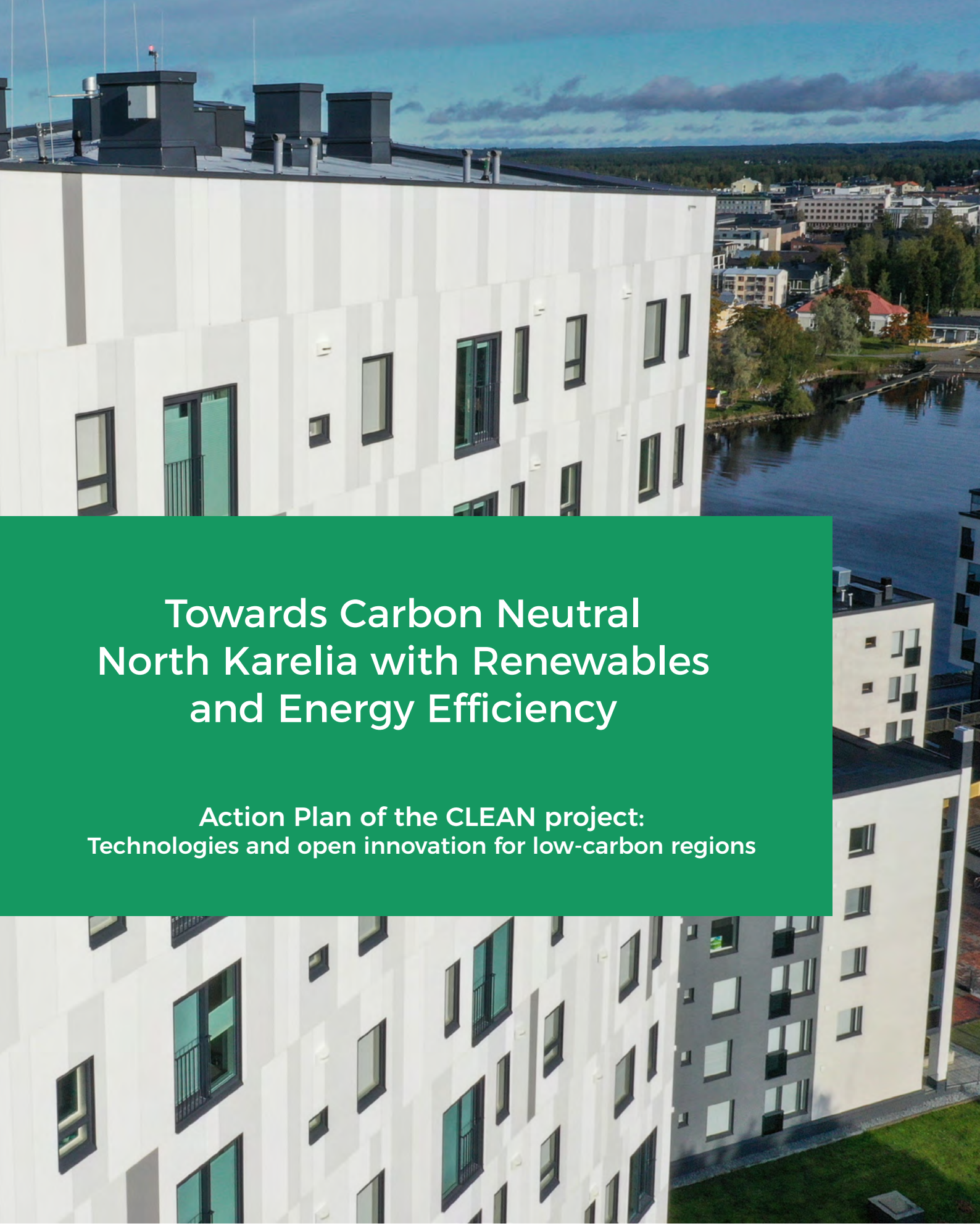

Towards Carbon Neutral North Karelia with Renewables and Energy Efficiency

Action Plan of the CLEAN project:
Technologies and open innovation for low-carbon regions

CLEAN
Interreg Europe

European Union
European Regional
Development Fund

Regional Council of
North Karelia


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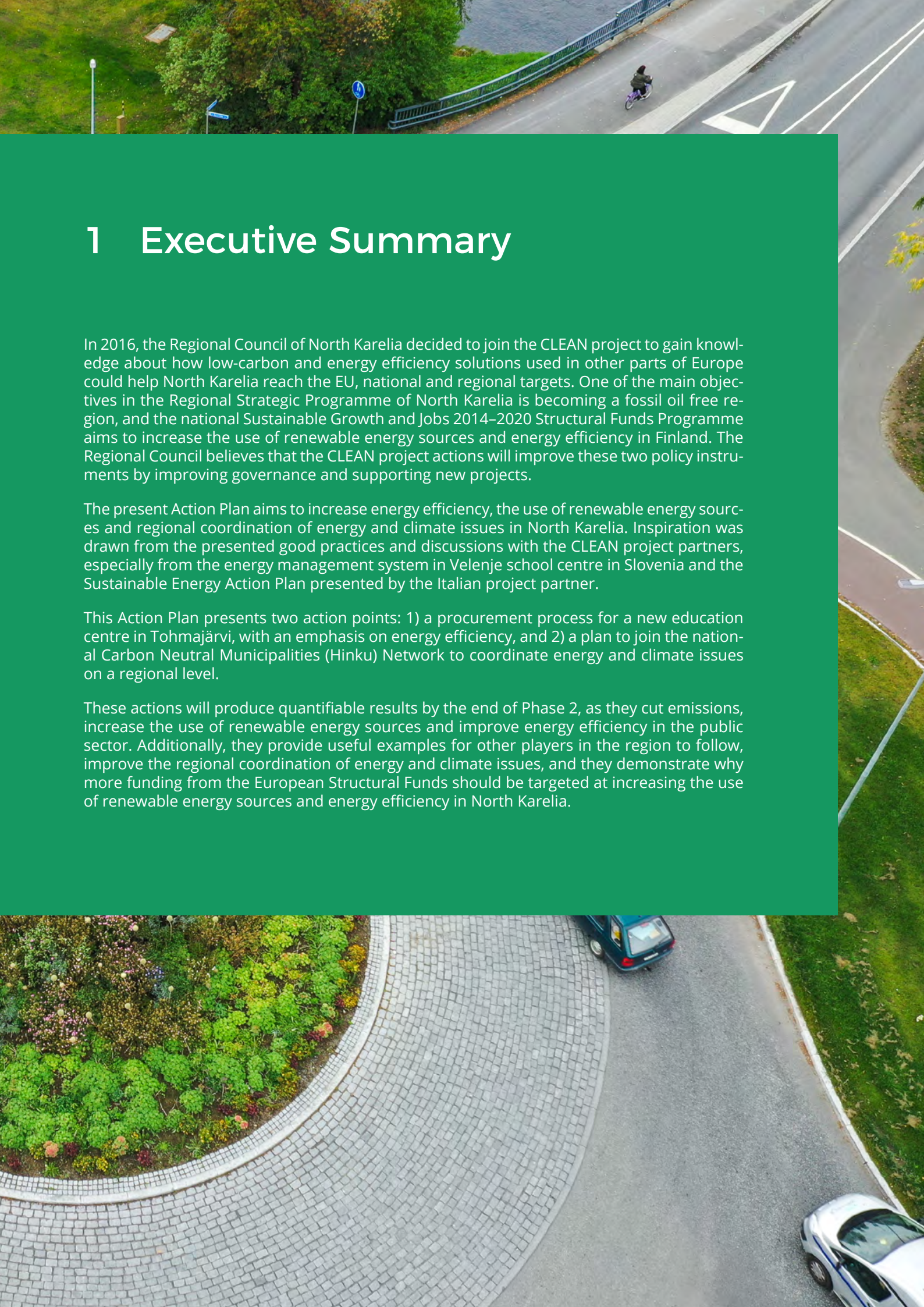
Contents



1 Executive Summary

In 2016, the Regional Council of North Karelia decided to join the CLEAN project to gain knowledge about how low-carbon and energy efficiency solutions used in other parts of Europe could help North Karelia reach the EU, national and regional targets. One of the main objectives in the Regional Strategic Programme of North Karelia is becoming a fossil oil free region, and the national Sustainable Growth and Jobs 2014–2020 Structural Funds Programme aims to increase the use of renewable energy sources and energy efficiency in Finland. The Regional Council believes that the CLEAN project actions will improve these two policy instruments by improving governance and supporting new projects.

The present Action Plan aims to increase energy efficiency, the use of renewable energy sources and regional coordination of energy and climate issues in North Karelia. Inspiration was drawn from the presented good practices and discussions with the CLEAN project partners, especially from the energy management system in Velenje school centre in Slovenia and the Sustainable Energy Action Plan presented by the Italian project partner.

This Action Plan presents two action points: 1) a procurement process for a new education centre in Tohmajärvi, with an emphasis on energy efficiency, and 2) a plan to join the national Carbon Neutral Municipalities (Hinku) Network to coordinate energy and climate issues on a regional level.

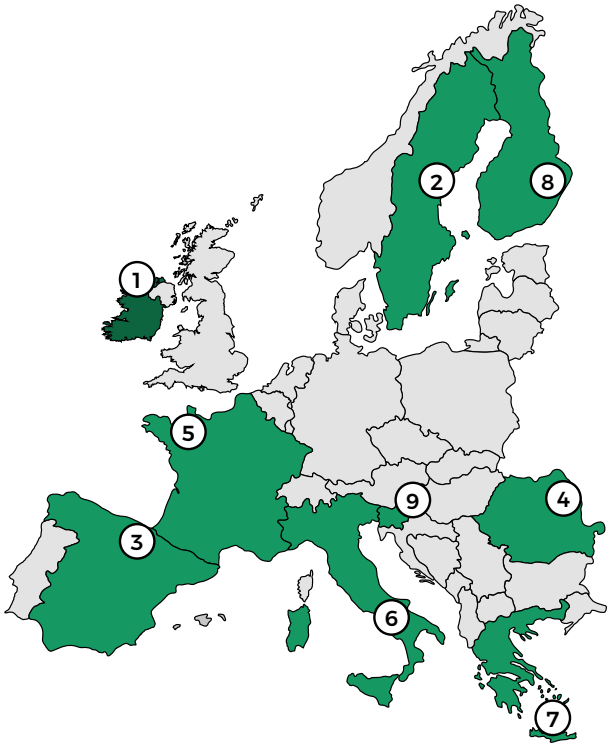
These actions will produce quantifiable results by the end of Phase 2, as they cut emissions, increase the use of renewable energy sources and improve energy efficiency in the public sector. Additionally, they provide useful examples for other players in the region to follow, improve the regional coordination of energy and climate issues, and they demonstrate why more funding from the European Structural Funds should be targeted at increasing the use of renewable energy sources and energy efficiency in North Karelia.

2 General Information

CLEAN or "Technologies and open innovation for low-carbon regions" project aims to increase energy efficiency in housing and public infrastructure through technology, open innovation and improved low-carbon policy instruments. The project partners are managing authorities, regional or city authorities and energy centres from nine countries all over Europe, and they represent different climates, urban and rural areas, and different levels of development.

The CLEAN project has a total budget of 1 598 948 euros, and it lasts from 1 January 2017 to 31 December 2021. During the first phase in 2017–2019, the project partners have identified good practices in their own regions, shared knowledge with each other, discussed energy efficiency and low-carbon solutions with local stakeholders, and as a result, created Regional Action Plans that will help implement the ideas into practice. These actions and their effects will be monitored by each partner during the second phase of the CLEAN project in 2020–2021.

The present Action Plan has been created by the Regional Council of North Karelia in collaboration with the local stakeholder group, which consists of the municipality of Tohmajärvi, the cities of Nurmes and Joensuu, the joint municipal authority for social and health services Siun sote, Karelia University of Applied Sciences and the Finnish Environment Institute SYKE (short for *Suomen ympäristökeskus*).



1 **ERNACT** (Ireland)

2 **Association for Local Authorities in Västernorrland** (Sweden)

3 **Fomento de San Sebastián** (Spain)

4 **Iasi Municipality** (Romania)

5 **Cooperative Les 7 Vents** (France)

6 **Naples Agency for Energy and Environment** (Italy)

7 **Region of Crete** (Greece)

8 **Regional Council of North Karelia** (Finland)

9 **Development Agency of Savinjska Region** (Slovenia)

Project acronym: CLEAN
Partner organisation: Regional Council of North Karelia (RCNK)
Region: North Karelia
Country: Finland

NUTS2 region: East and North Finland
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3 Policy context

The Action Plan aims to impact:
☒ Investment for Growth and Jobs programme

☐ European Territorial Cooperation programme

☒ Other regional development policy instrument

Names of the policy instruments addressed:

Sustainable Growth and Jobs 2014–2020 – Structural Funds Programme of Finland[1]

The Structural Funds Programme of Finland receives 1,3 billion euros of EU funding for the programme period 2014–2020, and with national co-funding (50 per cent), there is approximately 2,6 billion euros available in public funding. As much as 15 per cent of the programme funding is allocated to the Thematic Objective 4, "Low-carbon economy". The target groups are small and medium-sized enterprises, research and educational organisations, and municipalities.

The goal of the programme is to enhance the competitiveness of small and medium-sized enterprises by promoting, for example, the adoption of environmentally friendly, energy-efficient technologies and innovations, as well as the practice of a low-carbon, resource-intelligent and sustainable environmental business. The programme also promotes the use of new energy- and material-efficient products, services and production methods, renewable forms of energy, and research, development and innovation activities.

The first action and other impacts of CLEAN described in the present Action Plan improve this policy by supporting new projects that 1) provide energy advisory services for municipalities, businesses and households, 2) use sensor technology to monitor energy consumption, and 3) use smart metering to gather evidence-based energy efficiency data.

Regional Strategic Programme of North Karelia POKAT 2021[2]

The Regional Strategic Programme known as POKAT (short for *Pohjois-Karjalan maakuntaohjelma*), drawn up for a four-year period, is a statutory regional development programme that must be taken into consideration by the authorities in their decision-making. It states the regional development objectives, which are based on the characteristics and opportunities specific to the region in question. The Regional Strategic Programme steers the use of EU funds and other resources allocated to the region, and the annual level of funding is estimated to be approximately 170 million euros.

The current Regional Strategic Programme POKAT 2021 has three vision foci: 1) smart specialisation, 2) an oil-free region and 3) life-long participation. North Karelia seeks to be at the forefront of sustainable and resource-smart production, the use of renewable energy, and independence from fossil fuels. The Regional Strategic Programme will be updated in 2020–2021, and partly as a result of the CLEAN project, the next programme period is expected to put an even greater emphasis on climate and energy issues.

More detailed information on how the regional strategy can be implemented is provided in the POKAT Regional Action Plan and in individual sectoral strategies and action plans. These action plans can be improved by including more concrete and innovative examples of projects that could receive regional development funds. Prompted by the CLEAN project, more exam-

[1] https://tem.fi/en/sustainable-growth-and-employment-2014-2020
[2] https://www.pohjois-karjala.fi/en/web/english/strategies-and-reports

ples of energy efficiency and low-carbon actions have been added to the POKAT Regional Action Plan for 2019–2020 – for example, developing and using smart systems and clean tech solutions to improve energy efficiency in housing, as well as developing small-scale heating entrepreneurial activities that use renewable energy sources. These additions steer regional development funding toward such projects in the future.

An annual publication called POKAT Success Stories gathers and highlights different types of examples on how the regional strategy is implemented in North Karelia. During the second phase of the CLEAN project, actions described in the present action plan may be included in these Success Stories.

The Climate and Energy Programme of North Karelia 2030[3]

One of the sub-strategies of the Regional Strategic Programme is the Climate and Energy Programme of North Karelia, which presents a plan of action for the region on climate change mitigation and adaptation. The Regional Council of North Karelia acted as the programme coordinator for the current Climate and Energy Programme 2020, which was created in 2010–2011 in cooperation with several actors in the region – including the Forest and Bioeconomy Cluster Group of North Karelia, which is a quadruple helix based group, consisting of educational, research and development organisations as well as businesses.

Participation in the CLEAN project helps North Karelia formulate the next regional Climate and Energy Programme for the period of 2021–2030, by promoting low-carbon and energy efficiency themes, providing relevant background research and highlighting examples of energy efficiency projects. More specifically, the second action in the present Action Plan requires a regional coordination group to lead these issues in the region and create a regional emission mitigation plan, which is expected to directly help prepare the new Climate and Energy Programme.

The Regional Plan of North Karelia

The Regional Plan is a document describing the long-term plan and strategic outline for North Karelia, and it forms the basis for other regional strategy work, including POKAT and its sub-strategies. The Regional Plan is drawn up for a ten-year period and will be updated again in 2020. Although the current Regional Plan includes the target of becoming a fossil oil free region, more emphasis must be put on climate and energy issues during the next decade. The CLEAN project is expected to provide content to the Regional Plan on these themes, and the realised improvements will be reported at the end of the second phase of CLEAN.

[3] https://www.pohjois-karjala.fi/en/web/english/strategies-and-reports

4 Action 1:

Tohmajärvi Education Centre – energy efficiency in procurement process

4.1 Background

In 2017, the Municipal Council of Tohmajärvi decided to build a new education centre to replace some of its school buildings, which were in a poor condition and had indoor air quality issues. The new centre would gather several operations under one roof: a preschool, a comprehensive school, a general upper secondary school, a library, a conservatoire and an adult education centre.

Tohmajärvi is a member of the national Carbon Neutral Municipalities Network and committed to reducing emissions[4], which means that energy efficiency is an important factor in all public procurement in Tohmajärvi. Certain environmental requirements for the procurement were also set by the green leasing from Municipality Finance[5]. Therefore, preliminary information on energy efficiency solutions was gathered from different environment-friendly schools, for example Nepenmäki comprehensive school in Joensuu, which uses advanced sensor technology and automation. Energy-efficient schools and energy efficiency in general were also discussed extensively within the CLEAN stakeholder group, which includes a representative of Tohmajärvi.

One example discussed was Velenje school centre in Slovenia, which was presented as a good practice by the CLEAN project partner Development Agency of Savinjska Region (RASR). The school centre has an ICT based energy management system (EMS), which provides energy managers with detailed information on energy consumption – for instance, in each classroom. The data from the energy management system is publicly available on the Internet, and it is used in education and training in Velenje. The system and several energy efficiency actions have reduced energy consumption considerably, and RASR recommends having a model of energy management and combining different approaches to energy efficiency for the best results.

4.2 Action description

Tohmajärvi Municipal Council decided to procure the new education centre by using a competitive dialogue procedure, where selected representatives of the municipality negotiated with four contractors about designing and constructing the new education centre, before the final tenders were submitted. This method allowed the representatives of Tohmajärvi to discuss energy efficiency in depth with the contractors and together find a way to reach their ambitious environmental targets. Ideas from the CLEAN stakeholder group meetings carried into the procurement negotiations – for example, how to define energy efficiency, how to use a points system to emphasise environment-friendliness in the procurement process, and what the minimum requirement for the energy performance level should be.

The contractors were instructed to aim for an energy performance class of A or B (on a scale of A–G), which is based on the calculated energy performance reference value, aka E value, that counts in the standardised use of the building and the energy carriers used. The winning tender by Lujatalo Oy calculates the estimated E value at 66 kWh_E/m^2a, which is significantly better than the minimum requirement for class A schools and kindergartens, 90 kWh_E/m^2a.

Karelia University of Applied Sciences has calculated the carbon footprint for the whole life cycle of the building to be approximately 11 690 tonnes CO_2-eq, or 39 kg CO_2-eq/m^2 per year. The majority, 89 per cent, will be caused by energy consumption during day-to-day operation of the centre.

An energy management system along with other automation will be installed, and the mechanical ventilation will include heat recovery and a variable air volume system to save energy. The building will use district heating, which is produced nearly 50 per cent from renewable sources, and photovoltaic panels on

[4] http://www.hiilineutraalisuomi.fi/en-US/Hinku/Hinku_municipalities
[5] https://www.munifin.fi/green-bond

the roof will provide solar energy on a small scale. The contractor Lujatalo will create an environmental management plan, which includes detailed information on how automation and the energy management system will be used to ensure energy efficiency.

The energy management system data on energy consumption and solar energy production will be displayed on a screen in the education centre and, with the help of this technology, teachers can provide real-life learning experiences for pupils and students. Inspired by the example of Velenje school centre in Slovenia, the data may become available also on the Internet, which could help spread information on energy efficiency and solar energy solutions in the North Karelia region and beyond.

4.3 Players involved

Tohmajärvi Municipal Council appointed the representatives, who negotiated with the contractors.

The CLEAN stakeholder group (members listed in General Information), among others, provided ideas for the negotiations.

Lujatalo Oy and its subcontractors designed and will construct the education centre under a turn-key contract.

4.4 Timeframe

10/2017: Tohmajärvi Municipal Council decision to build a new education centre

06/2018–03/2019: Competitive dialogue process and final tenders

04/2019–10/2020: Construction phase

01/2021: Schoolwork starts, and data on energy consumption and solar energy production is gathered

4.5 Costs / Budget

The design and construction of the education centre under a turn-key contract costs approximately 11,8 million euros, including the required automation and energy management system. Another 600 000 euros is reserved for change orders, furnishing and equipment - for example, the screen displaying the energy management system data.

A compensation of 80 000 euros was divided among the other contractors who participated in the competitive dialogue procedure and submitted an acceptable tender.

4.6 Funding sources

Green leasing from Municipality Finance.

4.7 Impact expected

This action may be included in the new Climate and Energy Programme as a good example of emphasising energy efficiency in public procurement, which in turn can prompt other similar projects in the future. It also promotes the use of sensors and ICT monitoring, which is a common theme in the Sustainable Growth and Jobs Programme and the Regional Strategic Programme.

The competitive dialogue procedure allowed Tohmajärvi municipality to include various energy efficiency solutions in the new education centre, and those, in turn, will help Tohmajärvi reach its low-carbon goals. This procurement method can be adopted by other players in North Karelia, which could benefit other municipalities and the whole region by increasing energy efficiency and reducing heating-related emissions.

The new education centre will be a modern school that provides its students with hands-on learning experiences on energy efficiency and renewable energy. The energy management data and energy efficiency solutions

can also be used as good examples for training people from other organisations, for example, universities.

If the number of pupils and students in Tohmajärvi falls in the future and space is freed up for other operations, the education centre can be modified to include a kindergarten or a retirement home, among others. This saves Tohmajärvi municipality from frequent renovations to old, energy-inefficient buildings with indoor air quality issues.

4.8 Action Monitoring

Schoolwork is expected to start in the new Tohmajärvi education centre in January 2021, which means that, by the end of the second phase of the CLEAN project, the education centre will have been operational for almost a year and the energy management system has gathered data for several months. It should be noted, however, that the energy consumption is expected to reach the optimal level only after 1–2 years of use, through constant monitoring and adjusting. Therefore, the initial data in 2021 will not represent the final energy consumption levels.

To monitor the action, the energy management data will be compared with the preliminary estimates, and the solar panel production will be presented as a percentage of total electricity consumption at the end of the second phase of CLEAN. The data will be received directly from Tohmajärvi municipality. Also, a questionnaire will be sent to the teachers to see if the energy management data and other technology has been used in education.

Additionally, the Regional Council will monitor new ICT-based energy efficiency projects and and, in particular, similar projects that may be inspired by the example of Tohmajärvi education centre, its energy efficiency solutions or energy management system. These new projects will be reported at the end of the second phase of the CLEAN project.

"The CLEAN project has given us an opportunity to learn from our peers and to receive new ideas on how to increase energy efficiency, which helps Tohmajärvi continue working on these important issues."

Jorma Berg, Technical Director, Municipality of Tohmajärvi

5 Action 2:

North Karelia – towards carbon neutral region

5.1 Background

A project called "Fossil Oil Free North Karelia", funded by the European Regional Development Fund, ran in 2011–2018, resulting in a roadmap that defines the steps needed to abandon fossil oil fuels altogether by 2030 and to reach 100 per cent renewable energy use by 2040.[6] After the project ended in 2018, members of the project network expressed their interest in continuing the important work with energy and climate issues in the region. Currently, there is a need for a new specialist forum that would consist of energy and climate professionals and representatives of the North Karelian municipalities and which would create a regularly updated plan for reducing emissions in the region. The group would also work as a steering group for the Climate and Energy Programme and the Regional Strategy Programme.

CLEAN project partner Naples Agency for Energy and Environment (ANEA), from Campania region in Italy, presented a Sustainable Energy Action Plan (SEAP) as a good practice that encourages public and private engagement and funding to reach common goals. SEAP is a document detailing all greenhouse gas emissions from energy consumption in an area, and a comprehensive set of actions to reduce them. A forum of stakeholders on a local, regional and national level, from public and private sector, should be included in the drafting stage, to make sure that the targets set in SEAP are realistic and attainable.

Finland has a similar concept called The Carbon Neutral Municipalities Network or Hinku Network (short for *Kohti hiilineutraalia kuntaa*), which is coordinated by the Finnish Environment Institute SYKE. The Hinku Network consists of municipalities, businesses, citizens and experts, who voluntarily work together to reduce greenhouse gas emissions by 80 per cent from the 2007 level by 2030[7], which is more ambitious than the national or EU targets.

During the past decade, the Regional Council has actively encouraged North Karelian municipalities to join the Hinku Network, and the "Fossil Oil Free North Karelia" project gave much needed practical support to municipalities that wished to join. Nine out of thirteen municipalities in North Karelia are now members of the Hinku Network, amounting to 82 per cent of the inhabitants in the region.

In 2019, the Hinku Network decided to allow whole regions to join the network, which now makes it possible for North Karelia to seek Hinku status as a region. Pirkanmaa and South Karelia were the first regions to join the Hinku Network in autumn 2019.

5.2 Action description

The Regional Government of North Karelia decided in October 2019 that North Karelia will apply for a membership in the Hinku Network as a region. A membership in the Hinku Network will give North Karelia useful tools to reduce emissions, such as contact with other players in the field, information and support, and access to research and development projects. A membership also signals a serious commitment to climate issues.

The Sustainable Energy Action Plan, presented by the project partner ANEA, requires intersectoral collaboration, an emission inventory and a set of actions to reduce the emissions – very much like the Hinku Network.

To join the Hinku Network, a municipality must:

- commit to an 80 per cent net reduction of greenhouse gas emissions from the 2007 level by 2030 and take this commitment into account in all major decisions
- join the national Energy Efficiency Agreement for Municipal Sector

[6] https://www.pohjois-karjala.fi/web/hinku/in-english
[7] http://www.hiilineutraalisuomi.fi/en-US/Hinku

- appoint a contact person to communicate with the Hinku Network coordinator Finnish Environment Institute SYKE
- appoint a Hinku working group from different administrative sectors
- create an annual plan of emission reducing investments, which are approved in the next year's municipal budget
- create an annual mitigation plan, which details the actions and investments that reduce emissions each year, and how citizens and local businesses will be engaged
- report annually the most significant emission reducing activities and energy savings, which are then published on the Energialoikka website[8]
- inform the staff and municipal council of the project highlights every year
- inform the residents, companies and entrepreneurs of climate change mitigation

A region, on the other hand, can join the network only if at least 80 per cent of its inhabitants live in Hinku municipalities, the regional council makes the same commitment as the municipal councils, and a regional cooperation group is formed to create an annually updated mitigation plan. The plan must contain actions that improve energy efficiency in buildings, energy saving, energy solutions in transportation, land use, waste management, energy use in agriculture and energy production. The regional plan can include actions from the municipalities' mitigation plans.

As a part of the CLEAN project, a calculation of emissions in North Karelia in 2017 was conducted by an external consultant, to bring the earlier statistics of 2007–2016 more up to date. Based on the emission inventory, the consultant proposed concrete and realistic actions to reduce greenhouse gas emissions in the region, see Annex 1 – Greenhouse gas emission reduction potential. Additionally, the energy efficiency of municipality-owned buildings in North Karelia was investigated, and the findings with potential improvements can be found in Annex 2 – Energy consumption of buildings owned by municipalities. These statistics and proposed actions have been presented in several events, for example in the Sustainable Growth Forum 2019.

One of the consultant's suggestions was replacing fossil oils with geothermal heating in several municipality-owned buildings. Therefore, another research was conducted in November–December 2019 to gain information on the geoenergy potential of North Karelia and the municipalities' possibilities to use geothermal heating in their buildings. The summary of the research can be found in Annex 3 – Geoenergy potential of North Karelia. The combined information of these studies helps the regional Hinku coordination group draft the emission mitigation plan and it also provides background information for the upcoming Climate and Energy Programme of North Karelia.

CLEAN project partner ANEA notes that barriers between administrative offices and communication issues can make it difficult to monitor the SEAP results. The Regional Council of North Karelia is a public regional authority that already cooperates with different administrative sectors, organisations, businesses and inhabitants – which should, in theory, reduce those barriers. However, ensuring clear communication between different parties is a valuable piece of advice.

5.3 Players involved

The Regional Government of North Karelia made the official decision to apply for a membership in the Hinku Network and to pursue the status of a Hinku Region.

The Regional Council of North Karelia hires a climate expert to coordinate the regional Hinku emission mitigation work and the regional Climate and Energy Programme.

The Regional Administrative Board appoints members to the new coordination group, which consists of energy and climate specialists, representatives of the North Karelian municipalities and central organisations. The coordination group creates the mitigation plan and updates it annually.

The existing Hinku municipalities in North Karelia make sure that the regional targets are implemented on a municipal level and, if necessary, are committed to increasing their efforts to reach the regional target on behalf of other municipalities.

[8] https://www.energialoikka.fi/en/

5.4 Timeframe

10/2019: The Regional Government decision to apply to Hinku Network

12/2019: A climate expert hired by the Regional Council

Spring 2020: A regional coordination group appointed and creation of the mitigation plan

2020: North Karelia gains membership and the status of a Carbon Neutral region

2021: The end of CLEAN project, emission levels expected to be reduced by 49 per cent

2020–2030: Emissions monitored by the Finnish Environment Institute, the regional mitigation plan updated accordingly, and emissions reduced eventually by 80 per cent

5.5 Costs / Budget

Staff costs of the climate expert, and costs from meetings and events with the regional coordination group.

5.6 Funding sources

Action funded by the Regional Council of North Karelia, Hinku municipalities and the stakeholder organisations involved in the coordination group.

5.7 Impact expected

According to the information from 2017, gathered by the consultant, the greenhouse gas emissions in North Karelia were 1 195 tonnes CO_2-eq, which is 27,8 per cent less than in 2007. This reduction is in part thanks to the efforts by the Hinku municipalities in North Karelia, and the regional membership in the network is expected to further help North Karelia reach the target of an 80 per cent reduction of emissions by 2030.

Membership in the Hinku Network improves governance by appointing resources – that is, the climate expert and the regional coordination group – for specifically driving forward carbon neutrality in North Karelia. The regional coordination group is expected to become simultaneously a steering group for the Climate and Energy Programme and POKAT Regional Strategy Programme, and consequently help improve the policy instruments in the future. The Climate and Energy Programme will be formulated through workshops and events and it will involve several stakeholder groups in the area, including participants in the CLEAN project.

The Hinku Network members support sustainable businesses, new ideas and technologies through public sector procurements, which in turn helps reach the targets of the Sustainable Growth and Jobs 2014–2020 – Structural Funds Programme of Finland. The POKAT 2021 Regional Strategic Programme of North Karelia also views public procurement as an opportunity to give small and medium-sized enterprises valuable reference cases. Joining the Hinku Network makes it easier to find suitable business partners in innovative, environment-friendly small and medium-sized enterprises.

5.8 Action Monitoring

The Finnish Environment Institute SYKE conducts greenhouse gas emission calculations for Hinku members every year, providing comparable data from 2007 to 2030, and it requires annual reports of the most significant emission reducing activities and energy savings in the region. Combining the information of realised actions and changes in the emission levels helps the regional coordination group to adjust the emission mitigation plan accordingly. The results and progress will be closely monitored during the second phase of the CLEAN project by the Regional Council of North Karelia.

6 Other impacts of CLEAN

Starting in 2019, Karelia University of Applied Sciences will provide **Energy Advisory Services** in the region for household owners, small and medium-size enterprises and municipalities. The service is financed by the Energy Authority of Finland and supported by the Regional Council of North Karelia.

Sustainable Growth Forum is an annually held event that highlights sustainability and resource efficiency in North Karelia. 25 November 2019, the Forum focused on wood construction and circular economy in construction. In the event, the Regional Council launched the preparation of the Climate and Energy Programme and presented the results of the two studies conducted for the CLEAN project (see annexes 1 and 2) to an audience consisting of the Finnish Minister of the Environment and Climate Change, the municipal managers in North Karelia and other central players in the region.

In CLEAN stakeholder meetings, the representative of Siun sote, which is the joint municipal authority for social and health services in North Karelia, voiced an interest in using **solar energy at the central hospital** in Joensuu. Information was gathered from the good practice of solar panel installations at Härnösand hospital in Sweden, presented by the CLEAN project partner Association of Local Authorities in Västernorrland. However, the investment in solar panels was not feasible for Siun sote, so the CLEAN project brought Siun sote together with a local energy company to discuss the possibility of an on-site power purchase agreement. In the discussed model, the energy company would install panels on the parking hall roof near the hospital, and Siun sote would agree to buy the produced solar energy. Eventually, the negotiations between these two parties did not lead to an agreement, but the model of an on-site power purchase agreement could potentially be realised in the future with another energy company and it also presents an interesting concept for other parties in the region.

ANNEXES

Annex 1 – Greenhouse gas emission reduction potential

ABSTRACT

Greenhouse gas emission reduction potential in the North Karelia region has been assessed as a part of CLEAN project. *Clean* or *Technologies and open innovation for low carbon regions* project will address the challenge of how best to meet EU energy efficiency targets for buildings in Europe's regions. Furthermore, nine of North Karelia municipalities are a part of *Hinku* "*Carbon Neutral Municipalities*" project in which municipalities are committed to reduce 80 % of their greenhouse gas emissions from 2007 to 2030 within their municipality borders.

Greenhouse gas emissions generated in North Karelia in 2017 have been calculated in this assessment. Greenhouse gas emissions were calculated for transport (road traffic), agriculture, waste management (including wastewater treatment), energy, and industry & machinery sectors. Energy sector emissions includes those generated in decentralized heating (light fuel oil and electricity as energy sources), district heating, consumer electricity consumption, and industrial electricity consumption (industries outside emission trading). Emissions of industries outside emission trading scheme are included in industry and machinery sector emissions.

Greenhouse gas emissions in North Karelia have decreased by 27.8 % during the time frame of 2007 and 2017. The total greenhouse gas emissions were 1 195 kt CO_2-eq in North Karelia in 2017. Main sectors contributing the emissions are transport (30 % proportion), agriculture (22 %), and industry & machinery sectors (12 %).

Public sector can implement a variety of actions to reduce greenhouse gas emissions. Actions should particularly concentrate on transport, energy and industry & machinery sectors. Emissions of transport sector could be reduced by investing in electric vehicles, public electric car charging stations and city bikes. Additionally, electric car sharing services and teleworking have been proposed as emission reduction actions. Overall, these actions could reduce transport sector emissions by 1.7 % at minimum. Energy sector emissions could be reduced by renovations improving energy efficiency of buildings, replacing conventional and fossil heating methods with alternative renewable energy methods, and switching regular electricity to green electricity. These actions can reduce energy sector emissions by 21,4 % at minimum. Emissions from industry and machinery sector could be reduced via sustainable public procurements. For instance, the requirement for replacing fossil fuels with renewable and low emission alternativities at machinery can reduce greenhouse gas emissions by 0-90% depending on the machinery and replacement share.

LCA Consulting

Annex 2 – Energy consumption of municipality-owned buildings

ABSTRACT

The energy consumption of buildings owned by municipalities in the North-Karelia region has been assessed as a part of the CLEAN project. *Clean* or *Technologies and open innovation for low carbon regions* project will address the challenge of how best to meet EU energy efficiency targets for buildings in Europe's regions. Furthermore, nine of North Karelia municipalities are a part of *Hinku* "*Carbon Neutral Municipalities*" project in which municipalities are committed to reduce 80 % of their greenhouse gas emissions from 2007 to 2030 within their municipality borders.

The total energy consumption of municipality-owned buildings was 275 GWh in North Karelia in 2018 based on the assessment. Heat consumption was 185 GWh corresponding to 67% of the total energy consumption. Electricity consumption (not including electricity used for heating) was 83 GWh (30%) and energy used for water heating was 8 GWh (3%). Overall, 92% of the municipality-owned buildings are heated by district heating. The rest of the buildings are heated with decentralized heating systems (i.e. buildings have their own heat production units and systems). The most commonly used fuel in decentralized heating systems is light fuel oil; 45 municipality-owned buildings use light fuel oil for heating. The use of light fuel oil for this purpose was 8,6 GWh in North Karelia in 2018 based on the assessment. The amount of renewable fuels and energy sources used for the energy consumed in municipality-owned buildings in North Karelia in 2018 was 185 GWh which corresponds to 67% of the all energy sources and fuels used. Wood-based renewables (i.e. biomass) compose 65% of the total energy sources and fuels used for heating. Peat has the highest proportion of fossil-based fuels (26%). The proportion of light fuel oil was 4% of total fuels and energy sources used for heating.

Based on the assessment, further utilization of renewable energy sources and energy saving potential actions was mapped out by recognizing 20 potential actions where renewable energy use and production as well as actions to reduce energy consumption could be promoted. The proposed actions focused on geothermal heat, air source heat pumps, solar energy, pellets plants, and energy saving actions. By utilizing geothermal heat, total saving of light fuel oil could be over 6 680 MWh in all municipality-owned buildings in a year. An alternative for geothermal energy is utilizing pellets as an energy source. Utilizing air-source heat pumps as an additive heat source with electric heating reduces electricity consumption by 1 930 MWh/a. Applying solar energy for renewable energy production increases renewable energy production from 55-93% depending the building type.

Overall, the North Karelia region should focus on renewable energy promotion and energy saving actions in municipality-owned buildings. The focus should particularly be paid on actions which reduce the use of light fuel oil in decentralized heating systems as well as decrease the specific heating coefficient of a building.

LCA Consulting

Annex 3 – Geoenergy potential of North Karelia

ABSTRACT

The Regional Council of North Karelia (Finland) is a partner in the CLEAN- Technologies and open innovations for low carbon regions –project since January 2017. The project addresses the challenge of how best to meet EU energy efficiency targets for buildings in Europe's regions and is financed by the Interreg Europe programme. One of the main objectives of the project is to promote energy efficiency in the public sector owned buildings and further to reduce the energy consumption GHG emissions resulting from the heating of the premises. North Karelia region is aiming for a net reduction of 80 % in the CO2-eq emissions by the year 2030 (compared to 2007 level), which demands a wide range of measures among different sectors. For example the energy sector responsible for the heating of the buildings in Northern Karelia, and generally in Finland, is a major source of carbon dioxide emissions. Therefore it is necessary to identify potential for the renewable energy based heating solutions, which can be used for the replacement of the still common oil and peat based heating technologies.

The study describes the potential for the utilization of geothermal power in the heating of buildings in the North Karelia. A map of the province's geoenergy potential and a summary of principles that can be used to promote the use of geoenergy in public buildings have been produced and described. The study identifies particularly suitable areas for the use of geothermal power in the region, but also describes the possibilities how to use the geothermal energy elsewhere. As a main result of the study it can be stated that the geoenergy can be used efficiently for the heating of the buildings in North Karelia as well as for the cooling during the summer. It is necessary to point out, that the surface temperature in Northern Karelia varies greatly among areas and during the year, but the temperature stabilizes at a depth of about 15 meters (and further grows with the depth), being around the same as the mean year-round surface temperature. The utilization of the geoenergy for the heating of buildings in North Karelia requires an electric heat pump, which usually results in that 2/3 of the outcome heat produced is GHG emissions free energy.

Quartz-containing rocks such as granites and quartzites represent the ones with the best thermal conductivity and, at the same time, the best source of the geoenergy among the bedrock. In addition the geothermal energy from other types of rocks is also available, as well as for example from the water bodies. In Finland, the average thermal conductivity of the bedrock is 3.24 W / mK (Peltoniemi 1996[1]) and in the North Karelia region the thermal conductivity generally varies between 2 − 4 W / mK. The geothermal utilization potential is affected by the thickness of the soil mass above the bedrock. The thickness of the land cover affects the viability and profitability of the project, since the part of the geothermal well covering the top soil is always protected by piping. The piping increases the costs of the well solution, which might be significant part of the entire geo-energy system, depending on the depth. The thickness of the soil cover in the region varies from none to over 50 meters. Because of this, the final 5-class (very potential, potential, suitable, low potential, very low potential) geoenergy potential map was created by combining the bedrock properties with the soil cover thickness data using geographical information system (GIS) methods.

During the project, the possibilities of the geothermal heat utilization in the public sector properties as well as the solutions implemented were mapped using an online questionnaire. The questionnaire was addressed to all thirteen municipalities in the North Karelia region. The results of the questionnaire as well as the description of the CASE sites are presented in the final report. The results of the project can be used to promote renewable energy solutions among the public and private real estate sector, potentially leading into reduced GHG emissions.

[1] Peltoniemi, S. ja Kukkonen, I. Geologian tutkimuskeskus, Geofysiikan osasto. 1995. Kivilajien lämmönjohtavuus Suomessa: Yhteenveto mittauksista 1964 –1994.

Date: 20.12.2019

Name: RISTO POUTIAINEN

Position: REGION MAYOR

Signature:

Stamp of the organisation:

REGIONAL COUNCIL OF
North Karelia

CLEAN
Interreg Europe

European Union
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Development Fund

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NORTH KARELIA