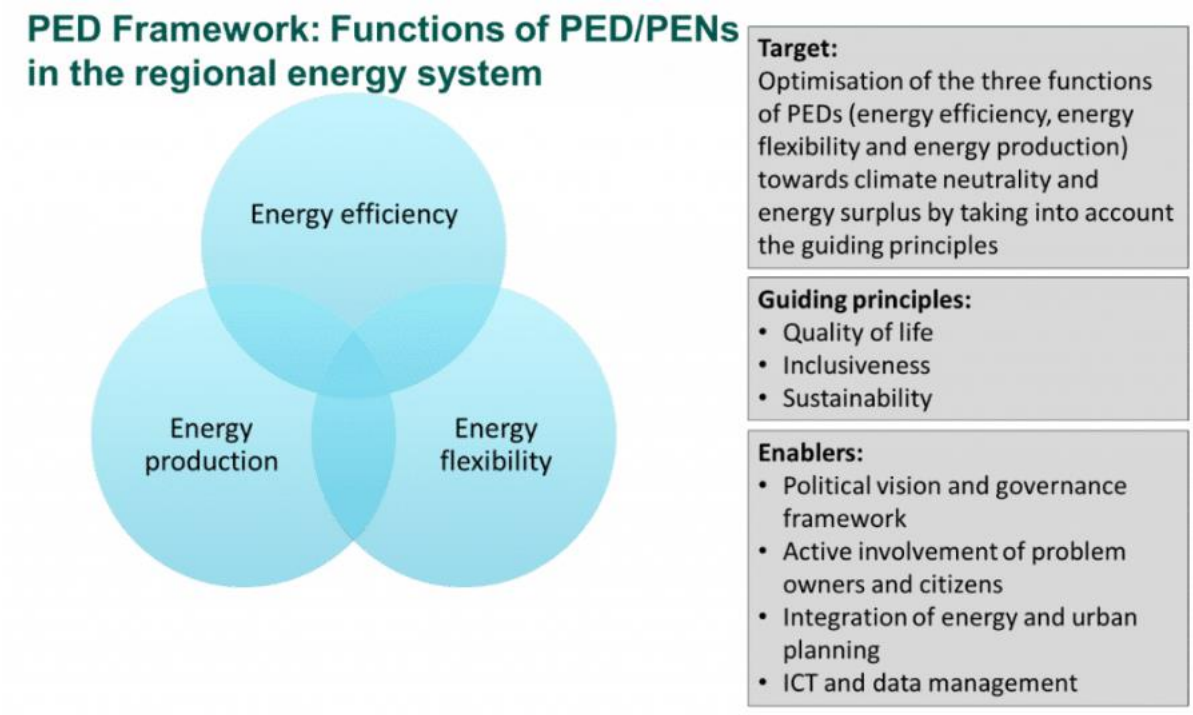

Figure 1: The three functions of PEDs in the regional energy system, which are related to the key aspects (energy efficiency, renewable energy generation and beneficiary to the energy system) [2]

Based on such a basic framework, cities should be able to optimise the different functions and guiding principles against one another, to find a balance, which can best represent the renewable energy resources available in their respective climate zone, together with their specific ambitions and needs. When developing PEDs, the specific situation of the city should be taken into account (e.g. density, type of buildings, available local renewable energy resources).

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3. RELEVANCE TO SPARCS

The SPARCS Work Plan for the City of Espoo (Deliverable 3.1) provides a breakdown of activities that will be completed as part of Action E10-1 and the Kera PED demonstration. Identification of barriers is explicitly stated as an activity.

Action E10-1	**City Planning for Positive Energy Blocks. Exploring the possibilities to utilize the continuously updated Espoo 3D City model as a support and tool in the development and planning of the new Kera area.**
Detailed plan	• Communicate with city architects and zoning personnel to understand and document the role of the 3D city model in Kera planning. • Map technical, economic and regulatory barriers in piloting innovative PED solutions. • Identify opportunities offered by energy community legislation and new cost-efficient renewable energy generation and distribution technologies • Assess new business models for generation, aggregation, storage and distribution. • Explore the benefits of using 3D city model in pursuing new opportunities and implementing PED solutions • Draft process to mainstream 3D city model support in PED development in Espoo.
Targeted outcome	Mainstreamed process to routinely integrate PED considerations in the early stages of city planning will reduce costs and improve the effectiveness of energy efficiency and distributed energy generation measures in new area development.
Roles and responsibilities	ESP: Main responsibility VTT: Support in identifying technologies relevant to PED development leveraging experiences from similar Lighthouse projects Siemens, Adven, PlugIt, Kone, stakeholders: Propose private sector solutions and new business models for public private partnerships in PEDs
Schedule	M18: 3D model in city architecture and zoning process documented M21: Barriers, opportunities and business models assessed M28: Assessment of 3D model feasibility in PED implementation finalized
KPIs	Qualitative assessment (Likert scale) of city planning tool Prospective On-site Energy Ratio and Annual Mismatch Ratio in Kera Prospective impact on energy expenditure for residents (€/year)
Financial scheme	This action does not require infrastructure investment. The city is actively engaged in projects to support renewable energy, circular economy and low-carbon mobility solutions, with specific budgets allocated to local pilots.

4. ENERGY SYSTEM IN FINLAND

In Finland the roles of electricity distributor and trader are differentiated. While the electricity distributor is a state legislated monopoly, the trader has a compete market-based position, meaning that electricity consumers may choose the trader, but they are bound to the local electricity distributor. Consumers' electricity prices are composed of the electricity price, taxes, and the distribution costs. Currently there are around 80 distribution system operators in Finland, most of which are municipality owned [3].

In 2019 the share of electricity produced from renewable energy sources was 47 percent, and the total amount of electricity produced was 66 TWh. The remaining amount of electricity was produced from nuclear power (23 TWh), combined heat and power production (22 TWh), and condensing power (around 3 TWh) [4].

In Finland, the heating of buildings accounts for about one fourth of the total energy consumption. Households are mainly heated with district heat, wood, and electricity and around half of all Finnish households are connected to a district heating network. In 2019, the district heat production amounted to 38 TWh, of which 40 percent were produced with renewable fuels, around 35 percent with fossil fuels, 15 percent with peat, and 10 percent with other energy sources. The length of the Finnish district heating network is roughly over 15000 km and it's growing by 250-500km every year. Industrial heat production, which is mainly produced with domestic wood-based fuel (75 percent of total industrial heat production), amounted to 55 TWh in 2019. [4, 5, 6]

The Finnish electricity market is shaped by its centralized generation, and so far, the role of citizens in energy production has been negligible. The secure supply of electricity and low market prices are most likely one reason, why there hasn't been a need to develop energy communities to ensure cheap energy access for locals in the past.

A large amount of greenhouse gas emissions is formed in cities, and to achieve carbon neutrality and develop positive energy districts, municipalities must engage in active and effective climate work. Their responsibilities lie within functions such as land use and planning, traffic planning, ownership steering of energy companies and choices of heating and methods for their buildings. Cities also serve as platforms and enablers, and they can promote the climate work of residents, entrepreneurs, and other stakeholders in many ways. In the future, residents will not only be energy consumers, but instead they will play an important role in the energy market as energy prosumers. Renewable and decentralised energy production can empower and engage communities to take an active role in the energy market. To get there, an energy transition from the current large-scale and centralized system to a de-centralised and renewable- or carbon neutral energy-based system is necessary.

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5. POLICIES AND REGULATORY FRAMEWORKS IN FINLAND

The key pillar of Finland's national climate policy is the Climate Change Act, which entered into force in 2015. According to the Act, Finland must reduce its greenhouse gas (GHG) emissions by at least 80% by 2050 from the levels in 1990.

One of the national objectives set by Prime Minister Sanna Marin's Government is, to reach carbon neutrality by the year 2035 and to be the first fossil-free welfare society. Plans are to reform the existing Climate Change Act in such way, that the targets concerning carbon neutrality by 2035 will be reached. Additionally, the 2050 target will be updated and interim targets will be added to the Act. The proposal for the revised Climate Change Act is due to be completed in early 2021. A legislation to phase out the use of coal in energy production by 2029 has already been adopted. A stepwise phase-out of the use of oil for heating by the beginning of the 2030s and a reduction of the use of peat by 50 percent by 2030 are also foreseen by the Government Programme.

The National Energy and Climate Strategy and the Medium-term Climate Change Policy Plan (KAISU) are part of the climate policy planning system under the Climate Change Act and therefore both plans will be updated during 2021 as well. The National Energy and Climate Strategy as well as the Medium-term Climate Policy Plan guide Finland in achieving its climate objectives.

The Medium-Term Climate Policy Plan was approved in 2017 and set to run to the year 2030. The Plan sets out the measures necessary to reduce GHG emissions for the effort sharing sectors (which are not involved in the emission trading scheme), and Finland's current objective is to reduce GHG emissions nationally by 39 per cent by 2030, compared to the level of 2005.

Finland must also comply with the obligations and policy decisions under the European Union climate and energy legislation.

5.1 Existing energy and climate policy measures

The following table summarizes the existing emission reduction measures defined in the Medium-Term Climate Policy Plan. The policy measures are categorized into the non-emissions trading sectors, the so-called effort sharing sectors.

Since the Medium-term Climate Policy Plan entered into force, further measures were introduced. A summary of additional policy measures is presented in Table 2.

Over the last decade a lot of progress has been made in improving administrative procedures to remove regulatory and non-regulatory barriers to the development of renewable energy in Finland. Finland's fifth progress report under article 22 of Directive 2009/28/EC outlines the measures that were already taken, and which are still planned to promote the growth of energy from renewable sources.

The following paragraph gives an overview of Finnish regulations and actions performed in respect to the promotion of the use of renewable energy sources and the development of positive energy districts.

In 2014 the Finnish Land Use and Building Act was amended so that wind power construction in an area designated as an industrial estate or a port is no longer regarded as having a significant impact in terms of town planning. Already in 2012 and 2013 procedures related to wind power construction were simplified, and barriers and restrictions were removed. The Finnish Ministry of the Environment has been sponsoring

Table 1: Overview of the existing energy and climate policy measures [7]

Energy Supply	Industry	Transport	Residential & Services	Waste	Agriculture
Energy and carbon dioxide taxes	Energy and carbon dioxide taxes	Energy and carbon dioxide taxes	Energy and carbon dioxide taxes	Waste tax	Energy and carbon dioxide taxes
Promoting wind power	Energy Audit Programme	Promoting biogas in road transport	Consumer energy advice	Regulation on packing, waste management	Energy Efficiency Agreement for Agriculture and other energy efficiency initiatives
Promoting forest chips and other wood-based fuels	Energy Efficiency Agreements		Eco-design and energy labelling	Landfill regulation limiting deposit of organic waste	Rural Development Programme for Mainland Finland
Promoting biogas in electricity and heat production	Implementation and improved enforcement of F-gas regulations		Information dissemination and campaigns on energy efficiency		Climate Programme for Finnish Agriculture
Promoting solar power			Building regulation		
Energy efficiency agreements			Energy certificates for buildings		

Table 2: Additional national policy measures which have been decided after the completion of the Medium-term Climate Policy Plan [7]

Energy Supply	Industry	Transport	Residential & Services	Agriculture
Tendering process concerning a renewable energy production subsidy (so-called premium system)	Public procurement criteria, information measures, etc. Concerning F-gases	Quota obligation for the use of biofuels in the transport sector, enhanced measures	Quota obligation for the use of bioliquids in space heating	Activities on organic soils
Act on Phasing out Coal in Energy Use	Quota obligation for the use of bioliquids in machinery	Improving the energy-efficiency of vehicles, enhanced measures	Action plan for encouraging the transition of oil-heated properties to other forms of heating in the 2020s	Quota obligation for the use of bioliquids in machinery
Investment support for energy projects replacing coal in 2020–2025	Reducing the industrial electricity tax to the EU minimum level	Improving the energy-efficiency of the transport system, enhanced measures	Promoting renovations through grants to improve energy efficiency in 2020–2022	Promoting the production and use of biogas

a nationwide advisory service for the coordination of wind power construction projects since 2015. Additionally, many restrictions related to wind power plants and transport infrastructure as well as procedures related to planning permissions (Finnish Aviation Act) have been eased and simplified considerably.

In 2014 the Finnish Land Use and Building Act was amended so that wind power construction in an area designated as an industrial estate or a port is no longer regarded as having a significant impact in terms of town planning. Already in 2012 and 2013 procedures related to wind power construction were simplified, and barriers and restrictions were removed. The Finnish Ministry of the Environment has been sponsoring a nationwide advisory service for the coordination of wind power construction projects since 2015. Additionally, many restrictions related to wind power plants and transport

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infrastructure as well as procedures related to planning permissions (Finnish Aviation Act) have been eased and simplified considerably.

In 2017 also another amendment was introduced to the Land Use and Building Act with the purpose to relax regulations on the installation of solar panels and solar thermal collectors. Since then, action permits for installing solar panels or solar thermal collectors are only needed if the installation may significantly alter the cityscape or the environment.

Procedures to source, license and connect small-scale production to the national grid have been simplified. Like all other Nordic countries, also Finland has regulatory frameworks, which enable the development of self-production and self-consumption of electricity. Past tax reforms raised the lower taxation limit for self-produced and -consumed electricity considerably and simplified taxation procedures. In Finland, the grid operator is charged for ensuring the technical functionality and operational reliability of the entire electricity system. Under the Finnish Electricity Market Act, all parties that join the system must be treated equally. This means, that the operator's conditions and technical requirements imposed for connecting to the system must be equitable and non-discriminatory.

Finland has a deregulated electricity market, which means that electricity produced from renewable energy sources enjoys no special status in the market. The viability of renewable energy production is being promoted through various support schemes. The amended Finnish Act on Support for Electricity Production from Renewable Energy Sources (1396/2010) provides for a premium scheme based on technology-neutral renewable energy tendering. The premium scheme aims to increase the capacity of electricity produced from renewable energy sources at minimal cost, by paying assistance to electricity producers.

The Finnish Act on Biofuels and Bioliquids (393/2013) entered into force in 2013 and transposed the sustainability criteria for biofuels and bioliquids set by the EU into Finnish law. Since then, the Act was revised twice, and requirements concerning the reduction of greenhouse gas emissions were tightened. The Finnish Act on the Reduction of Life-cycle Greenhouse Gas Emissions from Certain Fuels (170/2018) entered into force in 2018 and transposed among others EU requirements related to the quality of petrol and diesel fuels into Finnish law. The reformation of the Finnish energy tax system in 2011 changed the taxation of all fuels (including transport fuels) so that energy content, carbon dioxide emissions and strategic stockpile fee are used as base for the taxation. Yearly tax increases on the carbon dioxide tax on heating fuels allowed renewable energy to become more competitive against fossil fuels.

The expansion of Finland's electric car charging network is being promoted through investments in electric transport infrastructure and special support schemes. [8]

5.2 Existing regulations for Energy Communities

The recent directives by the European Union (Directive on common rules for the internal market for electricity and amending Directive 2012/27/EU [IEMD] & the Directive on the promotion of the use of energy from renewable sources [RED II]) require all member states to implement measures with regard to energy communities and self-generating customers.

The amended Government decree on determination of electricity supply and metering defines local energy communities, active customer groups, and a new service model for electricity net-metering. The new legislation entered into force in January 2021 and changes will be implemented by January 2023. By 2023 Fingrid will establish a national

datahub to collect meter data from all Finnish power customers and allocate self-produced solar electricity directly to residents in the same building.

The new legislation allows:

1. to form local energy communities (definition of an energy community was added to the legislation)
2. end-customers to form an active customer group (definition of an active customer group was added to the legislation)
3. energy communities and active customer groups to operate a local energy production plant (e.g. solar plant) and share the electricity between members via a new net-metering service model.

The new legislation allows housing associations and their residents to benefit from local small-scale energy production under the same principles and rules as private small-scale energy producers. Before the new legislation entered into force, there was only little motivation for housing associations to invest in renewable energies.

Small scale-energy producers were obliged to pay a distribution fee as well as taxes for the produced electricity and housing associations and multi-apartment buildings could only benefit from using the self-produced electricity for covering the general building's electricity bill (e.g. for elevators and lightning). Since January 2021 it is possible to share rooftop solar power directly to the residents living in the building. While solar energy did not appeal as an interesting investment opportunity for housing associations before, it has now become a viable option. As illustrated in Figure 2, solar systems were relatively small and expensive compared to their size, since based on the old legislation any produce should be consumed within the premises. Enabling residents to consume the electricity increases the size of the solar system up to three times and at the same time reduces the pay-back time of the system. [9]

Figure 2: Usage of local small-scale energy in housing associations before and after the legislation changes [10]

<u>Main principles of the new hourly-based net-metering service model:</u>

The new net-metering service model will allow for hourly-based net-metering, meaning that, based on the sum of electricity bought and sold within one hour, electricity is either bought or sold, but not both. The net-metering service model is based on the information provided by already existing smart meters, meaning that there is no need to install new smart meters within the housing network. The electricity production is shared between

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the shareholders computationally based on the data received from the installed smart meters. The hourly-based net-metering service will be available in most of the municipalities in Finland already before 2023 (see Figure 3). At the moment, the majority of installed electricity meters do not net-meter between phases (see illustration on the right hand side in Figure 3). Without phase metering, each phase of the electricity grid will be measured separately, and this may result in situations where electricity is bought as well as sold at the same time (an imbalance of phases results in tax and distribution tariff paid for self-consumed energy). Especially when appliances are not connected to all three phases, but instead e.g. only to one phase.

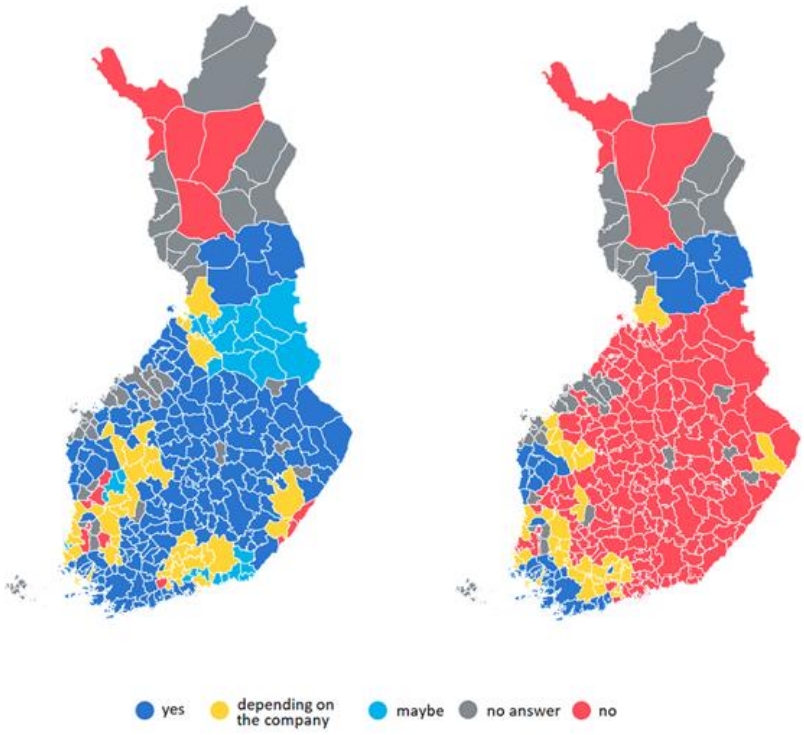

Figure 3: Hourly-based net-metering for customers before 1.1.2023 (left hand side) and current implementation status of net-metering of phases (right hand side) [9]

By May 2023 Finland as well as all other Nordic countries will change the imbalance settlement period from one hour to 15 minutes [11].

6. REGULATORY BARRIERS

Generally, regulatory barriers can be understood as barriers, which exist because of government policies, usually established through regulation.

Bossi et.al. [12] recently identified success factors as well as barriers for PED projects. The analysis underlines, that big challenges for the successful implementation of PED projects are provoked by a lack of funding, most likely connected with political support, and legal and regulatory barriers.

Policy impacting on the electricity market:

The open electricity market in Finland allows all electricity customers to buy their electricity from an electricity supplier of their choice. While consumers may freely choose their electricity trader, they are bound to the local electricity distributor, who enjoys a state legislated monopoly.

Even though the terms and technical requirements for connecting to the distribution system, as stated within the Finnish Electricity Market Act, must be equitable and non-discriminatory, the technical requirements set by the grid operator can limit the types of generation installations which can be connected to the grid. This might pose a barrier for some energy producers.

A report by Sweco and Oslo Economics examines the barriers preventing the development of distributed electricity production in the Nordics. One of the key findings of this study is that in Finland there are only few- if any- barriers and that there are no discriminatory measures or obstacles hindering the development. [13]

Policy impacting on district heating:

There is no separate district heating act in Finland, meaning that there is no specific legislation concerning the pricing of heating and/or cooling or the selection of heating/cooling methods. The Finnish competitive heating market allows customers to freely choose the heating and cooling method they want to use and, generally, customers are not obliged to connect to a district heating network. It is also their right to disconnect from the network without paying additional fees. Even though the customer has the freedom of choice, many political decisions, such as taxes, subsidies, and emission control and regulation have an impact on the attractiveness and lucrativeness of different services. In Finland, third-party access (TPA) is not guaranteed by law. If a third party wishes to conduct business on the network, it needs to negotiate the terms with the energy company owning the district heating network.

The integration of waste heat in the district heating network via the utilization of a heat pump, requires a separate connection pipe and heat metering. If the heat pump is not located within the facilities of the power plant, its electricity consumption needs to be taxed. As of January 2021, if the waste heat is used within the industry sector, the corresponding tax category is II. If heat is used elsewhere, the electricity tax will be applied according to category I [14]. Electricity taxes for each category are currently (since 1.1.2021) the following [15]:

Category I: 2,79372 c/kWh (incl. VAT 24%)
Category II: 0,07812 c/kWh (incl. VAT 24%))

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Policy impacting on Energy Communities:

While electricity transfer within property borders is possible since January 2021, power transfer over the property border will remain prohibited, with the exception of the direct line provision defined in the Internal Market for Electricity and Amending Directive. This direct line can only connect one specific production unit on one side of the border to one specific consumer on the other side, therefore this excludes minigrid infrastructures with 2-directional power flow.

It is still expected that more national legislation will be required to fully transpose all provisions of the two directives IEMD and REDII. In particular, cross-border energy communities must be defined to properly address the needs of PEDs. The definition states that a PED must consist of several buildings, including different types of power consumers, in order to boost self-consumption and avoid curtailment. If national law requires that all these functions exist on the same plot, significant difficulties will arise in urban districts where land area is limited and plot sizes are accordingly small. Furthermore, energy storage is a key component of any PED and might need substantial land area. Particularly solutions like Pit Thermal Energy Storage and pumped hydro cannot be located close to the building, and energy communities can't implement such solutions under current regulation.

Finally, the owners of electric vehicles should be allowed to charge their vehicles using their residential solar equipment. If the parking facility is not located on the same plot as the residence, direct charging is not possible and this basic right of car owners is violated.

Other challenges:

In their proposal about a new law on the licensing procedure for renewable energy production plants to the Parliament of Finland, the Finnish government assessed that current permission- and administrative processes for renewable energy production investments and projects can vary significantly depending on the type and scope of the investment/project. Furthermore, the complexity and the processing time of permission processes vary also within different municipalities. [16]

Energy system integration enables the optimization of the energy system as a whole and plays a fundamental role in building a more decentralized and flexible energy system. However, a lack of cooperation between sectors can hinder the acceleration towards an integrated energy system. Misaligned incentives can lead to a lack of cooperation as some sectors might not see the cooperation as beneficial, even though the cooperation would present a cost-effective way of reducing emissions.

7. ECONOMIC BARRIERS

Finland has keenly invested in clean and smart energy system solutions. In recent years, the number of investments in research and innovations was much above EU average measured in % of GDP [7].

Especially for private individuals, financial instruments and subsidy schemes to support investments are crucial. An example for the importance of financial support to support the use of renewable energies comes from the Finish wind sector. The implementation of the feed-in tariff scheme allowed the wind power capacity to steeply grow from 200MW (2012), to over 500MW in 2014, and finally 2000MW in 2018. [17] In 2018 also the first wind project was built without financial support from the state. Financial support by the state has played a fundamental role in ensuring that Finland reaches its renewable energy targets and enables a growth in RES capacity. Especially for the case of off-shore wind farms, and since the technology is not as well-established yet compared to on-shore wind farms, governmental financial support is still needed. The property tax on off-shore wind turbines for example, is still around three times higher compared to on-shore wind turbines [18]. In order to accelerate the construction of off-shore wind farms it will be necessary to level the taxes.

Very important for hydro and wind power investments, and also for some cases of thermal power, is the operation of Mankala companies in the Finnish electricity market. Many Finnish electricity companies operate according to the so called Mankala principle in which several companies jointly set up a non-profit limited liability company. Mankala companies aim to generate electricity for the shareholders at production cost instead of making profit and paying dividends. In doing so, they operate like cooperatives. The Mankala principle enables different sized utilities and industrial companies to take part in various energy production investments and offers a group of companies to share the risks of energy investments.

One important aspect for PEDs are the contractual conditions between the local energy producers and the energy companies. While some energy companies might charge a fee for off taking surplus electricity, others are willing to purchase the surplus with the spot price. Smaller installations (with a rated generation capacity of less than 100kVA) are exempted under the current electricity tax regime, however, larger installations (100 kVA–2 MVA) need to register for tax and in case their production exceeds 800 MWh they are obliged to pay the electricity tax. [19]

Battery systems play an important role in distributed electricity production, but their growth is currently limited due to large investments and high technology costs. Battery storages will allow the prosumers to save self-generated electricity and consume it when electricity prices are high. A drop in technology costs will potentially impact the deployment of battery storage systems, and at the same time increase the profitability of investments in distributed electricity production. [13]

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8. TECHNICAL BARRIERS

Working towards a surplus production of renewable energy, in order to achieve an annual net zero energy import and net zero CO_2 emissions, PEDs often combine several energy sources. Preferred energy typologies are district and local heating, heat pump systems, photovoltaic, and geothermal energy [12].

The development of PEDs in Finland faces big challenges caused by the climate and the seasonal unavailability of renewable energy sources during high demand peaks. An example are extreme winter events, when temperatures are very low and at the same time there is no sunshine and no wind. The combination of multiple energy topologies and the integration of storage systems is therefore key to exploit high onsite energy ratios and to solve the problem of renewable energy intermittency.

It is expected that the share of intermittent renewable energy will reach high levels in the future, which requires changes to the grid management. Grid network stability and flexibility will therefore play a major role in future grid management. To achieve an overall flexible power system it is essential to increase flexibility in all sectors of the system: power generation, transmission & distribution, storage (both electrical and thermal), and flexible demand (demand-side management).

To enable demand response on a wide scale the deployment of an advanced metering infrastructure (AMI) will be necessary. Data storage solutions must be developed to enable demand response and its development. In the past, high financial costs and a lack of expertise and experience were responsible for the slow development of electric batteries in Finland. Nevertheless, a lot of new data is continuously gathered through research- and investment projects and predictions indicate an increase in the share of electric batteries on the market in the near future [20].

Another potential contributor to increase the flexibility of the power system is hydrogen. As an emerging technology it could not only act as a storage solution, but also integrates different sectors such as electricity, industry, buildings, and transport. Green (emission free) hydrogen production from renewable energy sources is, however, not a feasible solution yet, since production costs are too high and needed infrastructures are missing. At the moment there isn't a single hydrogen gas station in Finland, and Finland's gas pipeline network is not as extensive as compared to those of other European countries (e.g. Germany).

Despite the strong momentum of solar PV power projects, there are still existing technological barriers that could potentially hinder the accelerated growth needed in the near future. Some of those challenges are grid connection and integration challenges, grid flexibility challenges, and architectural and space barriers. Additionally, very densely built urban environments may impose constraints on the availability of local energy sources. Shadowing needs to be addressed, especially for wall-integrated solar PV installations but also for PV installations on rooftops. The installation of wind turbines might be hindered by interferences with the radar system and other conflicting issues, even though wind conditions might be favourable (especially on the seashore).

Contrary to wind and solar energy, geothermal energy is not depending on weather conditions and geothermal power plants are capable of supplying baseload energy. Developments in the field of geothermal energy production nowadays allow the drilling of much deeper boreholes (even more than 1 km), which means that less land area is required in order to produce the same amount of heat compared to conventional boreholes (around 300m depth). However, more experience is yet needed, in order to

improve the drilling process, decrease drilling times, and make deep drilling projects economically feasible. Important factors for the design of deep boreholes are flow rate, depth of the well and local geological properties. The unique geological conditions make it difficult to directly replicate projects.

The district heating network of the future may feature an emission free and two-way district heating network, which allows the integration of renewable energy sources, waste heat (or also called surplus heat), and geothermal energy. While the use of waste heat in district heating has been increasing sharply within the last decade, studies point out that there is still a great potential of unexploited waste heat. [21] In general, the higher the temperature level of surplus heat, and the more constantly it's available, the more technically and economically feasible it is to utilize. Waste heat that can be used directly with a heat exchanger is of higher value than heat recovered with the help of a heat pump. Since waste heat is often harnessed at much lower temperatures than the supply temperatures of the district heating network (70-115°C), it is necessary to increase the temperature after the heat pump. New higher-temperature heat pumps, which produce heat of over 100° C, are already available at the market but their power factor is still low, meaning that their electricity consumption is higher. Once mature, this new technology may revolutionise the utilization of low-temperature waste heat. Another approach could be to operate district heating networks – or part of the network - at lower temperatures to increase the efficient use of waste heat and to safe costs on heating pumps.

One strategy to reduce GHG emissions in the transportation sector is to replace fossil fuels with biogas. In their report, the Finnish Ministry of Economic Affairs and Employment evaluated that main challenges of the production and the broad usage of biogas lie in the poor profitability of biogas production. [22] As a product for the transportation sector and for working machines, biomethane currently has the highest market value. However, its demand is rather small as the national coverage of biomethane stations within the distribution network is poor.

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9. QUESTIONNAIRE ABOUT THE BARRIERS AND PREREQUISITES FOR THE DEVELOPMENT OF POSITIVE ENERGY DISTRICTS

As part of SPARCS, the City of Espoo created a short questionnaire about the barriers and prerequisites for the development of positive energy districts. The aim of the questionnaire was to bring forward the opinion and experience of different companies and experts and to evaluate how the development of positive energy districts is perceived in general. The complete questionnaire (in Finnish) can be found from the Appendix.

The questionnaire was shared with 28 specialists and professionals from different energy companies and organizations during September 2021. In total a number of eight answers from professionals representing five different business industries were received (see the business industries represented by the respondents in Figure 4).

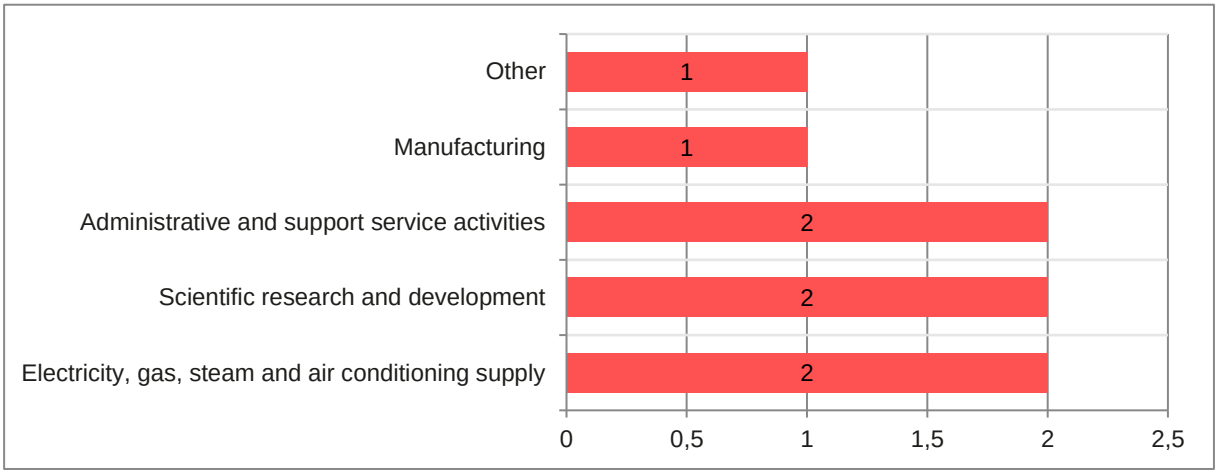

Figure 4: Questionnaire respondents and the business industries they are representing

To the question "In your opinion, what is the role of positive energy districts in future cities?" the respondents answered very differently. While some respondents think that PEDs will be the future status-quo in district planning and that they will lead the way in the future, other respondents think that PEDs are or will be inefficient and unprofitable. Some also argue that PEDs could lead to sub-optimization, which might have negative and weakening effects on the overall energy system. In the opinion of some respondents, PEDs will play an insignificant role in the overall picture with only little effects on the future energy system. Others again think that PEDs could serve as platforms for pilots and new technologies, however new business models, roles and regulations will be needed. One of the respondents also raised the question why, in general, districts should be energy positive and produce more energy than necessary.

The respondents were further asked to estimate the impact of different barriers to the current development of positive energy districts in Finland (with 1 - having a small impact, to 5 - having a huge impact). 63% of the respondents estimate, that economic as well as regulatory barriers have a great impact (4) to the development of PEDs in Finland.

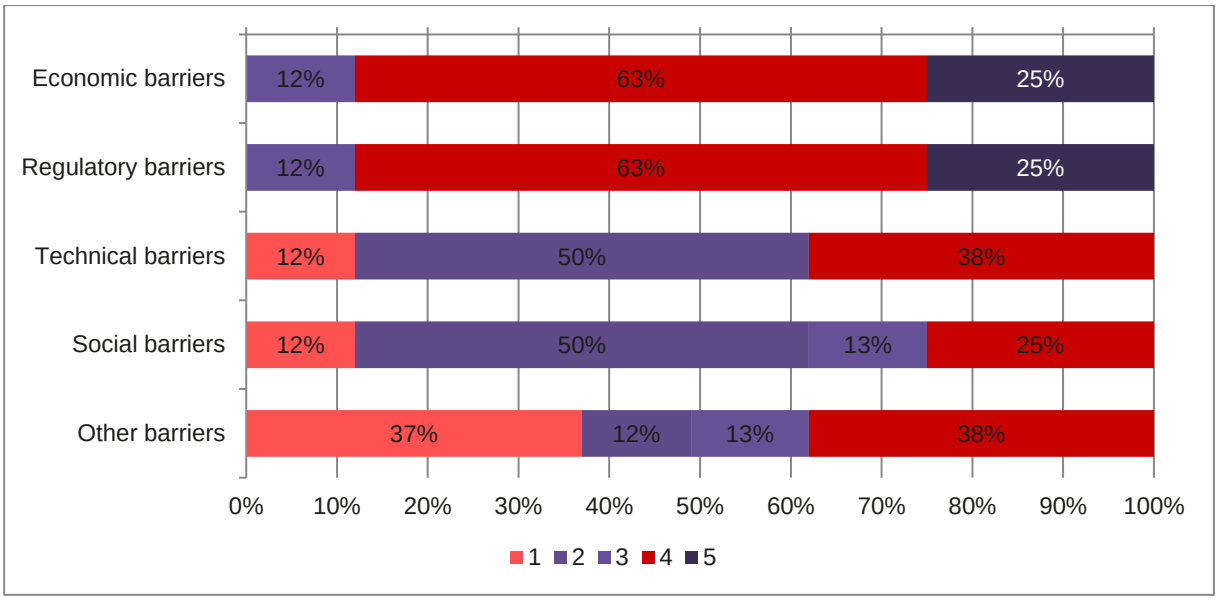

Figure 5: Respondents' answers to the question: "Estimate the impact of different barriers to the current development of positive energy districts in Finland. (1 - small impact, 5 - huge impact)"

Almost 90% of the respondents believe, that clear economic benefits for stakeholders are one of the most important prerequisites for enabling PEDs. Also the development of business models is seen as an important prerequisite.

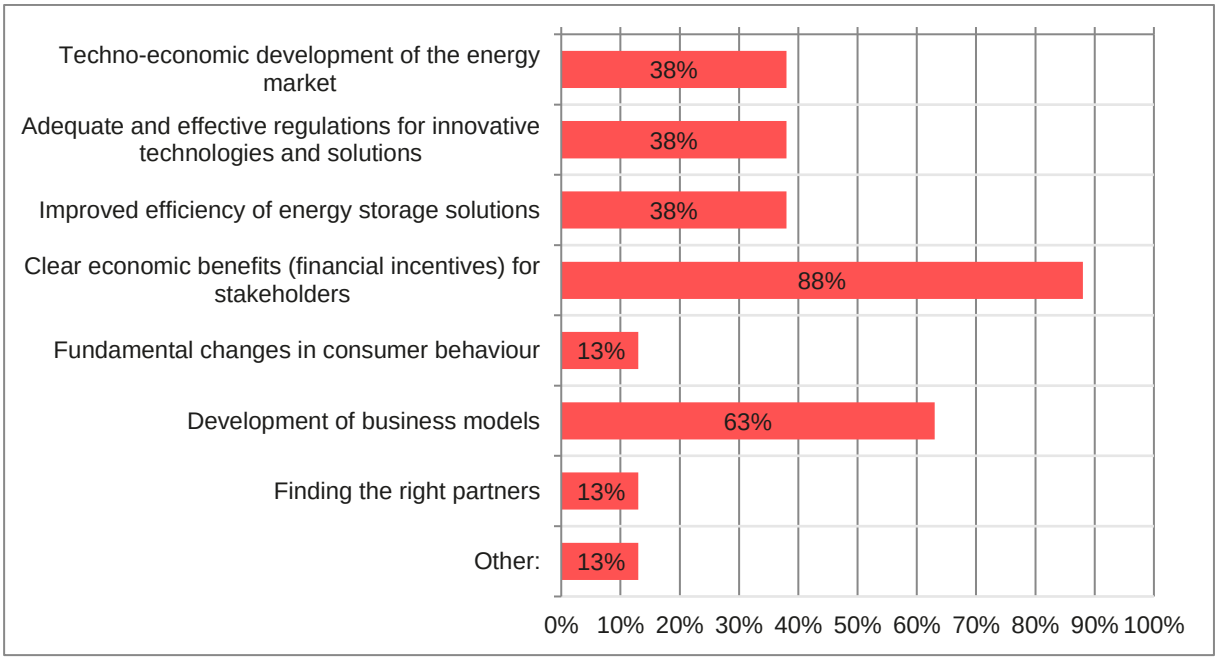

Figure 6: Respondents' answers to the question: "In your opinion, what are the most important prerequisites for enabling positive energy districts? Choose three prerequisites."

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As part of the questionnaire, the respondents were also asked what they think the most problematic regulatory barriers are when developing positive energy districts. The following regulatory barriers were reported by the respondents:

- *regulated monopolies*
- *electricity market regulatory framework*
- *requirements and demands set by the city*
- *slowness of the city planning process*
- *slowness and stiffness of the approval/permit processes*
- *energy storage investments are not part of the regulated market environment, which leads to less investments in energy storage solutions*
- *regulations and controlling mechanisms are lagging behind real world development*
- *legislation is hindering the full potential of energy communities*
- *electricity market regulations are limiting the distribution of electricity within districts*
- *Finland is lacking piloting platforms for legislations for clean and smart city solutions*
- *lack of readiness and enthusiasm for the development of new business models*
- *there are no regulatory barriers within the district heating market; the regulating body is the district heating network operator*

Some respondents also noted that not only regulatory barriers, but also economic challenges are problematic:

- *current building stock is far away from being energy efficient, but big energy renovations are expensive*
- *technology for energy positive districts is ready, but especially electricity autonomy is expensive to pursue*

In the next question, the respondents were asked to share their opinion and ideas about how to overcome these barriers. The respondents' ideas and suggestions are listed below.

- cooperation with the network operators
- reducing amount of bureaucracy
- reformation of current legislation
- improving the working processes within the city and making them more efficient
- more possibilities for testing and piloting of new solutions in districts
- improvement of energy rights (for distribution) within districts
- more economic benefits for producing a surplus of energy
- experiments with legislation, new business models and services, and social innovations (regulatory sandbox experiments) should have their own development environments, ground rules and operating models
- involving new investors and companies

For the last question in the questionnaire the respondents were asked to share their opinion on how cities can promote the development of PEDs. Reflecting the respondents' answers, the role of cities in promoting the development of PEDs can be summarized as following. Cities can actively take part in the development by developing their own building stock, but also by providing piloting platforms to companies and other partners. It is important that energy solutions are already considered and thought of during the city planning process. City planning not only has to consider the future energy needs but also the fast pace at which technology is being developed. When developing new areas and districts, the cooperation with local energy network providers and local energy

companies can be of a valuable asset for cities. Cities can support the development of PEDs by finding funding opportunities and ensuring public funding for development projects.

10. MUNICIPAL STRATEGIES TO OVERCOME REGULATORY BARRIERS FOR THE DEVELOPMENT OF POSITIVE ENERGY DISTRICTS

Espoo's strategy, the Espoo Story, directs all of the city's operations toward common goals. One of the city's seven major goals is to achieve carbon neutrality by 2030. The strategy states that carbon neutrality will be achieved through determined cooperation with businesses, universities and other communities as well as residents. The implementation of the city strategy is supported by cross-administrative development programmes that allow the city, together with its partners, to develop innovative solutions through experiments and pilot projects in line with the Espoo Story.

The Sustainable Espoo programme is one of the city's four cross-administrative development programmes. Espoo's sustainable development work has started to pursue the enablers of good life through smart urban solutions, smooth and versatile mobility, emission-free energy production, responsible operations of the residents of Espoo and the surrounding environment. One of the strong points of the programme is the fact that its activities are carried out in cooperation with numerous companies, public sector actors and research institutes. The Sustainable Espoo programme states that the city is following up the development of regulations and if necessary, affects on them.

A close cooperation with businesses, universities and other communities can help the city of Espoo to not only bring forth regulatory or administrative barriers, but also to accelerate the removal of these barriers.

Espoo's goal of carbon neutrality by 2030 (including the decarbonisation of the district heating system) can only be achieved through the transformation and electrification of the current energy system. Therefore, the Sustainable Espoo programme aims to meet this challenge and to identify the requirements of the future energy network.

Also city planning takes on an important role in supporting the future functionalities of the energy system. The Espoo Story states that municipal regulations related to zoning and construction will be reduced without compromising the regulatory quality. At the same time clearer operational objectives will be set for districts and regions in Espoo. The city of Espoo will also analyse how the preparation of zoning- and permit processes as well as land use agreements can be accelerated and how processing times can be reduced.

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11. REFERENCES

[1] "Positive Energy Districts (PED)," JPI UrbanEurope, N/A. [Online]. Available: https://jpi-urbaneurope.eu/ped/. [Accessed 03 January 2022].

[2] R. Hinterberger, C. Gollner, M. Noll, S. Meyer and H.-G. Schwarz, "White Paper on PED Reference Framework for Positive," JPI Urban Europe, 2020.

[3] Energiateollisuus, "Sähköverkkoyhtiöt," [Online]. Available: https://energia.fi/energiasta/energiaverkot/sahkoverkot/sahkoverkkoyhtiot. [Accessed 19 May 2021].

[4] S. Finland, "More district heat was produced with renewable fuels than with fossil fuels for the first time in 2019," 3 November 2020. [Online]. Available: https://www.stat.fi/til/salatuo/2019/salatuo_2019_2020-11-03_tie_001_en.html. [Accessed 19 May 2021].

[5] Energiateollisuus, "Kaukolämpöverkot," [Online]. Available: https://energia.fi/energiasta/energiaverkot/kaukolampoverkot. [Accessed 19 May 2021].

[6] Syke, "Rakennusten lämmitys kuluttaa runsaasti energiaa," 19 June 2018. [Online]. Available: https://ilmasto-opas.fi/en/ilmastonmuutos/hillinta/-/artikkeli/fi/73fa2827-42d1-4fd7-a757-175aca58b441/rakennusten-lammitys-kuluttaa-runsaasti-energiaa.html. [Accessed 19 May 2021].

[7] Ministry of Economic Affairs and Employment, "Finland's Integrated Energy and Climate Plan," Helsinki, 2019.

[8] n/a, "Finland´s fifth progress report under Aticle 22 of Directive 2009/28/EC," European Comission, 2020.

[9] P. Juuti, "Aurinkosähkön kannattavuus paranee omakotitaloissa ja taloyhtiöissä – katso kartalta, milloin säästöt kasvavat omalla paikkakunnallasi," 07 February 2021. [Online]. Available: Aurinkosähkön kannattavuus paranee omakotitaloissa ja taloyhtiöissä – katso kartalta, milloin säästöt kasvavat omalla paikkakunnallasi. [Accessed 04 June 2021].

[10] K. Energia, "Energiayhteisö tekee aurinkopaneeleista kannattavampia taloyhtiöille," 09 12 2020. [Online]. Available: https://www.keravanenergia.fi/artikkeli/energiayhteiso/. [Accessed 01 06 2021].

[11] "Varttitase eli 15 minuutin taseselvitysjakso," Fingrid Oyj, n/a. [Online]. Available: https://www.fingrid.fi/sahkomarkkinat/markkinoiden-yhtenaisyys/pohjoismainen-tasehallinta/varttitase/#taustaa. [Accessed 04 June 2021].

[12] S. Bossi , C. Gollner and S. Theierling, "Towards 100 Positive Energy Districts in Europe: Preliminary Data Analysis of 61 European Cases," *Energies,* vol. 13, no. 22, p. 6083, Nov. 2020.

[13] F. Krönert, G. Land Henriksen, S. Boye, E. Edfeldt, E. Wiesner, M. Fogsgaard Nilss and O. Uusitalo, "Distributed electricity production and self-consumption in the Nordics," Sweco Energuide AB, 2019.

[14] Vero.fi, "Energiaverotus," 19 February 2021. [Online]. Available: https://www.vero.fi/syventavat-vero-ohjeet/ohje-hakusivu/56206/energiaverotus2/#4.1-yhdistetty-tuotanto. [Accessed 09 June 2021].

[15] Caruna.fi, "Sähkövero ja sähköveroluokka - Lue mihin luokkaan kuulut," [Online]. Available: https://www.caruna.fi/palvelut/sahkonjakelu/sahkovero. [Accessed 09 June 2021].

[16] The Finnish Government, "HE 187/2020," Finlex, 2020. [Online]. Available: https://finlex.fi/fi/esitykset/he/2020/20200187#idp446049776. [Accessed 30 April 2021].

[17] Suomen Tuulivoimayhdistys, "Tuulivoima Suomessa," [Online]. Available: https://tuulivoimayhdistys.fi/tietoa-tuulivoimasta-2/tietoa-tuulivoimasta/tuulivoima-suomessa-ja-maailmalla/tuulivoima-suomessa. [Accessed 30 April 2021].

[18] R. Ukkonen, "Suomessa halutaan kohentaa merituulivoiman kannattavuutta – voimalahankkeet ovat edenneet hitaasti viime vuosina," 6 June 2020. [Online]. Available: https://yle.fi/uutiset/3-11195163. [Accessed 30 April 2021].

[19] J. Ahola, "National Survey Report of PV Power Applications in Finland," International Energy Agency, 2019.

[20] K. Blomqvist , J. Härkönen and T. Makkonen, "Sähkön varastointitekniikat- ja markkinat," Vanha Karelia, 2017.

[21] M. o. Finance, "Report of the working group on energy taxation reform: A proposal for implementing the intentions and goals of the Government Programme and for further development of energy taxation," Helsinki, 2021.

[22] M. o. E. A. a. Employment, "Biokaasuohjelmaa valmistelevan työryhmän loppuraportti," Työ- ja elinkeinoministeriö, January 2020.

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Kysely

Esteet ja edellytykset energiapositiivisien alueiden kehittämisessä / Barriers and prerequisites for the development of Positive Energy Districts

SPARCS-hanke on älykkäitä kaupunkeja koskeva aloite, jonka 31 osallistujan tavoitteena on luoda kestävien, energiapositiivisten ja hiilettömien yhteisöjen verkosto.

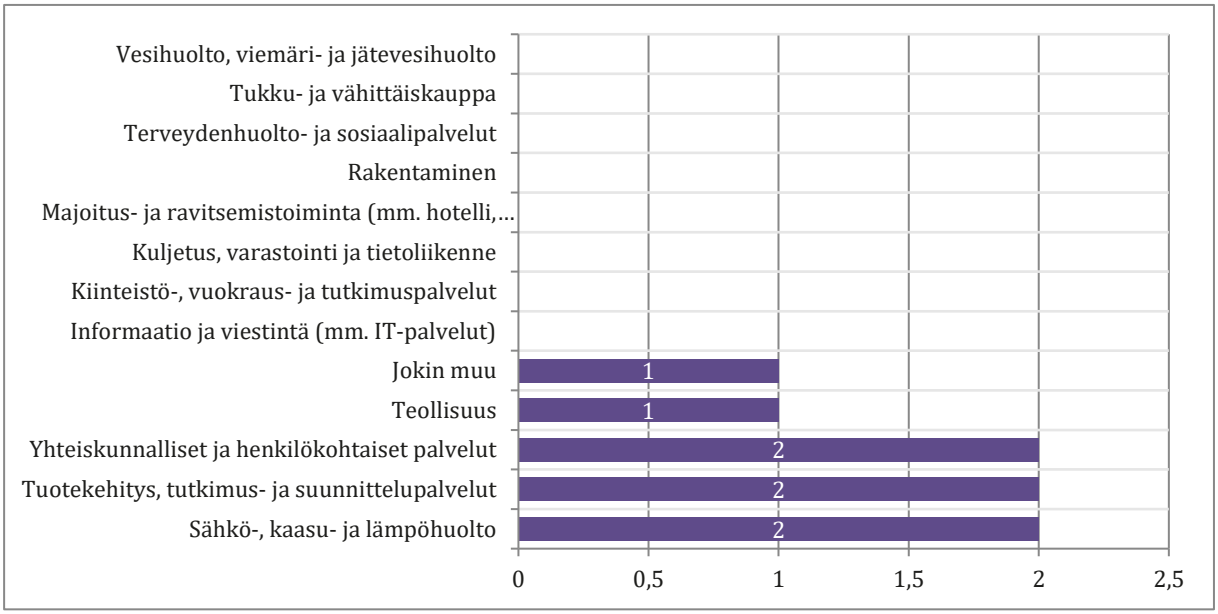
Energiapositiiviset alueet ovat energiatehokkaita ja joustavia urbaaneja alueita tai kortteleita, jotka ovat hiilineutraaleja ja aktiivisesti hallinnoivat vuosittaista paikallisen tai alueellisen uusiutuvan energian ylituotantoa.

Osana SPARCS-hanketta Espoon kaupunki on tunnistanut muun muassa teknologisia, taloudellisia sekä lainsäädännöllisiä esteitä energiapositiivisien alueiden kehittämisessä. Koska alueiden energiapositiivisuuden edistäminen edellyttää yhteistyötä eri toimijoiden välillä, haluamme tuoda myös eri asiantuntijoiden ja yrityksien näkökulmia esiin.

Tällä kyselyllä kerättyä palautetta säilyttää ja hallinnoi Espoon kaupunki. Anonyymi palaute säilytetään kaksi vuotta SPARCS-hankkeen päättymisen jälkeen (lokakuu 2026 asti) ja vastauksia käytetään SPARCS-hankkeen raportoinnissa ja (avoimissa) tutkimusjulkaisuissa. Palaute jaetaan SPARCS-hankkeen partnereiden kesken. Kerättyä palautetta voidaan myös käyttää anonymisoidusti Espoon kaupunki tutkimus-, palvelu- ja tuotekehitystoiminnassa. Anonymisoidun palautteen käyttäminen tarkoittaa, että henkilöllisyyttäsi ei voi tunnistaa vastaustesi perusteella.

Vastaajien kokonaismäärä: 8

1. Yrityksen toimiala



2. Miten näet energiapositiivisien alueiden roolin tulevaisuuden kaupungeissa?

Vastaukset
mitättömiä kokonaiskuvassa
Alueilla voidaan luoda edelläkävijyyttä, näkyvyyttä ja testausta sekä saattaa alan tomijoita yhteen konkreettisissa testauksessa alue, korttelitasolla talokohtaisuuden lisäksi.
Miksi alueiden pitäisi olla energiapositiivisia = ylituottaa energiaa. Energia pitää pyrkiä tuottamaan mahdollisimman tehokkaalla ja ympäristöystävällisellä tavalla. Se että joka alueelle näperrellään omia energia- ja tuotantoratkaisuja ei tunnu kovin tehokkaalta/taloudelliselta.
Erittäin tärkeä ja pitäisi olla tahtotila ja tavoite kaikkien uusien alueiden suunnittelussa ja vanhojen aluiden kehittämisessä.
Energiapositiiviset alueet voivat toimia tehokkaasti ja omavaraisesti hyödyntämällä erilaisia ympäristöystävällisiä tuontanto ja varastointiteknologioita.
Keskeinen tulevaisuuden suunta.
Välttämättä yksittäisillä alueilla ei ole tarvetta olla energiapositiivinen, vaan tärkeämpää on katsoa kokonaisuutta. Liian pienet alueet voivat johtaa osaoptimointiin, jossa kokonaisuus heikkenee. Esimerkksi lämmityksessä saattaa olla vaikuttavampaa tehdä isoja muutoksia koko kaupungin kaukolämpöjärjestelmään ja päästötön sähkö on järjevintä tuottaa tuulivoimalla tuulisissa olosuhteissa todennäköisesti kaukana tarkastelualueelta. Ratkaisujen sijainnillahan ei kokonaisuuteen ole suurta vaikutusta. Toki kuitenkin aluetasolla voidaan edistää monia järkeviä ratkaisuja.
Energiapositiiviset alueet tulevat olemaan keskeinen ratkaisu niissä kaupungeissa, jotka haluavat rakentaa aidosti kestävää ympäristöä kaupunkilaisilleen. Energiapositiivisuus edellyttää uusia toimintamalleja ja roolituksia sekä säätelyä. Energiapositiivisia alueita näemme erityisesti kaupungeissa, joissa on uudistusmielinen kulttuuri, verkostojohtamisen osaamista ja kansallinen lainsäädäntö tukemassa muutosta.

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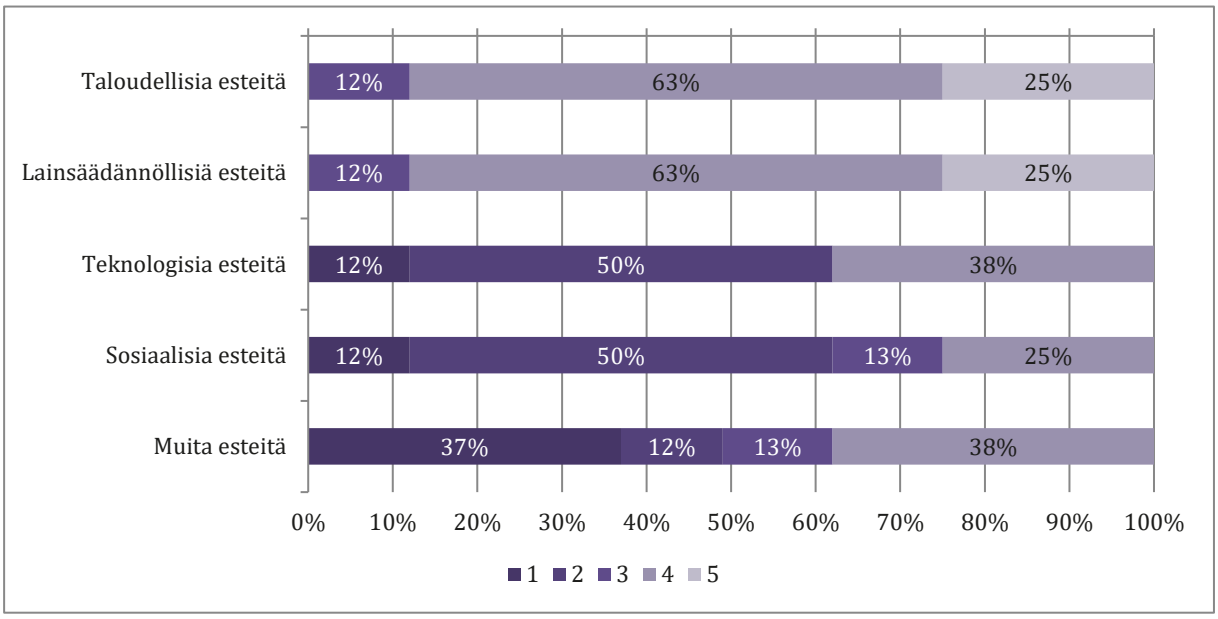
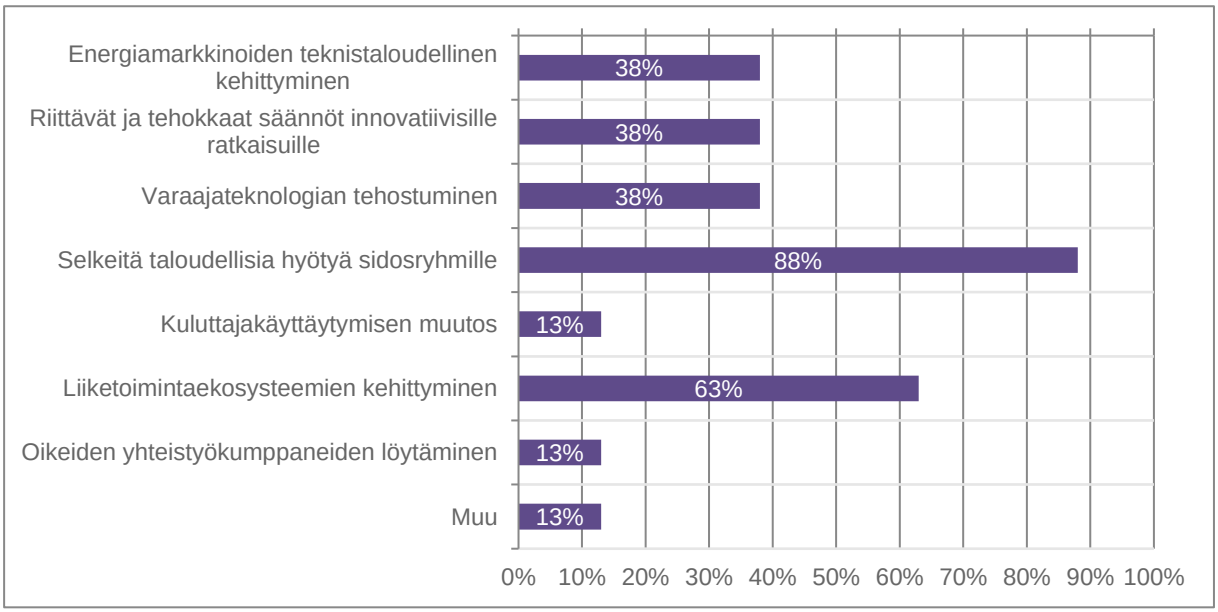
3. Arvioi kuinka merkittävästi eri esteet vaikuttavat energiapositiivisien alueiden kehittämiseen tällä hetkellä Suomessa (1 - pieni vaikutus, 5 - suuri vaikutus)



4. Valitse sinun mielestä kolme tärkeintä edellytystä energiapositiivisten alueiden kehitykselle.



Lisätekstikenttään annetut vastaukset

Vastausvaihtoehdot	Teksti
Muu	Erityisesti sähkön tuotantoon ei ole järkeviä ratkaisuja aluetasolla, mutta päästötöntä sähköä on järjestelmätasolla helppoa ja edullista tuottaa

5. Mitkä ovat tällä hetkellä sinun tai teidän yrityksenne näkökulmasta suurimmat säädökselliset- / lainsäädännölliset esteet energiapositiivisien alueiden kehittämisessä?

Vastaukset
reguloidut monopolit, sähkömarkkinalainsäädäntö, kaupunkikuvalliset vaatimukset
Sähkön osuudella oman sähkön "aluellinen" jakelu
Kaavoitusprosessien hitaus. Lupakäsittelyn hitaus ja kankeus. Nimby-ilmiö.
Energian välivarastointiin liittyvät investoinnit eivät ole reguloidun liiketoiminnan piirissä, vaikka ne olisivat erittäin luonteva osa sähkäverkkoja. Sähköverkkoyhtiöillä olisi erittäin paljon tietotaitoa asiaan liittyen, esim. energian välivarastointiratkaisuilla voidaan merkittävästi vaikuttaa siihen, millaista syöttöä ja kaapelia alueille kannattaa asentaa. Energian välivarastoinnilla voidaan vaikuttaa myös teho-ohjauksen lisäksi myös taajuuden eli laadun ohjaukseen. Nyt kun välivarastot eivät ole reguloitujen komponenttien piirissä, tämä johtaa siihen, että sähköverkkoyhtiöt eivät näihin investoi, koska perinteinen verkon rakentaminen on nykyisessä regulaatiomallissa yrityksille kannattavampaa. Tämä johtaa siihen, että sähköverkkoja rakennetaan ilman uusimman teknologian tuomia mahdollisuuksia. Myös erilaisten energiayhteisöjen muodostumista hidastaa tällä hetkellä se, että lainsäädäntö ja ohjaus tulevat reaalimaalilman mahdollisuuksia perässä.
Energian käyttö aluellisesti yhteisön hyödyksi ilman lainsäädönnöllisiä rajoitteita.
Olemassa oleva rakennuskanta on kaukana energiapositiivisuudesta, mutta isot energiatehokkuusremontit ovat kalliita. Käytännössä tulee vastaan kesä-talvi -ongelma eli kesäaikaan halpaa lämpöä on tarjolla kaukolämmössäkin + aurinkosähköä. Entäpä talvi?
Sinänsä energiapositiiviseen alueeseen teknologia olisi olemassa, mutta erityisesti sähkössä energiaomavaraisuus on kallista toteuttaa. Sähkön kannalta lainsäädäntö rajoittaa sähkön jakelua alueen sisällä. Myös lämpöpuolella lämmön siirto aluelämpöverkon kautta tulisi olla mahdollista. Muuten lainsäädäntö ei mielestäni ole esteenä. Energiapositiivisuuden määritelmässä tulee myös pohtia aikajännettä. Voiko alue olla esim. talvella energianegatiivinen ja kesällä energiapositiivinen ollen keskimäärin energiapositiivinen. Kokonaisuuden kannalta tämä ei välttämättä olisi optimi, koska kokonaisuudessa juurikin talvi on haasteellisin.
Suomesta puuttuu lainsäädännön kokeilualustat puhtaille ja älykkäille kaupunkiratkaisuille. Regulaation kehittäminen pitäisi saada heti ensimetriltä mukaan TKI-hankkeisiin. Suomessa pitäisi olla aktiivisempi ja innostuneempi ote uusien liiketoimintamallien luomiseen.

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6. Miten voidaan voittaa nämä esteet? Mitä pitäisi muuttaa?

Vastaukset
selkeä asiaa tukeva ja velvoittava päätöksenteko kaupunkiorganisaatiossa lainsäädännön kehittäminen
lakiuudistus ja yhteistoiminta verkonhaltijoiden kanssa
Kaupungin organisaation ja työkulkujen tehostaminen
Annettaisiin toimijoille helposti ja ilman raskasta byrokratiaa mahdollisuuksia testata eri ratkaisuja alueellisesti. Parhaat ja todistetusti tehokkaimmat energiapositiiviset ratkaisut otettaisiin osaksi lainsäädäntöä ja ohjausta.
Laajentaa energian käyttöoikeuksia alueen sisällä ja alueen kannalta parhaalla/kustannustehokkaalla tavalla.
Helppoa vastausta kalliisiin energiaremonteihin ei kai ole olemassa.
Sähkön siirrolle lähialueelle voisi olla helpotuksia, jolloin ylituotantoa voisi siirtää naapurustoon kohtuullista korvausta vastaan. Kaukolämmössä tai aluelämpöverkossa yksi toimija omistaa verkoston ja lämpöä ei tarvitse ottaa vastaan tai mahdollistaa lämmön kauppaa alueen sisällä. Lainsäädännöllistä estettä alueellisen energiakaupalle ei ole, vaan rajoittavana tekijänä on toimija, joka aluelämpöverkon rakentaa. Kaukolämmössä lämmön siirto voitaisiin eriyttää energiasta sähköverkon tapaan. Muuten lainsäädäntö ei varsinaisesti rajoita.
Lainsäädännön, uusien liiketoimintamallien ja palveluiden sekä sosiaalisten innovaatioiden kokeiluille pitäisi luoda omat kehittämisympäristöt, pelisäännöt ja toimintamallit. Smart Otaniemen tapaiset kehitysympäristöt voisivat näin ollen vielä tehokkaammin auttaa tuomaan tarvittavaa tietoa päätöksentekoon ja ratkaisujen skaalaamiseen. Euroopassa on jo paljon esimerkkejä toimivasta regulatory sandbox -työstä, opitaan verrokeilta ja parannetaan systeemiä entisestään vaikuttavammaksi. Näin houkutellaan uusia sijoittajia ja yrityksiä myös mukaan, mikä on edellytys energiapositiivisten ratkaisujen syntymiselle.

7. Miten kaupunki voi sinun mielestä edistää energiapositiivisien alueiden kehitystä?

Vastaukset
se 1 prioriteettina, muut kaupungin vaateet linjaan ko tavoitteen kanssa
Kumppanuudessa alan yritysten kanssa mahdollistaaa osallistumalla alan kehitykseen omalta osaltaan (myös omien kiinteistöjen kautta)
Antaa alueet energiantuotanto ratkaisuille. Huomioida kaavoissa energiaratkaisut ja varata niille riittävät tilat. Ennakoida tilatarpeet tulevaisuuden näkökulmasta - teknologia kehittyy 20-40 vuoden näkymällä ja tarvitaan tiloja näille ratkaisuille.
Rohkeasti testaamalla.
Kaupunki voisi suunnitella uusia alueita tyhteistyössä energia-alan toimijoiden kanssa. Annetaan erilaisille energiaratkaisuille tilaa kaavoituksessa.
Kunnianhimoisella kaavoituksella ja esimerkeillä omasta rakennuskannasta. Toimiva julkinen liikenne on myös tärkeä kestävässä kehityksessä.
Alueen energiaverkot (sähkö, lämpö ja mahdollisesti jäähdytys) tulisi toteuttaa siten, että energiakauppa alueen sisällä mahdollistuisi. Lainsäädäntö rajaa mahdollisuuksia sähköverkossa, mutta lämpöpuolella kunta voi vaikuttaa kuka aluelämpöverkon rakentaa ja millä ehdoilla. Kaavoituksessa tulisi myös mahdollistaa erilaisia ratkaisuja kiinteistökohtaisesti ja alueellisesti. Esimerkiksi energiajärjestelmien sijoittamista yleisille alueille, aurinkoenergian maksimaalista hyödyntämistä. Energioiden kauppa kiinteistöjen välillä ei myöskään toteudu ilman, että joku on luomassa järjestelmää. Kunnalla voisi olla tässä merkittävä rooli.
Kaavoitus, vaikuttamistyö säätelyyn ja innovaatiopolitiikkaan, tuki skaalaamiseen ja yhteistyöhön muiden kaupunkien kanssa. Julkisen rahoituksen löytäminen vivuttajaksi että saadaan kaupalliset ratkaisut syntymään nopeasti. Kaupunki voi tarjota living labeja ja kehittämisympäristöä ja verkottamaan toimijoita toisiinsa.

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