AREA 21

Interreg Baltic Sea Region

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

# Kalda
# Energy Improvement District (EID)
## Annelinn, Tartu, Estonia

Strategy on energy and climate

**Tartu, November 2019**

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## Strategy on energy and climate

By

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Cover photo: Austin Roose, Kalda tee, Tartu

Published by: AREA 21 - Baltic Smart City Areas for the 21st century, co-funded by Interreg Baltic Sea Region programme.

Website: www.area21-project.eu



November 2019

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# 1. Introduction

This strategy document envisions goals and objectives of the energy improvement in the quarters of Kalda street of the urban district Annelinn, Tartu, Estonia. The document is drafted in the framework of work package 2 “Strategy development” of the Baltic Smart City Areas for the 21st century project (AREA 21), co-funded by Interreg Baltic Sea Region programme.

The EID concept developed and promoted by the AREA 21 project is a cooperation process of integrated energy planning at neighborhoods level. The Energy Improvement District (EID) concept is an innovative system approach for low emission urban districts. It promotes a paradigm change from a strong public sector to a more cooperative model of development that involves also citizens and businesses. By promoting network and consensus-building activities it fosters identification of tailor-made solutions, piloting of new projects and establishment of both informal cooperation and formalized partnerships.

The Kalda Energy Improvement District is located in the north-western corner of Annelinn urban district, the biggest Soviet era modernist mass housing apartment block district. The district represents the land uses, housing types and socio-demographic structures of Soviet-era built urban districts, which require renewal, upgrading and renovation in their life-span. Kalda EID area size is 0.2 $km^2$, 3000 residents of the EID are living in 13 five- and nine-story apartment buildings. 700 people work or study in the kindergarten, school and business building located in the area. The Kalda EID, built in 1970s, is chosen to characterize the Annelinn urban district challenged by the need of urban renewal, relatively low awareness of dwelling owners on energy consumption, quite high and growing share of elderly ownership.

The strategy was drafted in 2018-19 based on the strategy-making process and its outputs involving the consultancy and dialogue on building stock renovation in three urban workshops held in 7.11.2018, 20.5.2019, and 1.10.2019 with key stakeholders from the Annelinn district and Tartu city. The strategy-making process involved property owners and users, citizens, officials, urban planners, and energy operators. The drafting promoted the ethos of energy efficiency and climate policy at district level fostering private and public cooperation models and deploying new planning models and technologies. The district mode and model should deliver the climate and energy targets more efficiently. It includes the ways at the urban district scale in which urban communities and operators can be equipped with the knowledge and tools to optimize the energy consumption resulting with substantial energy saving.

The strategy consists of six sections. The current section introduces the strategy. The section of urban district context is designed to describe the Kalda pilot district in relevant construction, engineering and urban qualities, to provide legal and financing framework on urban district renewal and to list key challenges and SWOT. The vision section provides the strategic future with imagination, declaring of urban district long-term goal, stating what inhabitants and community want to become in the future. This is further elaborated in the goal section 4. The final section ends with a listing specific objectives to renovate the pilot district using cooperative approach.

This report has been prepared in accordance with the rules, procedures and methodology established by the Hafencity University. The background surveys and the drafting process was implemented by Antti Roose, Marten Saareoks and Martin Kikas, the Tartu Regional Energy Agency.

The target audience of this strategy are inhabitants of modernist mass housing districts, civil and energy engineers and operators, city administrators and policy-makers, neighborhood activists and urbanists.

# 2. Urban district context

## 2.1. Description of Kalda pilot area, Annelinn

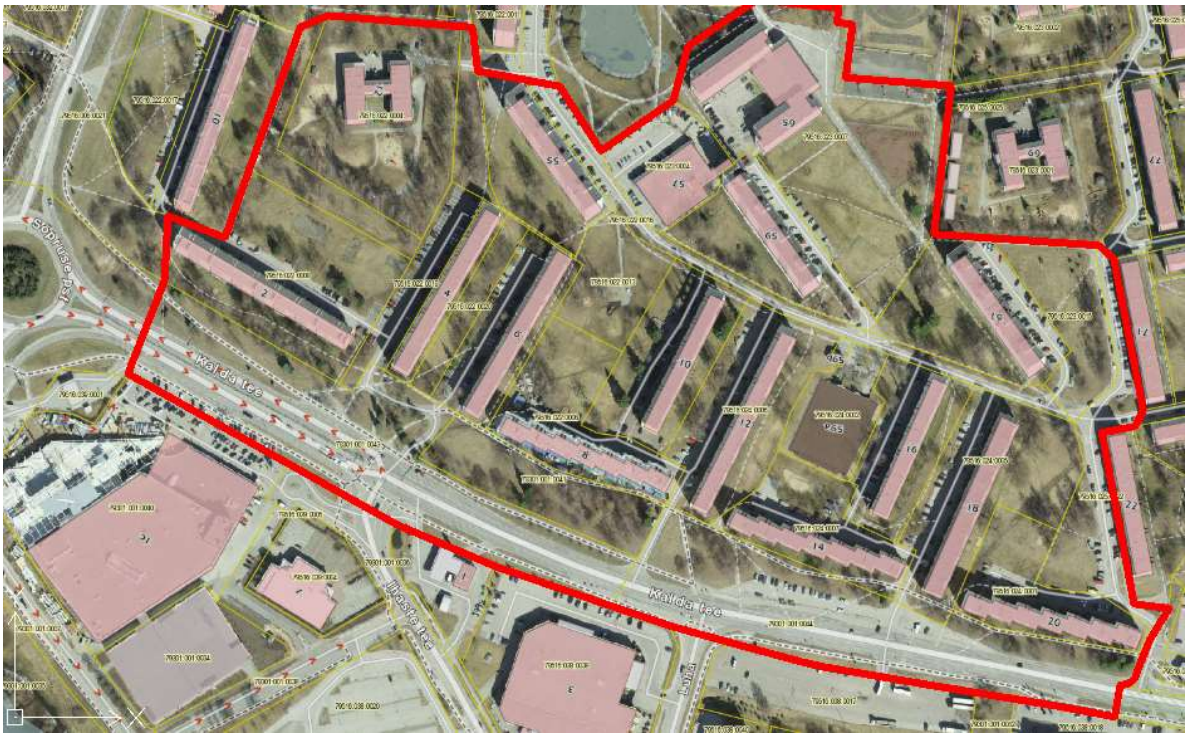


Figure 1. Kalda EID pilot area in Annelinn (Source: Maa-amet 2018)

Annelinn district, which consists Kalda EID, is the only large and compactly planned panel housing district in Tartu, the university city of 100.000 population and territory 40 km$^2$. All in all, life quality in the city is high with its green environment, fresh air, lots of educational and cultural opportunities and stress-free attitude of the citizens.

The compact district means designated functional zoning for the residential uses, education, social and service sector, leisure and transportation. The light mobility and traffic is well separated from the road traffic. There is quite a lot of greenery and parkland in this district, which is well maintained. The transportation infrastructure is upgraded, biking lines and paths are constructed last years, the streetlighting is partly renovated.

In regard urban form and morphology, the building groups form rectangles, step-shaped shapes, thin rectangles in the direction of the roads or H-shaped and cross-shaped shapes. The dwellings are arranged as geometric shapes to allow smaller spaces between them, green yards. In most cases, 5-storey residential buildings, plus few 9-storey houses are planned in the district.

The panel housing districts have been criticized for being monotonous and homogeneous, where everyone would live in the similar dwellings. The socialist city paradigm did not allow distinctive urban solutions or structural divisions, the quality of residential areas and their social composition had to be the same everywhere.

Residents are fairly satisfied with district's urban environment and shared life qualities in Kalda tee, though the quality of the living environment of the panel housing districts could increase further after housing and infrastructure refurbishments according to contemporary standards. Of course, the issue might be that all apartments in dwellings are privately owned, so it is difficult to upgrade the district collectively.

A half of district consist residential building land, (13 apartment buildings - 3 nine-floor buildings and 10 five-floor buildings, all privately owned), one third is transportation land, 18% of public building land, and 2% commercial land.

4 apartment buildings are fully renovated according to the contemporary standards (deep renovation), 3 apartment buildings are partly renovated during last decades.

Table 1. List of buildings in EID pilot area (Source: Estonian Registry of Buildings 2018)

| Address | Building type | Building ID | Year of Built | Building area, $m^2$ | Floors | Closed net area, $m^2$ | Volume, $m^3$ | Num. of dwellings | Energy label** | Renovation condition 2019 |
|---|---|---|---|---|---|---|---|---|---|---|
| Kalda tee 2 | Apartment building | 104026641 | 1971 | 1454 | 5 | 7290.1 | 26379 | 110 | E | Partly renovated |
| Kalda tee 4 | Apartment building | 104017432 | 1971 | 1421 | 5 | 7416.9 | 22670 | 117 | X | Renovated |
| Kalda tee 6 | Apartment building | 104017464 | 1971 | 1424 | 5 | 7297.5 | 22710 | 119 | X | Renovated |
| Kalda tee 8 | Apartment building | 104024984 | 1973 | 1262 | 5 | 5848.4 | 21134 | 95 | C (ETA) | Renovated |
| Kalda tee 10 | Apartment building | 104024997 | 1972 | 1057 | 5 | 5112.1 | 17768 | 85 | E | Partly renovated |
| Kalda tee 12 | Apartment building | 104017434 | 1972 | 1402 | 5 | 6703.9 | 23469 | 115 | C (ETA) | Renovated |
| Kalda tee 14 | Apartment building | 104017463 | 1973 | 1250 | 5 | 5872.0 | 20959 | 95 | E | not renovated |
| Kalda tee 16 | Apartment building | 104031724 | 1973 | 1057 | 5 | 5106.2 | 17768 | 85 | E | not renovated |
| Kalda tee 18 | Apartment building | 104017537 | 1974 | 1530 | 5 | 7892.7 | 25724 | 120 | D | not renovated |
| Kalda tee 20 | Apartment building | 104017523 | 1975 | 1223 | 5 | 5849.6 | 20730 | 95 | X | not renovated |
| Anne 55 | Apartment building | 104017492 | 1972 | 1142 | 9 | 9581.0 | 30931 | 144 | E | Partly renovated |
| Anne 59 | Apartment building | 104017436 | 1972 | 1139 | 9 | 9633.3 | 30411 | 144 | C (ETA) | Renovated |
| Anne 61 | Apartment building | 104017465 | 1973 | 1209 | 9 | 9600.1 | 31933 | 144 | E | not renovated |
| Anne 57 | Shop | 104017574 | 1975 | 1597 | 1 | 1429.6 | 6485 | 0 | C | Renovated |
| Anne 65 | Building (School) | 104017852 | 1982 | 2675 | 4 | 8054.2 | 7920 | 0 | D | not renovated |
| Sõprus pst 12 | Building (Kindergarten) | 104017413 | 1972 | 1111 | 2 | 2713.4 | 7047 | 0 | E | In renovation |
| Anne 59a | Garage | 104019220 | X | 2114 | 1 | 1933.4 | 5645 | 0 | X | not renovated |
| **Total** | - | - | - | 24067 | | 107334 | 339683 | 1468 | - | - |

*Average 113 dwellings per 13 apartment buildings, average construction year 1973 per 16 buildings.

**X – not available or in progress; Apartment buildings energy label scale 21.01.2019 (units in kWh/($m^2$a)):

A-class ≤ 105; 106 ≤ B-class ≤ 135; 136 ≤ C-class ≤ 150; 151 ≤ D-class ≤ 180; 181 ≤ E-class ≤ 22; 221 ≤ F-class ≤ 280; 281 ≤ G-class ≤ 340; H-class ≥ 341

## 2.2. Reference to urban climate, energy, environmental and spatial policies

At strategic level of Tartu city, The Development Strategy “Tartu 2030” as a basic strategic document for the long-term development of the city addresses future challenges for the city’s development in various fields of

actions. Among others, the strategy focuses on necessary changes related to urban structure, sustainable energy and transportation.

**Energy policy**

The main policy goals in the energy field are defined in the document "Action Plan for Sustainable Energy Management 2015-2020 for the City of Tartu" (SEAP). The document was adopted in 2015 by the City Council. The SEAP interim progress report will be done in the beginning of 2019 by Tartu Regional Energy Agency in cooperation with Tartu City Government. SEAP is also in process to be upgraded into Sustainable Energy and Climate Action Plan (SECAP) by the end of 2019 – process started in the end of 2018 with visioning workshops and will go all through the year 2019. Compared to SEAP, SECAP will have climate changes adoption included and climate mitigation goals will be also higher.

Relevant SEAP 2020 targets (T) important for the EID are:

T1: Assure a sustainable supply of district heating and district cooling that is based on renewable energy sources in the City of Tartu;

T2: Keep the district heating exhaust gas emission at the same level with 2010, reducing the loss of heat energy that happens with distributing, to at least 15%;

T5: The consumption of heat energy in the buildings belonging to the city government's administration has decreased 20%, the electricity used is 100% produced from renewable energy sources.

T6: Energy consumption has decreased 20% in the housing sector, 10% of consumers use renewable electricity.

T10: Street lights are renovated, it is controlled using smart management and the consumed electricity is 100% produced from renewable energy sources.

T12: Private initiative has led to the installation of devices producing electricity out of solar power with the total capacity of 2 MW.

**Urban planning framework**

The district planning and urban morphology is based on General Plan of Tartu 2030 (Comprehensive plan of the City of Tartu, 2017). In addition, the Annelinn thematic plan of parking was adopted in 2014 which set the optimal allocation of the parking places. The issues of parking were the most urgent due to the automobilization. The additional parking lots are planned, built and upgraded in areas between dwellings up to 500 meters from the places of residence. The standard service hinterland lays in the radius of 500 m as a set walking distance.

**Investment and funding of renovation**

In regard financial support in the housing refurbishment and renewables, following KredEx Fund national grants (financed by the Cohesion Fund) are available:

1) National reconstruction grant (up to 50% of costs) for apartment associations (construction year before 1993) to improve energy efficiency – III phase of funding started 2019, which sets annual national budget for renovation grant.

2) National investment grant on installation of PV panels for public and private legal entity (including apartment associations NGOs) up to 30% of costs (max 30000 € per applicant, <200 kW installed power) for increasing share of RES in buildings.

In terms of initiatives and empowerment, the public sector should strive to channel investments into such urban districts which go through the major refurbishment. Housing associations need the convincing plans, schemes, designs and solutions that upgrates and improvements are necessary in all contexts starting from city level and ending with the private interests and micro-living environments. Certainly, the neighbourhood communities are activated and voluntary movements and actions play more important roles. However, the whole activity still needs an institutional leadership and coordination, which is likely to be the city government as the Annelinn society acts on NGO and voluntary basis.

## 2.3. Energy efficiency potentials

Energy saving potential of the EID area is ca 5,0 GWh of current annual consumption. Energy consumption can be reduced form current 20,0 GWh to 14,8 …16,0 GWh. Most of energy saving can come due reconstruction actions (ca 4,1 GWh), additional savings can come from behavior change (ca 0,9 GWh). Installing on-site renewable energy production systems, PV panels, can reduce electricity consumption from grid up to 0,4 GWh. Tables 2 and 3 are describing energy efficiency potential by measure and by sector.

Table 2. Overall measures and impact for buildings in EID

| All buildings | Heat | Electricity | Gas | Total |
|---|---|---|---|---|
| **Potential measures** | | | | |
| EID area post-reconstruction change of energy usage, % | -25% | 0% | 0 | - |
| On site renewable production usage (PV panels, 50%), GWh/yr | 0 | 0.4 | 0 | - |
| Energy usage change by behaviour (5% overall), % | -5.0% | -5.0% | -5.0% | - |
| **Potential results** | | | | |
| Energy consumption after measures, GWh/yr | 11.6 | 2.9 | 0.3 | 14.8 |
| Renewable energy use, GWh/yr | 8.7 | 0.8 | - | 9.5 |
| Local renewables to grid, GWh/yr | - | 0.4 | - | 0.4 |

In addition to table 2, replacing old street lighting in the area will give 50% of electricity consumption savings, in total of 0,035 GWh.

Table 3. Sectorial energy saving potentials.

| Sector | Reference year 2017 situation | Energy Improvement District |
|---|---|---|
| Residential buildings | 17.5 GWh/yr | 13.0-14.0 GWh/yr (including -0.31 GWh PV electricity and 0.31 GWh PV production to grid) |
| Other Buildings | 2.4 GWh/yr | 1.8-2.0 GWh/yr (including -0.09 GWh PV electricity and 0.09 GWh PV production to grid) |
| Street lighting | 0.07 GWh/yr | 0.035 GWh/yr |
| **Total:** | **20.0 GWh/yr** | **14.8-16.0 GWh (including -0.4 GWh PV electricity and 0.4GWh PV production to grid)** |

Table 3 shows that the most potential comes from residential buildings, other sections actions give minor energy reduction compared with reconstruction of residential buildings. Reconstruction measures potential cannot be achieved quickly. Deep renovation is a long-term process that requires informing the apartment owners, making a reconstruction decision, choosing designer for building and signing a contract for design, preparing construction project, construction price quotes, choosing the construction company and signing the contract and the building process itself. The process of requesting renovation grant may also be added for whole reconstruction process.

Deep renovation includes adding decent insulation for whole building envelope full insulation, new windows and adding energy efficient heating ventilation system. Reconstruction will reduce heating costs to the greatest extent, up to 50% per building.

## 2.4. Key challenges to energy efficiency

The following key challenges for Kalda EID are formed together on SWOT analyses (table 4) that is compiled by meetings with citizens and by knowledge of local and foreign experts.

- C1 - Low awareness of dwelling owners and apartment associations for energy consumption and possible energy saving opportunities
- C2 - High share of elderly ownership – owners are not interested/able in long-term mortgages.
- C3 - High share of renting tenure (30%) – owners are not interested in financing, because renovation does not improve the return on investment.
- C4 - Private interest and self-interest: establishing a Cooperative Energy Planning - reluctance of (some) residents to cooperate or trust expected energy performance or financial results.
- C5 - Narrow funding options: lack of finances (including lack of relevant grants, bank does not give a loan) and less affordability.
- C6 - Energy suppliers and operators are passive to promote energy saving.

To address these challenges themes and goals listed on section 4 are formed. Theme 4 and theme 5 are aimed to overcome challenges C1, C4, C5. Awareness rising can also mitigate challenges C2, C3 and slightly

alleviate C6. Themes 1,2 and 3 are aimed for outcome that increasing awareness with theme 4 can be achieved. Themes 1 and can alleviate C2, C3 as running costs after reconstruction are not increasing and if energy efficiency measures with on-site renewable energy production and smart energy management systems are well planned, they can optimize energy grids as reducing peak-loads.

Table 4. SWOT analysis

| | |
|---|---|
| **Strengths**<br>▪ *Compact area with need of building renovation – (average construction year 1972).*<br>▪ *High real estate price (increasing trend) – supports renovation and getting house mortgages from bank.*<br>▪ *Strong apartment associations.*<br>▪ *Unions of apartment associations to facilitate renovations.*<br>▪ *Sustainable district heating available and used in district*<br>▪ *Solar energy prospects: roof spaces suitable for generating renewable with solar panels (PV)* | **Weaknesses**<br>▪ Low awareness of dwelling owners and apartment associations for energy consumption and possible energy saving opportunities<br>▪ *High share of elderly ownership – owners are not interested/able in long-term mortgages.*<br>▪ *High share of renting tenure (30%) – owners are not interested in financing, because renovation does not improve the return on investment.*<br>▪ *Private interest and self-interest: establishing a Cooperative Energy Planning - reluctance of (some) residents to cooperate or trust expected energy performance or financial results.* |
| **Opportunities**<br>▪ *Support schemes (KredEx national agency).*<br>▪ *Reconstruction lesson learned (process, technologies, renovation materials) due many renovations performed in recent years (also in neighboring buildings)*<br>▪ *Application of smart ICT tools for involving and directing inhabitants to increase energy efficiency (from behavior change to initiate dwelling owners for deep renovation).*<br>▪ *Testing Cooperative Energy Planning - Energy planning carried out in cooperation with third parties (municipality, energy advisors) and apartment owners, apartment associations and neighboring apartment associations*<br>▪ *Price of energy seems to be raising.* | **Threats**<br>▪ *Narrow funding options: lack of finances (including lack of relevant grants, bank does not give a loan) and less affordability.*<br>▪ *Energy suppliers and operators are passive to promote energy saving.*<br>▪ *Political framework can be change.* |

# 3. Vision

**Conscious citizens will be living in buildings refurbished to meet 21st century requirements and needs.**

The technological, investment and consumption choices made at urban district, apartment building and household level determine the future trajectory of the urban energy transition in decreasing their GHG emissions, reducing energy demand, improving energy efficiency and increasing the share of renewable energy in the energy system. The urban district should be upgraded from the strict and standardized modernist era to the 21st century sustainable and smart outlook on urban living. The vision is broadly defined to refurbish the Soviet era urban district. The citizens as end users face the challenge of meeting their high expectations, and at the same time has to mobilize all stakeholders that are engaged on climate and energy issues, starting from city government implementing urban policies in open participatory governance mode ending with the energy operators upgrading their business models.

# 4. Goals

**The Kalda EID strategy** is founded on five key themes supported by altogether 5 goals, to be accomplished by 2025. The reference year is 2017 against which the performance is measured.

**Theme 1: Energy efficiency**

*Goal 1: Decrease energy consumption by at least 20% by 2025*

**Theme 2: Renewable energy**

Goal 2: Increase the usage of renewable energy by 10% by 2025

**Theme 3: Indoor climate**

Goal 3: Improve indoor climate in dwellings

**Theme 4: Participatory urban planning**

Goal 4: Activate citizens and increase their awareness in urban energy

**Theme 5: District-wise housing reconstruction**

Goal 5: Accomplish entire district renovated by 2025

# 5. Objectives

| Specific objectives | Indicator |
|---|---|
| **Target year 2025, reference year 2017** | |
| **Goal 1: Decrease energy consumption by at least 20% by 2025** | |
| Objective 1.1 Promote cross-district building renovation | No. of deep renovations completed |
| Objective 1.2 Improve energy behavior to achieve 5% energy savings | % of energy savings by behavior change |
| **Goal 2: Increase the usage of renewable energy by 10% by 2025** | |
| Objective 2.1 Increase renewable production by 20% | Installed power of solar panels (kWp) |
| Objective 2.2 Accelerate heating energy transition by operator | % of fossil fuel in heating mix (nat. gas and peat) |
| Objective 2.3 Campaign households to switch to the green electricity | % of households using green electricity package |
| **Goal 3: Improve indoor climate in dwellings** | |
| Objective 3.1 Provide a stable interior climate through temperature control and ventilation | % of homes with intelligent controls<br>Exceedances in CO2 concentration |
| Objective 3.2 Increase awareness of citizens on indoor climate quality | No of directly informed citizens |
| **Goal 4: Activate citizens and increase their awareness in urban energy** | |
| Objective 4.1 Facilitate the participatory energy planning at district level | No of participatory actions in district |
| Objective 4.2 Provide ICT tools for the participatory planning | % of ICT tool users from total buildings |
| **Goal 5: Accomplish entire district renovated by 2025** | |
| Objective 5.1 Improve support measures, methods and techniques for apartment associations in regard reconstruction | No of consulted apartment associations<br>No of measures and tools |
| Objective 5.2 Increase the aesthetic appeal of panel buildings | Urban environment improved |

There are several aspects how the urban district projects can contribute to energy efficiency and urban renewal and support EU energy and climate policies. In regard softer measures, the exchange of refurbishment experience helps to begin the renovation process and act for the energy efficiency. Capacity building can be boosted as expert and stakeholder knowledge enhances in an energy efficiency projects. Demonstration of building refurbishment and urban renewal effects and broader policy change is endorsed. A new district appoach on energy efficiency ensures more systematic change. The outcomes also promote cost efficiency. The people-to-people aspect of the actionplan is very important for successful urban renewal in relation to the objectives 4.1 and 4.2.

## 6. Action plan

| No. | Action / Activity | Responsible | Timeframe | Status | Funding | Communication (status reporting) |
|---|---|---|---|---|---|---|
| **I** | **Goal 1: Decrease energy consumption by at least 20% by 2025**<br>Objective 1.1 Promote cross-district building renovation<br>Objective 1.2 Improve energy behavior to achieve 5% energy savings | | | | | |
| 1.1 | Renovate (deep) all buildings | Owners | 2020-2025 | Ongoing | Owners, partially grant | Every year |
| 1.2 | Renovate transit heating network and control units | Fortum | 2020-2030 | | Fortum | Every year |
| 1.3 | Install new metering devices in district heating | Fortum | 2020-2025 | | Fortum | Every year |
| 1.4 | Upgrade the street lighting system | City | 2020-2022 | Ongoing | City, partially grant | Every year |
| 1.5 | Renovate the school premises | City | 2022-2025 | | City | Every year |
| **II** | **Goal 2: Increase the usage of renewable energy by 10% by 2025**<br>Objective 2.1 Increase renewable production by 20%<br>Objective 2.2 Accelerate heating energy transition by operator<br>Objective 2.3 Campaign households to switch to the green electricity | | | | | |
| 2.1 | Install PVs on the roof | Owners | 2020-2025 | Ongoing | Owners, partially grant | Every year |
| 2.2 | Promote the green electricity contracts | City, TREA | 2020-2025 | Ongoing | 100% owners | Every year |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.3 | Set incentives to 100% renewable heat | Government | 2020-2025 | | Fortum | Every year |
| **III** | **Goal 3: Improve indoor climate in dwellings**<br>Objective 3.1 Provide a stable interior climate through temperature control and ventilation<br>Objective 3.2 Increase awareness of citizens on indoor climate quality | | | | | |
| 3.1 | Provide the smart controls to dwellings | Owners | 2020-2025 | Ongoing | 100% owners | Every year |
| 3.2 | Provide training on smart devices to managers and citizens | Owners | 2020-2025 | Ongoing | 100% owners | Every year |
| **IV** | **Goal 4: Activate citizens and increase their awareness in urban energy**<br>Objective 4.1 Facilitate the participatory energy planning at district level<br>Objective 4.2 Provide ICT tools for the participatory planning<br>**Goal 5: Accomplish entire district renovated by 2025**<br>Objective 5.1 Improve support measures, methods and techniques for apartment associations in regard reconstruction<br>Objective 5.2 Increase the aesthetic appeal of panel buildings | | | | | |
| 4.1 | Set up the energy efficiency campaigns | City, neighborhood society | 2020-2030 | | Projects | every year |
| 4.2 | Arrange the renovation workshops | Society of housing associations, TREA | 2020-2025 | Ongoing | Projects | every year |
| 4.3 | Perform energy audits and provide best available designs | Property Manager | 2020-2023 | Ongoing | 100% owners | every year |
| 4.4 | Arrange competitions on urban development and buildings, renovation prize | City government | 2020-2030 | Ongoing | City budget | every year |
| 4.5 | Design the outdoors and greenery (with or separately with renovation projects) | Owners | 2020-2030 | Ongoing | Projects, city support | every year |
| 4.6 | Mainstream the climate adaptation measures with renovation (urban heat islands, runoff) | City, owners | 2020-2030 | Ongoing | Projects, city support | every year |
| 4.7 | Support fast-lane documentation processing of EE projects at the city government | City | 2020-2030 | | City | every year |