



European Green Leaf Award 2021

Application Form

City of Lappeenranta
Finland



Application Form for the European Green Leaf Award 2021

Section A: City Introduction and Context

City history: Founded 1649, 1649-1743 part of Sweden, 1743-1811 part of the Russian Empire, 1811-1917 an autonomous administration under the Russian Empire, 1917- part of Finland.

Lappeenranta is the commercial centre of South-Karelia in southeast Finland and a border town of the EU with approximately 200 km from both Helsinki and St. Petersburg, Russia. Location on the southern shore of the Lake Saimaa makes Lappeenranta the region's center for tourism. The Lappeenranta municipality is a strong center of bio-based industries and 12% of the workforce is employed in the environmental and cleantech sectors.

Key features: 72 700 inhabitants, total area 1724 km², (42 inh./km²) of which 290 km² water (25 % of the size of South Karelia), GDP 37 000 €/capita (2015), operating expenses 432 M€ (2018). The municipality has four district centers of which the largest is the central urban settlement.

Lappeenranta strategy 2033 (launched 2018) guides the city's operations. Green Lappeenranta is a key strategic goal for the city, in terms of both residential comfort and industrial policy. The aim is to develop Lappeenranta into a model city for environmentally friendly actions in which business growth is based on a clean living environment and a waste-free world. The City has set two goals for the emission reduction: -50 % by 2021 and -80 % by 2030. Today 97 % of all energy produced at Lappeenranta comes from renewable sources.

Our brand is Lappeenranta Greenreality: Greenreality means being green for real – we put emphasis on results and actions. Greenreality is a shared brand with regional public actors, academia, citizens and companies. In digital media and social media, Greenreality gains continuous growth in users.

We're active in networks. On a national level we are members of HINKU (lead by Finnish Environment Institute) targeting to reduce of emissions by 2030, FISU (Finnish Sustainable Communities) targeting sustainable well-being, no overconsumption, no emissions, and no waste by 2050. Regionally we run the Greenreality Lappeenranta Network, which is a business-driven coalition of regional enterprises, municipalities and academia. On an international level we are members of ICLEI and the Covenant of Mayors.

Local industry, especially pulp, paper and electric drives and motors industries are our huge strength. The Lappeenranta University of Technology (LUT) is focused on clean energy research, sustainability, circular economy, water technology and gross cutting themes such as digitalization. As a city, we receive a continuous flow of new ideas from LUT. Together with the university, the city provides a world-class research and innovation environment for companies. We aim to be one of the climate capitals of the world and at the same time have a large environmental handprint through the solutions developed here and provided by our companies.

Based on history, our residential areas are scattered between old historical road and shores of Lake Saimaa resulting in a narrow city. The shape of the city means challenges for traffic and urban structure.

We're active in a large variety of national and international projects that focus on the decrease of emissions, energy usage and the discharge of nutrients to Lake Saimaa. Circular economy is significant



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as well.

Lappeenranta has successfully participated in several climate and environmental award competitions. The city has been nominated twice (2014, 2016) as Earth Hour Capital of Finland by WWF and was one of the three finalists in EGLA 2020. The association of Finnish Local and Regional Authorities awarded us in 2016 for long-time campaigning and actions against climate change. The city of Lappeenranta was the world's first city to use only EKOenergy -certified electricity with zero emissions.



Figure A1 - Overview of the municipality



Fig A2. Lappeenranta strategy



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Section B: Topic Areas

Topic Area 1: Climate Change and Energy Performance

1a – Current Situation and Strategic Approach

Lappeenranta has developed at the shore of Lake Saimaa and the Salpausselkä ridge. This has resulted a long and narrow city with a sparse structure. Later this has meant long distances for different modes of transportation, resulting in high usage of private cars. For the last 10 years city planning has concentrated on compressing structures – a development accelerated by climate change mitigation recently. Wood based industry has given work for generations. Today the wood industry offers a wide range of climate mitigating solutions. 5 ETS companies are located in Lappeenranta.

The city's GHG emissions have decreased 46 % from 1990 to 2017. Inventories have been calculated by the city and LCA Consulting Oy, with a program approved by national authorities. Verified and mainly national database has been used. They also include local information. Climate target of Lappeenranta is to be carbon neutral until 2030.

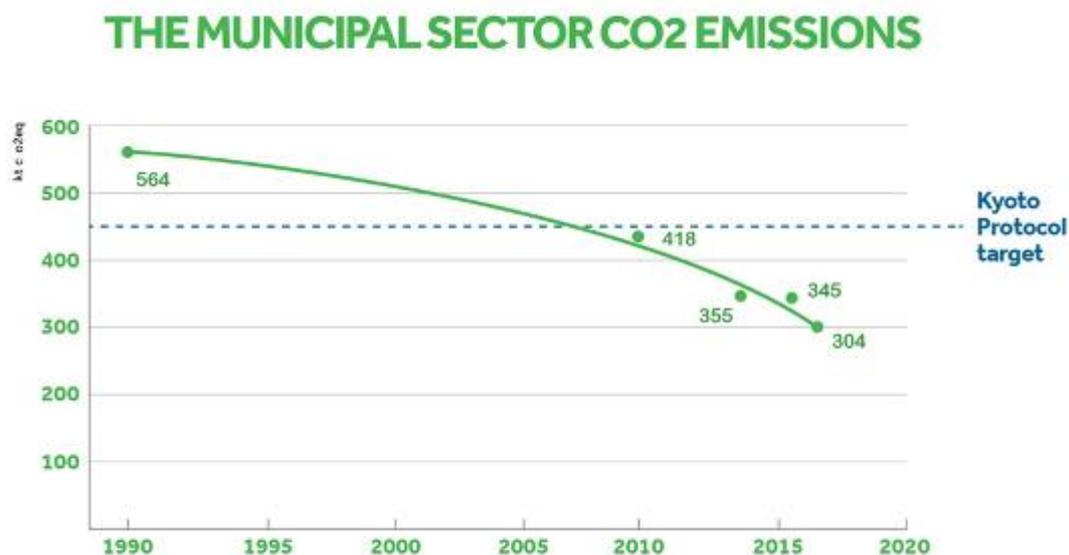


Fig 1.1. GHG emissions

The most effective results have been achieved in district heating as a transition to biofuel from natural gas in 2010. Biofuels are side streams from the wood processing industry. Forests are not cut to produce only energy. Over 80 % of buildings use this heating. Emissions have decreased in other sectors as well.

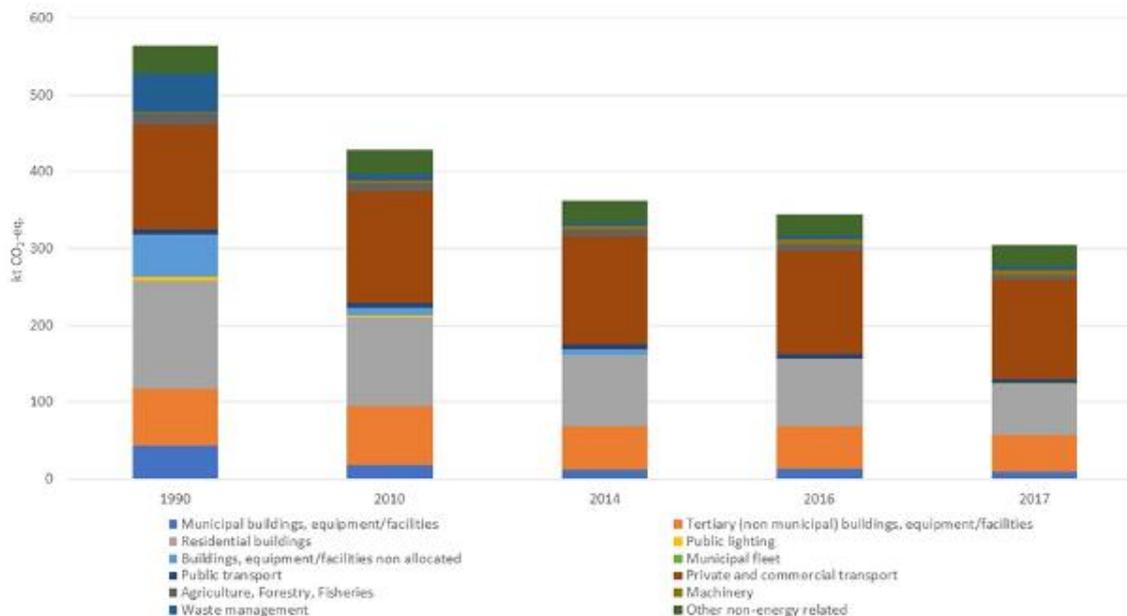


Fig 1.2. GHG SECAP - emission data

Lappeenranta has participated in climate work since the 1990s. The work has been intensive and continuous and the city has joined in several national agreements and networks. As the emissions have decreased city has accelerated the targets as well.

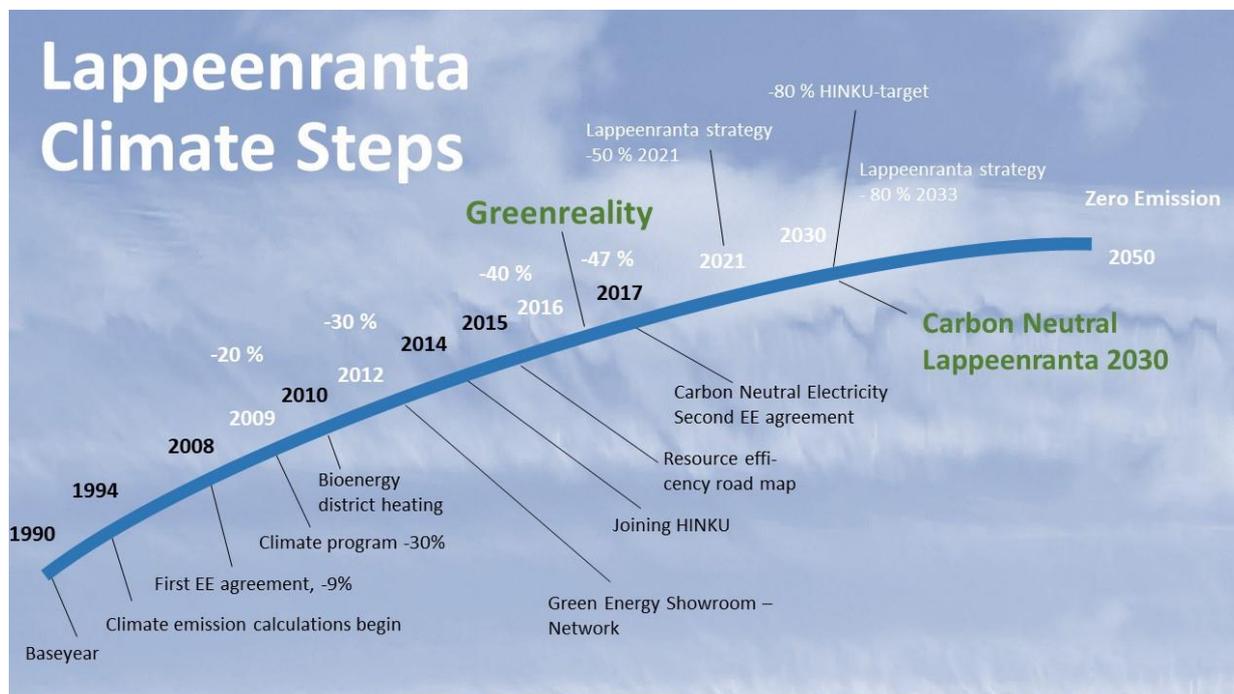


Fig 1.3 Climate Steps

New city strategy was approved in 2017. Target for 2018-21 is to decrease emission - 50 % to year 2021. In the new climate program, Lappeenranta will be carbon neutral by 2020. This can be achieved by 80 % emission decrease and 20 % increase in compensation and sinks. Zero-emission target will likely change from 2050 to 2040.

Lappeenranta’s unique city strategy for 2021, includes a strategic program “Clean and Sustainable”, according to which Lappeenranta has and will invest in strategic actions against energy and climate issues. There are many projects developing energy systems. Projects enhancing the energy efficiency of buildings are underway. Financial contribution to these actions is over 1 m€ during 2018-2021. As a flagship project the city of Lappeenranta has made an agreement of nine city-owned buildings to be used as a virtual power plant.

Renewable energy audit for the city owned building sector was made in 2018, according to which 85 % of used energy is renewable. Still, unused bioenergy potential is 1200 MWh.

Energy and Climate Actions - Lappeenranta

Current projects decreasing footprint

- Regional Energy Advice service 2019-2022
- Regional Climate Coordinator
- Greenreality Homes and Companies

Innovative actions increasing handprint

- 7 MW Heat Accumulator
- Data platform for buildings
- Effect4Buildings –financial tools for building energy efficiency
- Virtual Power Plant of 9 city buildings
- Power to X - Renewable fuels and protein from air
- High Speed Laboratory - Electrification of the world

ICLEI Local Governments for Sustainability

FISU Finnsisäilytyskeskus

© HINKU

GLOBAL COVENANT OF MAYORS for CLIMATE & ENERGY



Fig 1.4. Lappeenranta Footprint/Handprint projects

In climate adaptation, the city structure is resistant to flooding. Lake Saimaa flooding plan was conducted with a water authority in 2014. Predicted problems resulting from climate change include: Heavy rain and snowfall, diseases spread by ticks, health of seniors (heat), and vegetation and forest pests. Security bodies of the region are training annually for weather extremes. Lappeenranta has built seven constructed wetlands and many ditches to decrease the adverse effects of stormwater.



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1b – Citizen Participation and Public Awareness

Greenreality videos and social media campaigns have been launched in order to participate citizen to climate actions. Greenreality.fi webpages have been updated to support better sustainable living and business.

The city and Greenreality Network arranged *Medicine for Climate Anxiety* event. The message for youngsters was that instead of anxiety, you can do your own climate actions and get an exciting career with climate change solutions.

In 2019, the City of Lappeenranta turns 370 years. The celebration started on 29 August with the Greenreality Carnival with 3 500 participants. The Carnival is a collective effort between the city, energy and environmental companies, LUT University and associations.

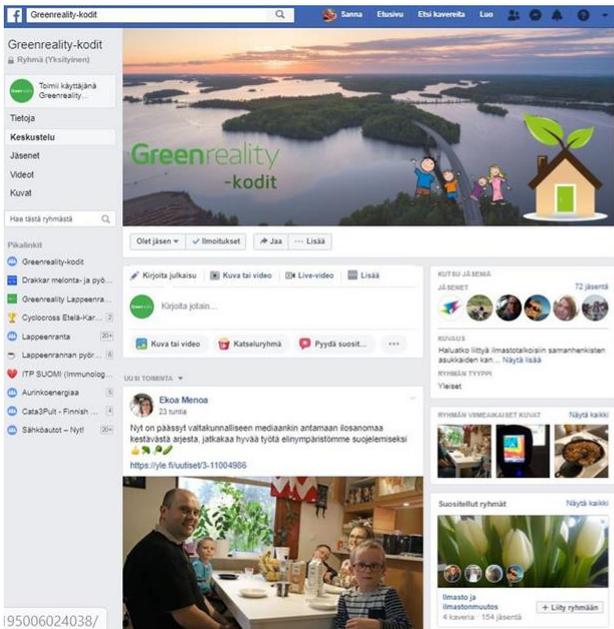
The city has established a Greenreality 370 Park where citizens, companies, and associations can make a climate action by planting a tree.

In August Lappeenranta hosted the Finnish Athletics Championships, Kalevan Kisat. Greenreality was the major theme of the event. It was strongly visible in the national television through the four-day event.

Lappeenranta and the Greenreality Network are partners in the Yrityskylä (Business Village), which is a learning environment, a miniature society for sixth-graders. Energy saving and sustainable living are implemented in the village.

At the Junior University, preschoolers learn about energy consumption and saving possibilities through fairy tales and small research tasks. 8th graders calculate the carbon footprint of their own household and deepen their knowledge about sustainable living in a multidisciplinary learning course. The themes of energy and climate change are also studied in workshops organized by LUT University. High school students do energy consumption surveys in local shops, and help them to set up goals to reduce energy consumption and to buy green energy.

The Energy Agency of the city activates citizens, SMEs, and municipalities in energy efficiency actions. Borrowing thermal cameras for leak detection has 0,5 GWh/a energy-saving effect in households.





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Topic Area 2: Sustainable Urban Mobility

2a – Current Situation and Strategic Approach

Lappeenranta's surface area is large, and Finnish national road 6 passes through it. Traffic is the main source of emissions, producing ca 40% of all GHG emissions, and has thus a crucial role in decreasing them.

Lappeenranta is a member of HINKU network (Finnish carbon neutral municipalities). Members of HINKU are committed to 80% emission reduction from 2007 level by 2030. The Lappeenranta HINKU-roadmap's targets for sustainable mobility:

- Reduce road traffic emissions -50%
- Reduce emissions from public transport -50 %
- Carbon neutral vehicles for city's use

Cycling Development Program's (2019) main goals:

1. Guide the city's traffic politics towards bicycle-friendly direction, making cycling an equal mode of transportation with others.
2. Increase the attractiveness and competitiveness of most essential connections compared to cars.
3. Increase the city center's vitality, comfort and attractiveness by improving the conditions of pedestrians especially in busy pedestrian precincts.
4. Decrease citizens' auto addiction, increase activity and well-being.

In 2019 sustainable urban mobility plan (SUMP) was prepared based on the Cycling Development Program. It'll be completed in early 2020.

Lappeenranta's city board decided in 2017 to only purchase vehicles utilizing renewable fuel or electricity (zero-emission vehicles). Since 2017 the city and Social and Health Care District (Eksote) have purchased/leased over 40 biogas vehicles and made a service agreement on four shared electric vehicles.

1,680,00 local public transport trips were made in total in Lappeenranta during 2018. Amount of passengers increased by 230,000 during 2013-2018 (+ 16.0%). Before strong campaigning, the number was around 1,300,000 for years - now it's grown steadily for almost 10 years.

In early 2019 two biogas buses started operating in local public transport, and public waste management company EKJH Oy began building a biogas plant to Lappeenranta. The plant and two new biogas stations start operating in 2020.

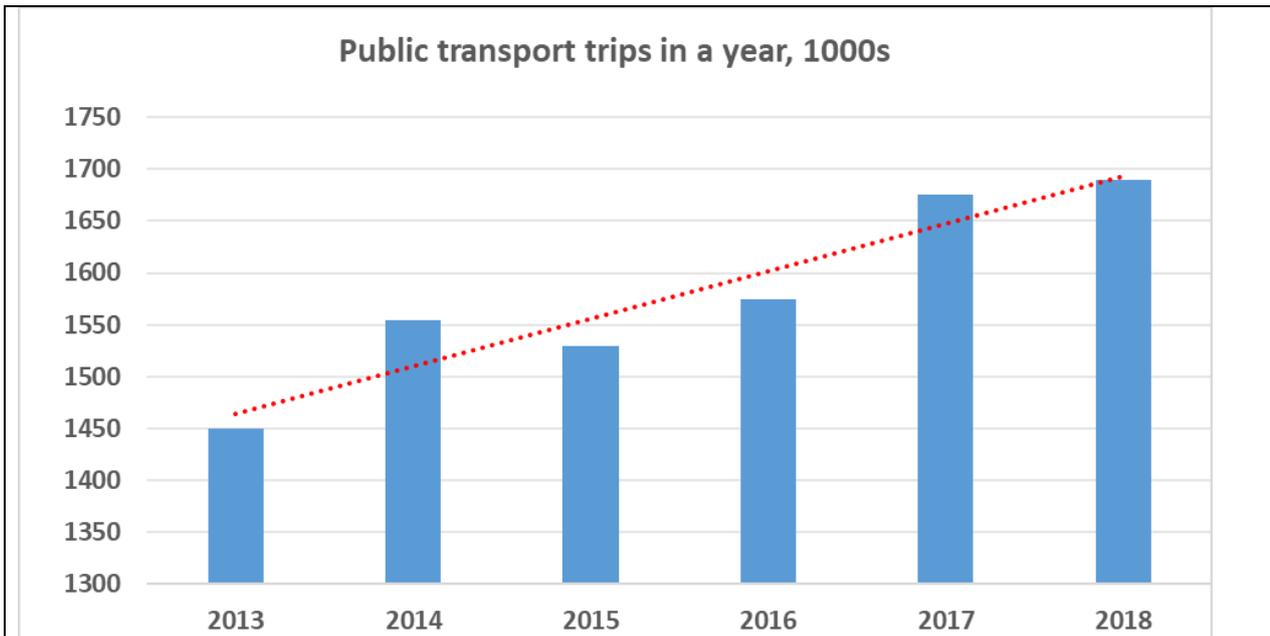


Fig. 1. Number of passengers in public transport

Lappeenranta has a total of 282 kilometers of bicycle roads and 95 kilometers of main bicycle routes. Main routes form a comprehensive network through the city from all directions. In addition to unification, pavements have been renewed, curb stones repaired, the safety of intersections improved and routes signposted. Guidance, lighting and bicycle parking spaces have been increased. Since 2017, over 14 kilometers of bicycle paths have been built and repaired with over 1,600,000€. Six new bicycle parking stations were built 2018-2019. A brochure map of routes has been produced in four languages and cycling pages added to the city's website to promote cycling.



Fig. 2. Biogas bus

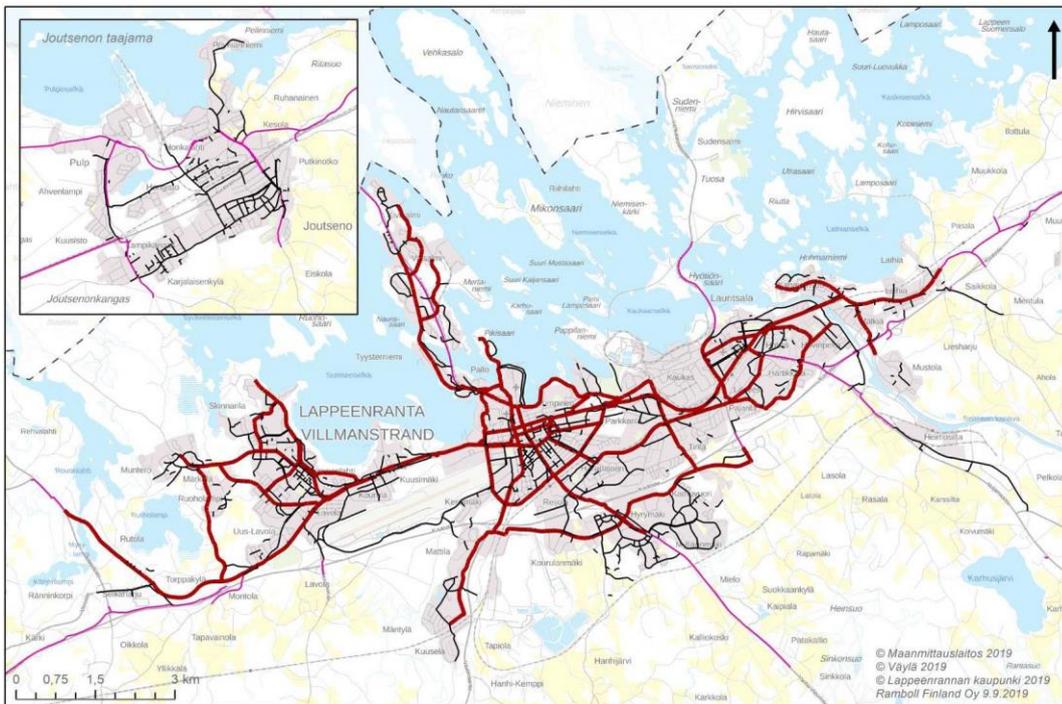


Fig. 3. Bicycle routes

In June 2019 Lappeenranta implemented city bicycles acquired in collaboration with local student housing foundation LOAS and Lappeenranta University of Technology. There's 85 bicycles in total and they've been well received, especially by local students. In September 2019 over 5000 trips were made with them.

Walking trail Rantaraitti opened in 2019. It's located near shores and it's approximately 11 kilometers long. The route proved extremely popular immediately. The city center is developed as bicycle and pedestrian-friendly. Valtakatu is one of the center's main streets - after reparations it's a so-called living street, where pedestrians and cyclists are prioritized over cars.

Lappeenranta was the first city to offer city-owned vehicles for citizens' use outside office hours (fall 2017). Lappeenranta was also the first in Finland to tender out electric cars through shared services, that include four electric cars available for citizens and travelers outside office hours.

The city industry utilizes freight transportations. Utilization of waterways decreases truck transportations. Finland's largest inland port is located in Lappeenranta, and UPM Kaukas paper mill is the only in Finland to utilize floating transportation, which substitutes 250 truck transportations.

2b – Citizen Participation and Public Awareness

The city has arranged or participated in many sustainable traffic -events. The annually arranged *Päästötöntä meno* –event exhibits low-emission mobility extensively: low-emission cars, and electric scooters/bicycles. In addition to familiarizing with vehicles, visitors can test drive them. The event is aimed towards all municipal citizens. During Bike Week, Lappeenrannan pyöräilijät (local association for cyclists) arranged, with the city, a bicycle parade, to which all municipal citizens were invited. In addition, shared cars and city bicycles have been displayed at the Greenreality Carnival and the Finnish Athletics Championships (Kalevan kisat), for example.



Fig. 4. Cycling parade

All 8th graders in Junior University study sustainable living. They consider the impact of transport on climate change, estimate their school and leisure trips' carbon dioxide emissions and search alternative modes of transport. High school students discuss freight transport and catering business mileage with companies, and help them set goals for sustainable driving and improving transport logistics. In the Greenreality Homes -project pupils explore, with their families, carbon footprints and reducing them.

The participation of immobile senior citizens is enabled by the "Pirstäjät" –service, in which volunteers drive senior citizens around with electric rickshaws. Plenty of schools have acquired bicycles for pupils' use, so everyone can participate in cycling during schooldays.

Cycling is also developed with the region's cycling activists in "Pyöräilyryhmä" (Cycling group). The group consists of city officials, cycling activists and Lappeenrannan pyöräilijät ry's representatives. They meet regularly and arrange annual cycling route inspections.

The city-coordinated Greenreality Network works in Lappeenranta. The members consist of local companies and representatives of educational institutions and associations. The network aims to enhance sustainable mobility and support businesses related to it.

Other inclusive exemplary acts include commuter cyclists' morning coffee, communications and a 2018 sustainable mobility -video.



Fig. 6. "Päästötöntä menoa" –event

Topic Area 3: Nature, Biodiversity and Sustainable Land Use

3a – Current Situation and Strategic Approach

The city of Lappeenranta is known as the city of lindens. Lappeenranta has planted lindens for over 250 years. Every citizen lives closer than 200 meters from 1.000 m² green areas. 88 % of all inhabitants live closer than 200 meters from 10.000 m² green area. The city has treatment and development plans for parks and forest areas.

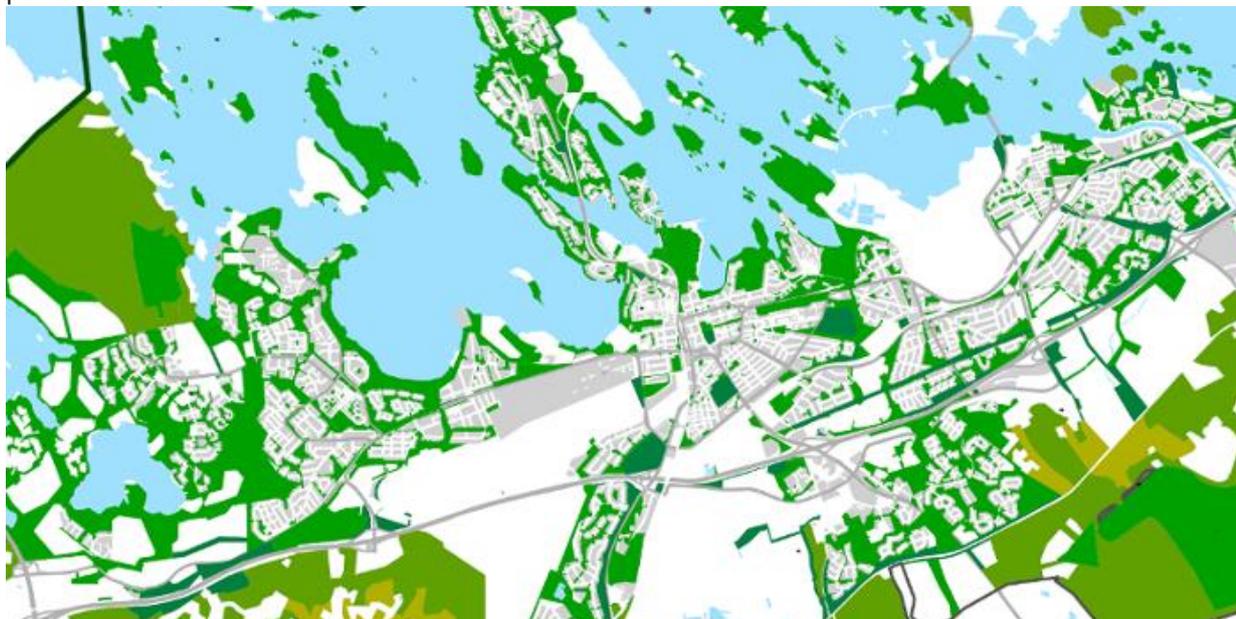


Fig 6.1. Green areas in General Plan

Lappeenranta is connected to the Green Belt of Fennoscandia. Wild animals such as foxes, beavers, deer, moose, and lynx can be seen close to the city center. Even bears and wolves live in the Lappeenranta area. There are 25 NATURE 2000 areas and 4 city-owned areas protected by the Nature Conservation Act. 14 new areas are in the conservation process.

The city owns 3600 hectares of forests. The city has been granted the PEFC certificate in the promotion of sustainable forestry. The protected areas are about 245 hectares in the city forests, i.e. 9 % of the recreational and commercial forests. Lappeenranta has also 106 hectares of built and maintained parks and 1500 hectares of urban forests. The latest nature conservation area was established in Pappilanniemi. There is a variety of habitats in the 28.8-hectare area; 350 plant species have been detected in the naturally aged forests.

The city develops natural and recreational possibilities for citizens. New nature trail "Rantaraitti" was built, while taking natural values into consideration, along the shoreline of Pien-Saimaa. Information signs highlight the natural diversity and well-being of the trail for citizens. 11 kilometers long "Rantaraitti" became successful very quickly. It is an excellent example of connecting green and blue areas of the city. There are 11 other natural trails in Lappeenranta.

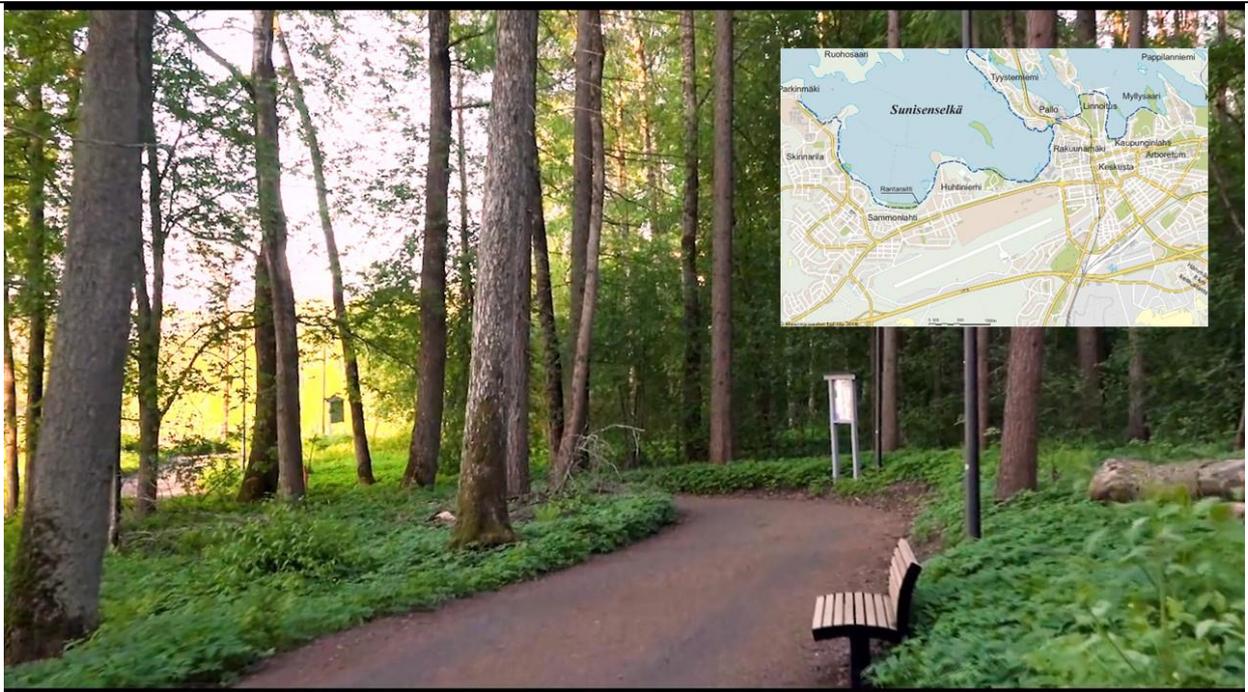


Fig. Rantaraitti

A plan for surveying, controlling and eradicating the most common local harmful invasive plant species was made in 2018. 2019 Lappeenranta joined a 6-year LIFE project that aims to continue eradicating the Giant Hogweed and the Himalayan Balsam. The work of city maintenance has started in collaboration with private landowners.

Lappeenranta has started a network project to increase meadow areas. The purpose is to increase biodiversity, comfort and resource efficiency of the green areas. Meadows increase the amount of bees and pollinators in the heart of the city. The first meadows will be established in 2020.

Lappeenranta has surveyed endangered species and habitats. The survey will be used as basic information for the City General Planning and land use planning. The endangered species include for example the Spring pasqueflower (*Pulsatilla Vernalis*), the Siberian flying squirrel (*Pteromys Volans*), several orchids and the Saimaa ringed seal (*Pusa hispida saimensis*).

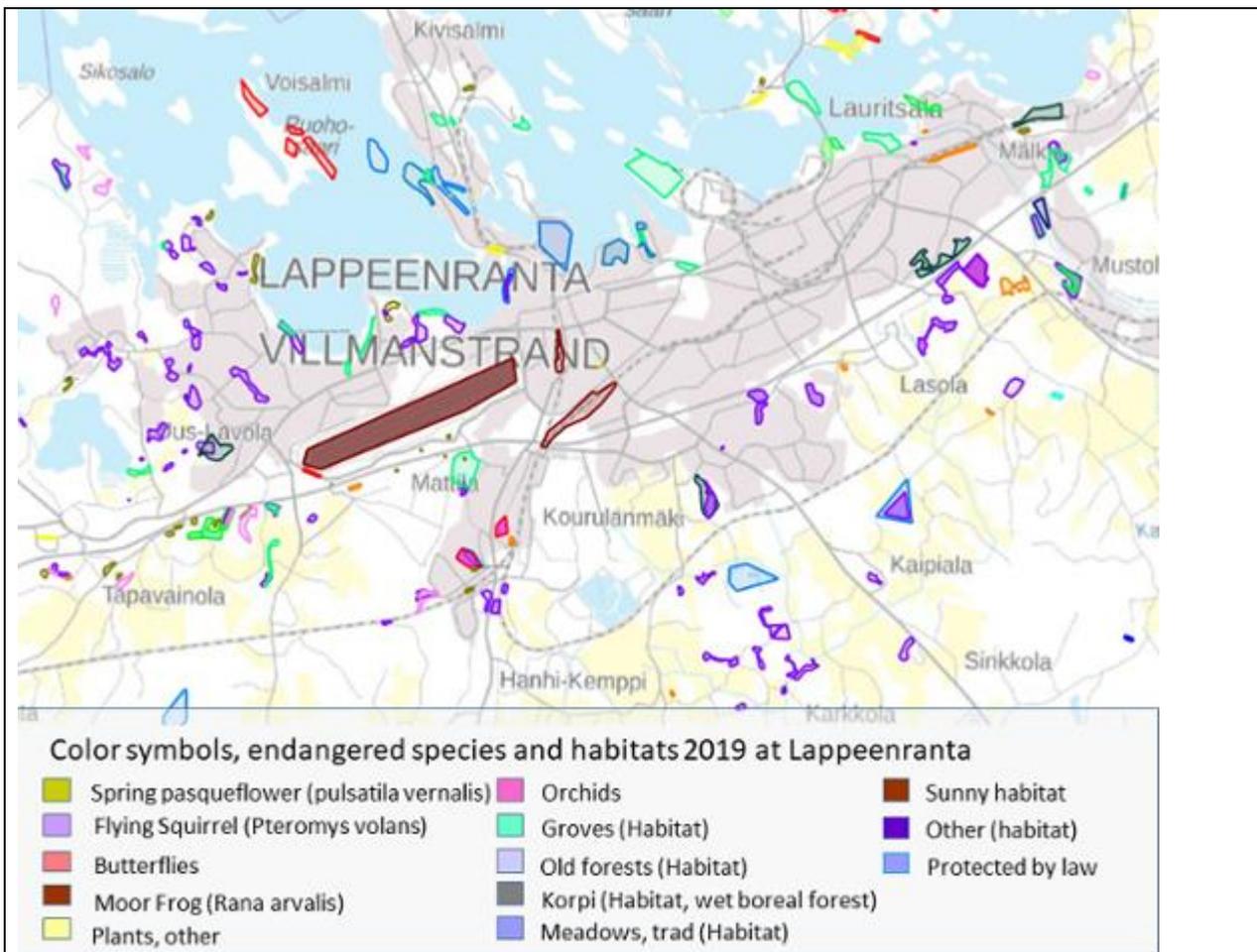


Fig. Endangered species and habitats survey.

A preparation for a Green General Plan "Horisontti" by Greenreality Lappeenranta started in 2018 and continued in 2019. The green stage plan will be a strategic tool that controls land use. The green plan has three focal points:

1. A greener city
2. Sustainable transport
3. Clean technology work areas

Saimaa Geopark has applied for the Geopark status from the Geopark Network which operates under the protection of UNESCO. Nine sites are located in Lappeenranta.

Seven stormwater wetlands have been constructed in the urban areas. The network of wetlands increases biodiversity and provides a habitat for many birds and insects. The protection work of Lake Pien-Saimaa was granted the award of Best Lake Restoration work in 2018.

There is a routine method to handle contaminated land areas. The areas can be found in the city land-use information system. Approximately 1.000.000 € is invested annually to clean areas by the city Lappeenranta.



SAIMAA ORIGINAL

*The Saimaa ringed seal
(Pusa hispida saimensis)*

Fig 6.4. Saimaa Ringed seal

3b – Citizen Participation and Public Awareness

The city of Lappeenranta organized 14 large invasive species eradication events in the summer of 2019. Lappeenranta participates in the Finvasive-LIFE project 2018-2023, which is coordinated by the Finnish Association for Nature Conservation and aims to raise awareness, survey, and control invasive alien species in Finland.

Lappeenranta has opened a Greenreality park, where any inhabitant or organization can plant a tree to take part in climate change mitigation and city green area development. At the grand opening 27.9.2019, 101 trees were planted.



Fig. 6.5. Grand opening of the Greenreality Park

Lappeenranta has established a Green working Group with active associations. The purpose of the group is to develop green areas and natural areas together with different stakeholders.

During Green General Plan and Meadow Network planning there have been collected public proposals in the citizen participation workshops held 2018 and 2019.

City forest handling plans and principles have been published in the city website, where inhabitants can see the plan of their neighboring park and forest areas.



Fig 6.6 Lake Saimaa in the winter and summer.

Lake Saimaa is one of the natural wonders of the world. Municipalities have together established natural recreation sites in the islands at Lake Saimaa. During winter, it is popular to explore lakes walking or skiing on ice. Events like “The Great Winter Day” on 24th February 2018 gather a lot of participants to the city harbor and nearby UNESCO Saimaa Geopark site.

Lappeenranta offers trails for walking, running and skiing to encourage sporting activities. There are 53 kilometers of tracks in the summer and over 200 kilometers of tracks in the winter.

One of the nature paths "Biotrail", is designed for kids in particular, because of signs with QR codes that allow them to watch videos of the subject.



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Topic Area 4: Air Quality and Noise

4a – Current Situation and Strategic Approach

The present situation regarding Air Quality:

Table 1: Benchmarking Data - Air Quality

Air Quality	Answer		
What air quality zone does the city belong to?	F10005 – South East Centre for Economic Development, Transport and the Environment		
Is there an air quality monitoring station(s) in the city? - Yes or No.	Yes		
If Yes:		Unit	Year of Data
Mean annual data of NO ₂ concentration.	10	µg/m ³	2018
Mean annual data of PM _{2.5} concentration.	6	µg/m ³	2018
Mean annual data of PM ₁₀ concentration.	11	µg/m ³	2018
Provide any historic data for those pollutants.	Please see a picture in the text.		
Provide information of the type of stations used to monitor pollutants?	5 automatic stations, SO ₂ , TRS (total reduced sulfur), NO _x , PM ₁₀ , PM _{2.5} , 3 deposition stations		
If No: Describe briefly the latest air quality assessment available for the air quality zone the city belongs to.			

The present situation regarding Noise:

Table 2: Benchmarking Data - Noise

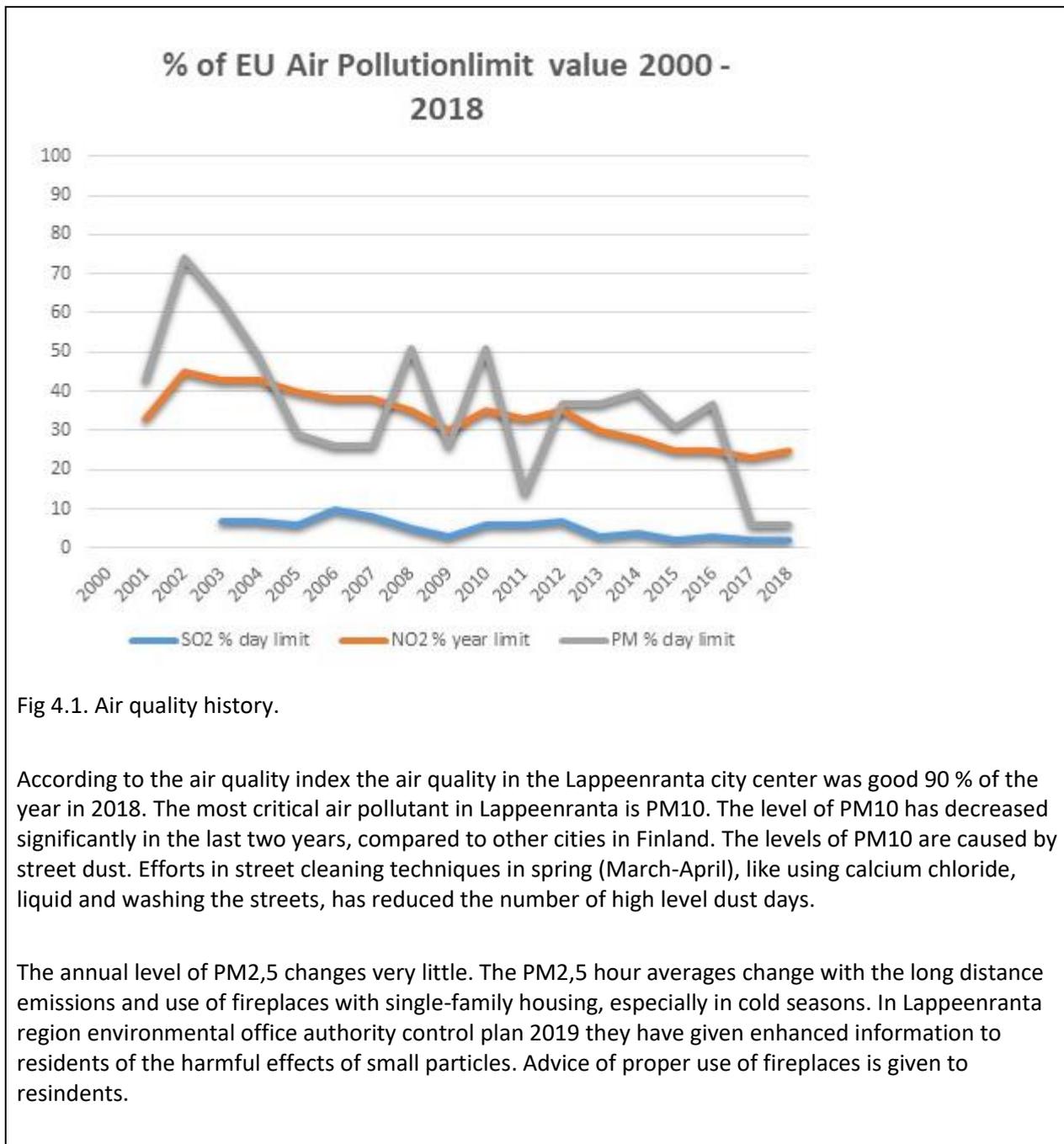
Noise	Answer
Year the last strategic noise map was	2015



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produced.	
Year the last noise action plan was prepared.	2016
% implementation of the last noise action plan.	not calculated
Does the city have an inventory of quiet areas?	Yes
Does the city have acoustic zoning?	No
Which limits or reference value does the city apply to residential areas? (Ld/Le/Ln).	55 dB, L_{aeq} 7-22
In the last year, how many noise complaints did the city receive related to leisure or recreational activities?	5 (28% of all complaints)
How many noise experts does the city have?	3 (part time)

Air pollution monitoring has started in Lappeenranta already in the 1970s. Previously SO_2 was a dominant problem. Along with the transition to centralized heating, natural gas and biobased fuels, SO_2 problems have disappeared. NO_x levels are low. Lappeenranta has a long tradition of the wood and mining industry. Therefore there is a wide network of air quality monitoring. Particles have been the most dominant problem during the last 10 years.



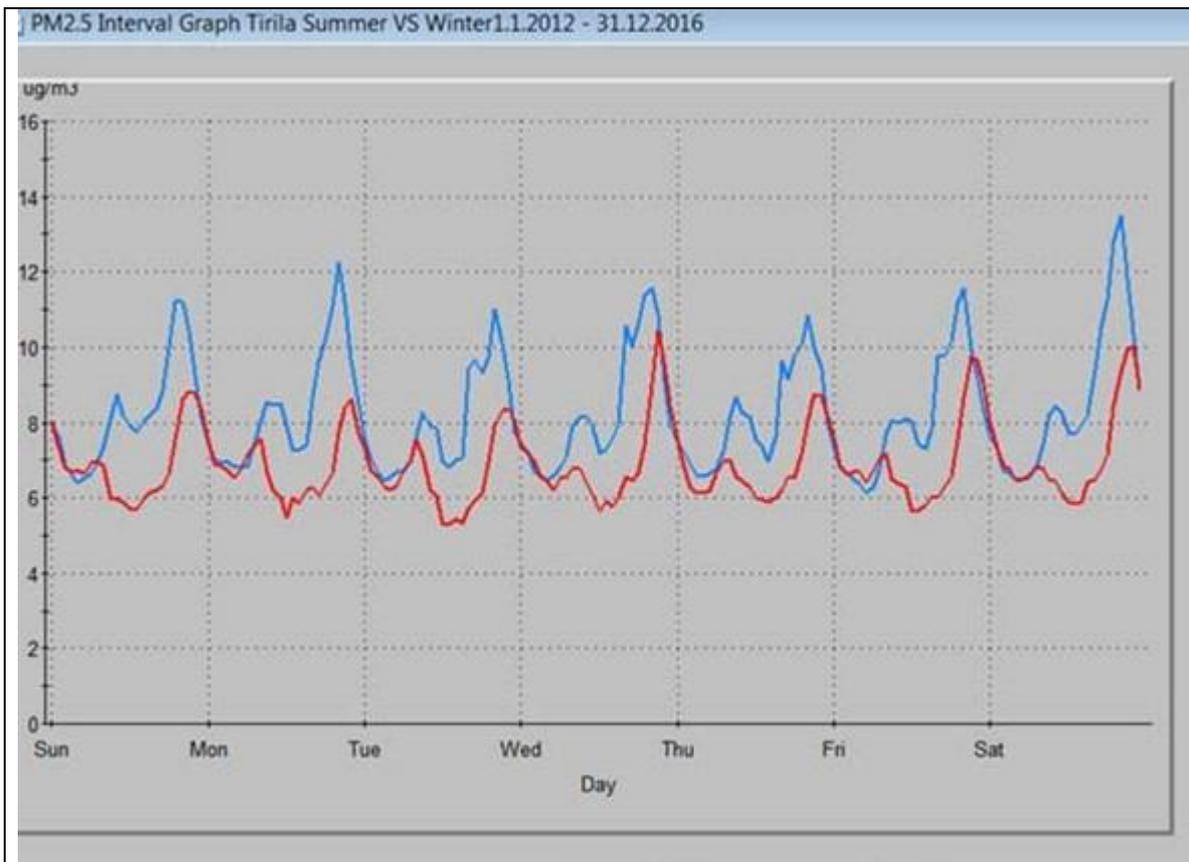


Fig 4.2. PM_{2,5} in winter and summer (4 years average).

The level of nitrogen dioxide is low in Lappeenranta compared to the air quality guidelines and limit values. The level of NO₂ changes only very little annually.

Co-operation with the municipal authority and the industry in air monitoring have lasted for over 20 years. That's why Lappeenranta has a very wide monitoring network compared to the population size, consisting of 5 measuring stations and 3 deposition stations. Measurements are done by Imatra's environmental office within the air quality network in South Karelia. Co-operation means the possibility for good-quality measurements.

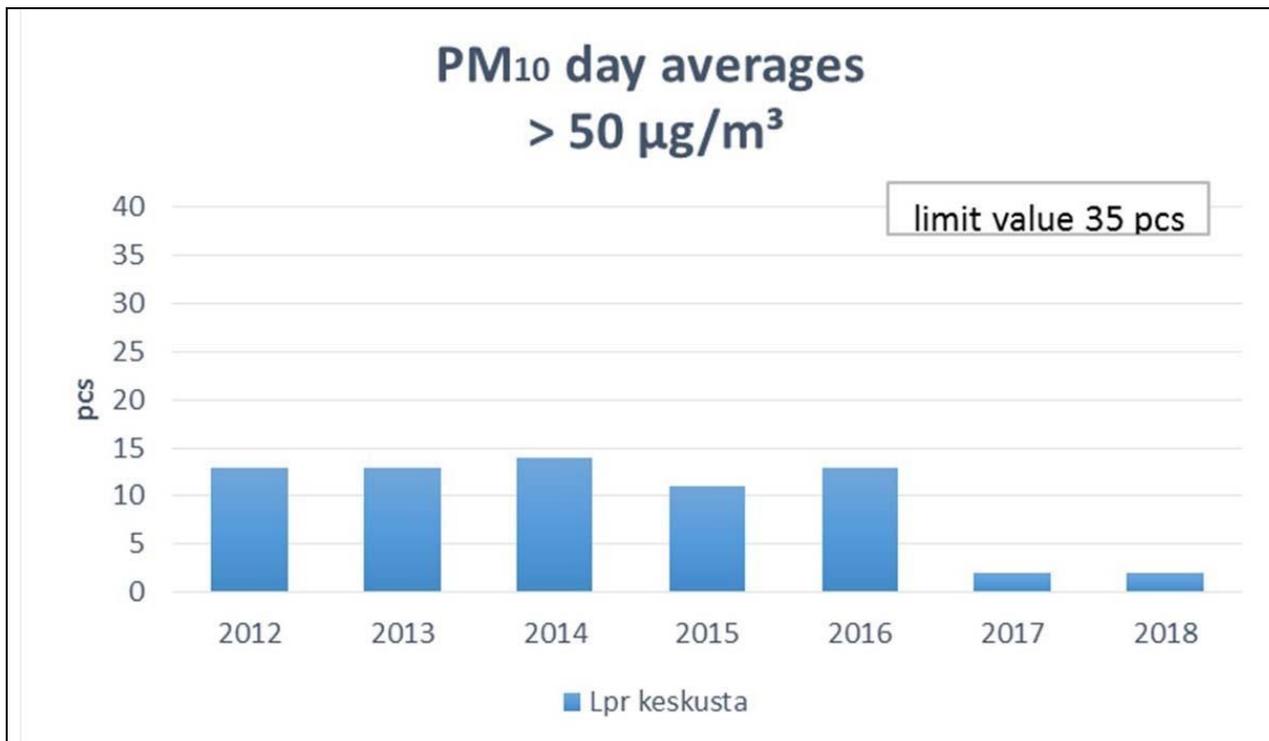


Fig 4.3. Better maintenance has decreased PM₁₀ values (city center).

Besides the emissions by traffic it was also needed to monitor pollutants from industry. One of the stations is classified as a traffic station, one as an industrial and one as an urban agglomeration station. The data is transferred to the Finnish Meteorological Institutes website. Because of large pulp industry emissions, measurements of odorous sulphur compounds (TRS) are important.

Noise

The last strategic noise map was done in 2015. In 2014 9,9 % of Lappeenranta's resident lived in a noise level area above Laeq7-22 over 55 dB. 9,7 % of the noise is caused by traffic noise.

The population of Lappeenranta is under 100 000 residents. Making the noise action plan is volunteer by legislation in small cities. Lappeenranta's volunteer noise action plan is in the making and the completing time of the plan is the beginning of 2020. In summer 2019 we did the noise residential inquiry.

Noise surveys are made in each General and Detailed Plan. Noise solutions of buildings and building yards are carried out in building permittig process.

Although The Noise Action Plan is not legally binding Lappeenranta has a draft Noise Action Plan. Several actions have been accomplished.

Lappeenranta executed an inventory of quiet areas in 2015. The inventory consisted of the urban quit areas where Laeq7-22 is below 45 dB. The inventory was completed by the noise inquiry in 2019 for residents. In fig 4.4 picture B we can see the points and areas where the resident feel are pleasant.

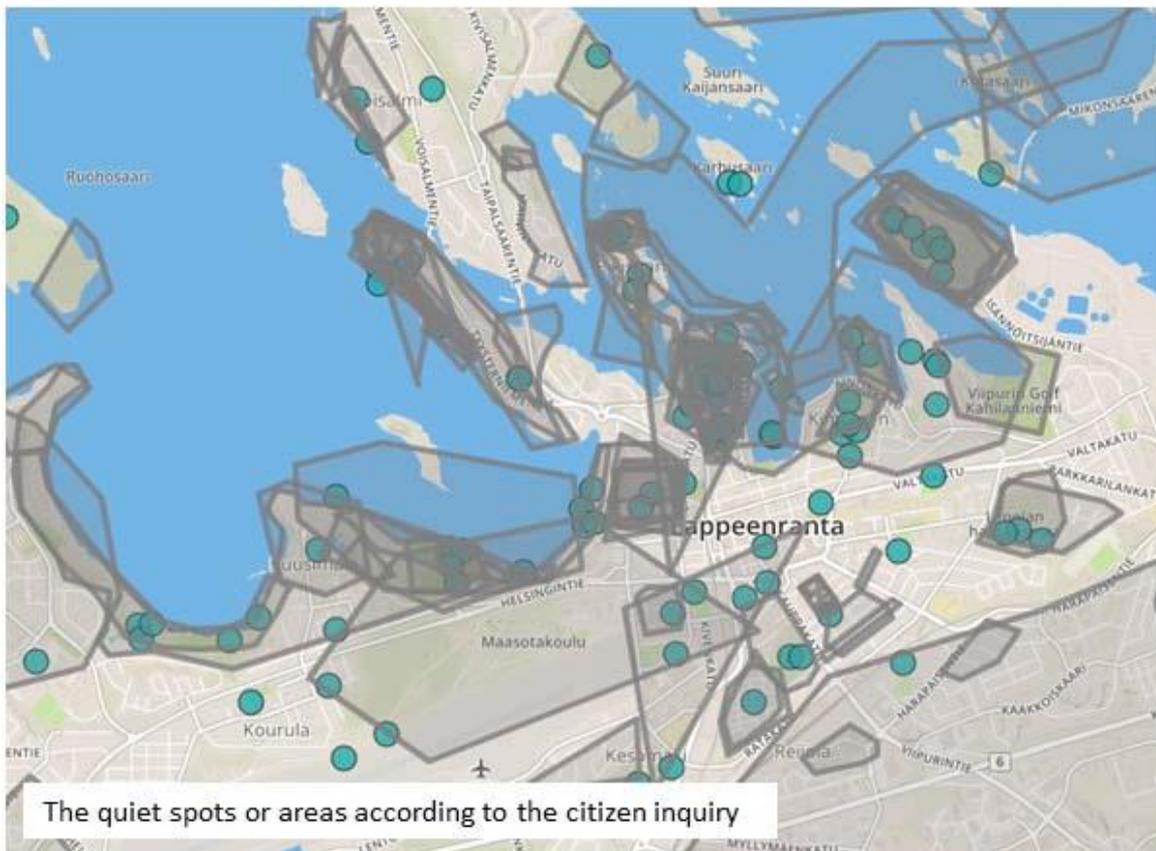
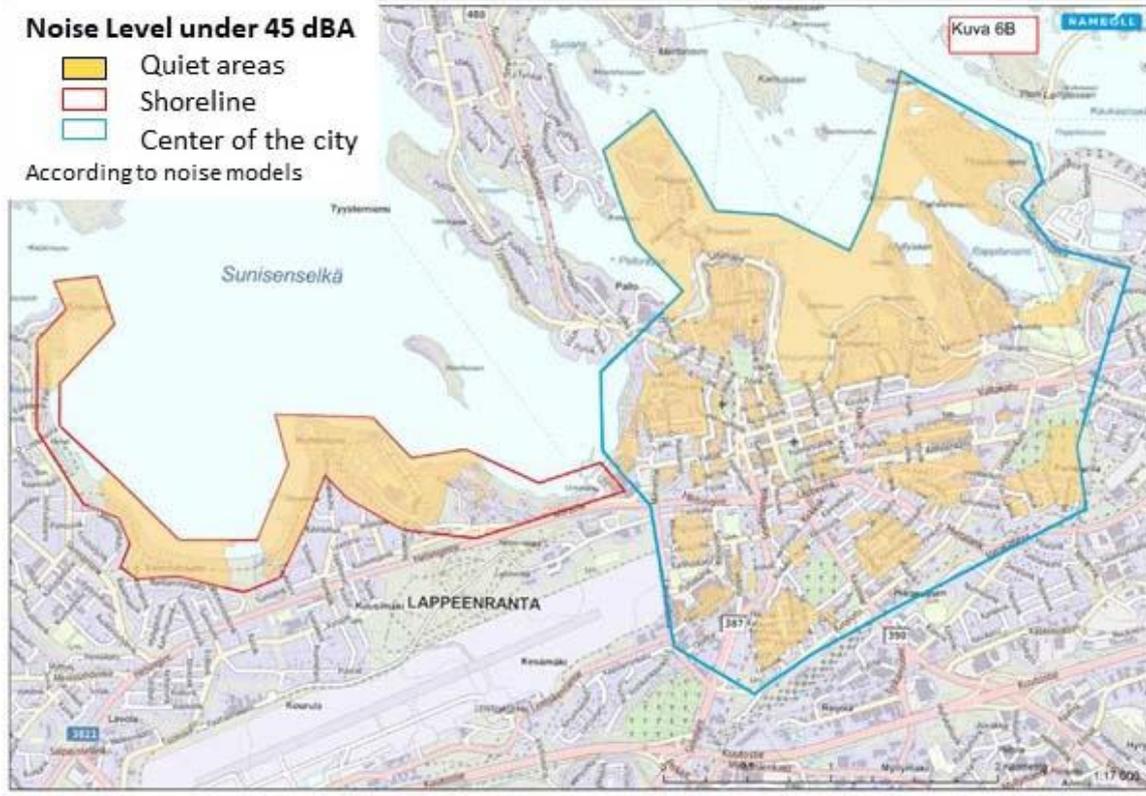
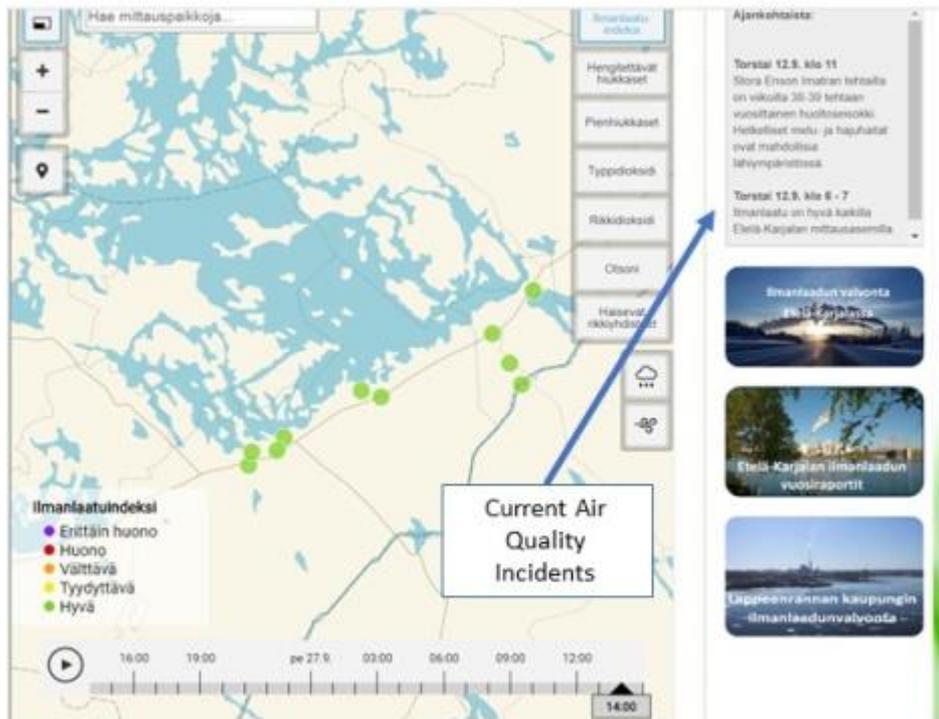


Fig 4.4. Comparison of noise models and inquiry results.

4b – Citizen Participation and Public Awareness

There is a routine method to inform citizens of air quality problems via the city's media channels. However, as a result of the feedback given from EGLA 2020 contest, a new air quality website was published in June 2019. Citizens are now able to follow better the situation of air quality information as it is in real-time. This will be useful especially in the situations when there are emission problems in pulp mills.



road Fig.4.5. Air quality data website, air quality index.

Noise

Noise surveys have been made together with the Greenreality General Plan "Horisontti". Noise residential inquiry was made in 2019. People appreciated the noises of nature, wind, singing birds etc. As we could guess, the most unpleasant noise was caused by traffic, especially motorcycles. At the same

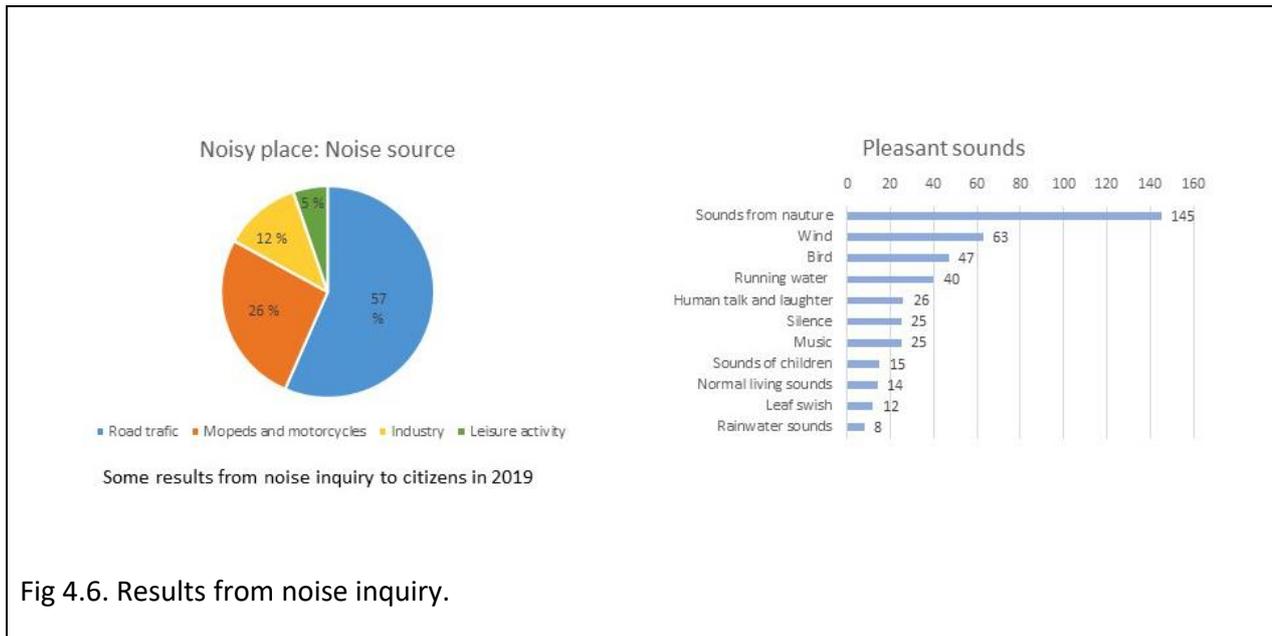


Fig 4.6. Results from noise inquiry.



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Topic Area 5: Waste and Circular Economy				
5a – Current Situation and Strategic Approach				
Recent data of waste and circular economy:				
Table 1: Benchmarking Data - Waste and Circular Economy				
Indicator	Type of Data (City/Regional /National)	Unit	Year of Data	Answer
Amount of Municipal Waste Generated Per Capita.	regional	Kg/capita/ year	2018	339
% Municipal Waste recycled (including composting and digestion of waste).	regional		2018	54 %
% Municipal Waste sent for Energy Recovery.	regional		2018	46 %
% Municipal Waste Sent to Landfill.	regional		2018	0
<p>Lappeenranta has organized waste management with other South Karelian municipalities by EKJH (Etelä-Karjalan Jätehuolto Oy). Lappeenranta aims to zero waste municipality in 2050. The target is in the city strategy and resource wisdom roadmap accepted in city council 2015. EKJH is responsible for transportation, reception, handling, and processing of dry and bio-waste. To the citizens, EKJH offers waste advisory and for companies limited waste services according to Finnish waste law.</p>				

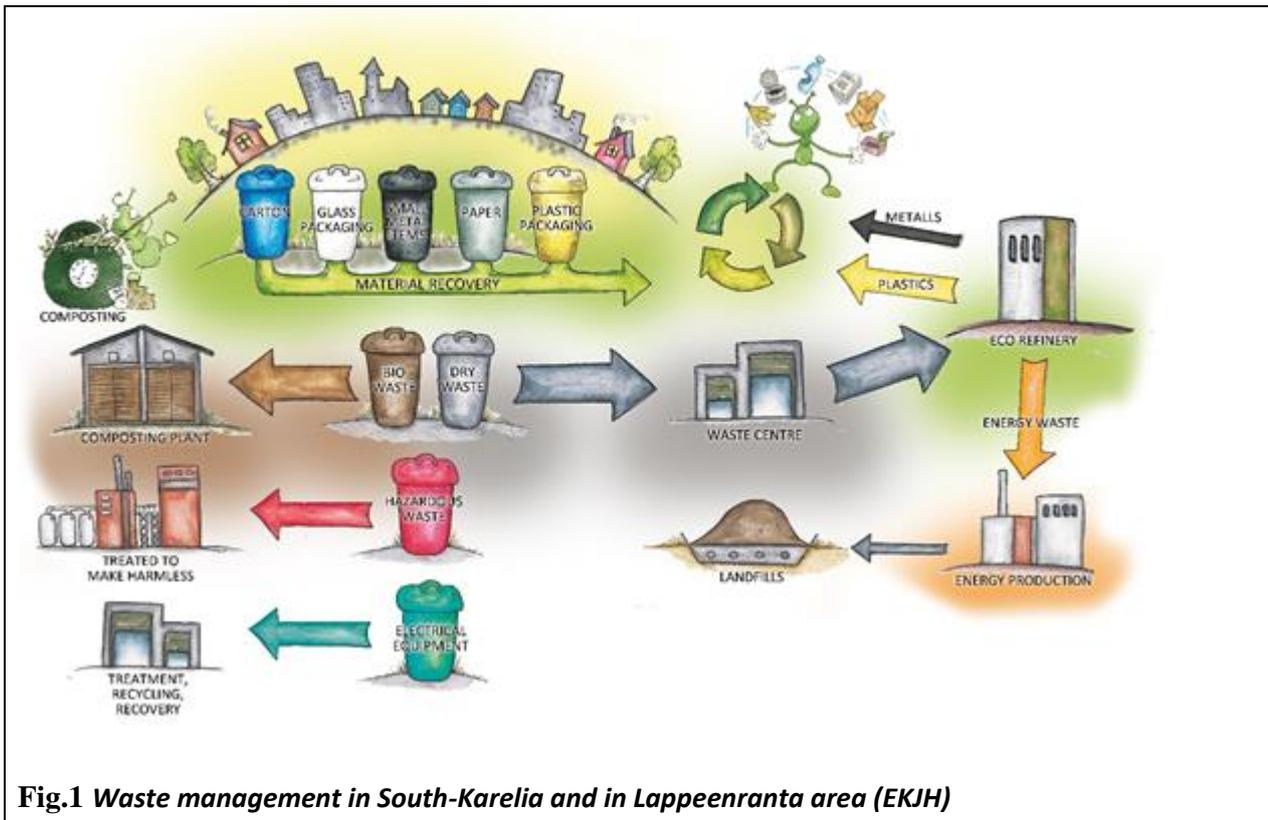


Fig.1 Waste management in South-Karelia and in Lappeenranta area (EKJH)

Management regulations of South Karelia municipalities control waste handling. In new regulations 2019, there is added an obligation to collect plastics in houses with several apartments. In 2016 started plastic recycling in Lappeenranta has grown fast. Plastic is collected now from properties, collective EKO stations, and recycled as material. Bio-waste separation has been compulsory for all the households in Lappeenranta since 2002.

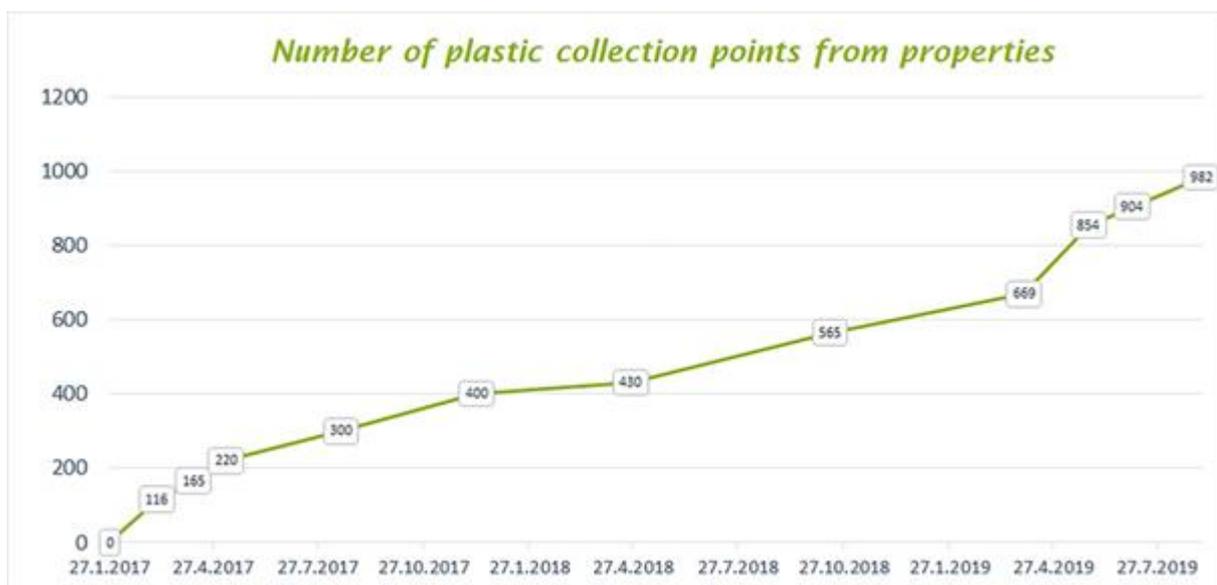


Fig. 2 Plastic collection.

In 2018 54 % of total municipal waste is recycled for material reuse, 46 % of waste (dry waste, sorted energy waste, wood, brushwood) is used for energy production.



Fig. Recycle bin for single house.

EKJH waste treatment center Kukkuroinmäki is a test environment in which businesses can develop and test circular economy business activities.

(video: <https://www.youtube.com/watch?v=sv4O9jHafjk>) In Kukkuroinmäki Kekkilä recycling company composts bio-waste and sludges are in tunnel composting plant and produces nutrient soil for gardens and soil improvement. Wimao produces composites from wood and plastic waste. A lot of concrete and brick waste is used in field structures. A biogas plant is under construction, and it will be ready and in use in 2020.



Fig 3. Energy advise service in action.

EKJH's local services include numerous Regional waste collection stations in sparsely populated areas for dry waste, 91 EKO waste stations in cooperation with Rinki Ltd. for glass, cardboard, metal, and paper, most also for plastic and textile and Hyödyksi (For use) stations for big sized or big amount wastes, like renovation and cleaning wastes. Construction waste experiment of wood waste recycling implemented in Toikansuo Hyödyksi (For use) station in summer 2019. Two people were hired to sort wood waste, which usually is burned. Citizens picked up wood free of charge. The experiment was successful and more wood is recycled.

Circular economy

In Lappeenranta 2033 strategy's Clean and sustainable program the City has set objectives for actions to promote circular economy: All the waste are utilized, nothing to landfill; the amount of collected plastics will be doubled in 2017 – 2021, Experiments related to sustainable development are facilitated, 45 new jobs related to circular economy/resource wisdom by 2021, Citizens' responsibility of environment is growing. Progress of strategy is monitored with the help of selected indicators. Named persons are responsible for reporting of actions.

Lappeenranta is a partner in CIRCWASTE project <http://www.materiaalitkiertoon.fi/en-US>, co-financed by EU LIFE IP. Lappeenranta has created with wide expert group a local Circular economy road map in which objectives and actions have set for selected focus areas.

Lappeenranta manages 4,3 m€ EU Urban Innovation Actions –project called Urban Infra Revolution. New sustainable material is developed by combining forest and mining industry side streams. The new target product is a geopolymer composite material that can be reinforced with bio fibres, for example. Composite products have a long life cycle and can be safely

recycled even after use. <https://www.uia-initiative.eu/en/uia-cities/lappeenranta>.

Recycling center Hyötyhalli accepts unbroken items suitable for recycling. Transport is also available for bigger things like furniture. Recycle center sells items at low prices. This autumn Association of Finnish recycling centers awarded certification of merit to Hyötyhalli for productive action in promoting recycling and employment.

5b – Citizen Participation and Public Awareness

Lappeenranta implements actively multiple actions to promote the circular economy. The city got honorable mention to be one of the first three in the competition of Circular economy municipality of Finland in 2019. The Jury valued the unique strength of the city to create solutions with LUT University and companies in the field of energy and environmental technology. An excellent example of this is a sharing electric car service. The vehicles used by the city staff during the office hours are in use for everyone in the evenings and weekends.

The city provides a lot of lending services, and premises are for rent in Varaamo-service. The circular economy is communicated actively to citizens via Greenreality actions and in vivid cooperation with schools and young people.



Fig. 4: Cleaning campaign Matt the Plastic – WANTED.

City organized cleaning campaign Matt the Plastic – WANTED! in spring 2019. Successful campaign gathered about 1000 people from all over the city, including companies, children, and teachers. About 20 m³ of waste from nature was collected. The campaign will continue each year.

EKJH arranges waste information campaigns annually. Guides of waste management are

delivered every year to households in Lappeenranta. EKJH organizes regularly hazardous waste collection campaigns around the region. From waste to value guide <https://indd.adobe.com/view/ffd5fafc-29ab-49be-9233-7b39226cdc51>

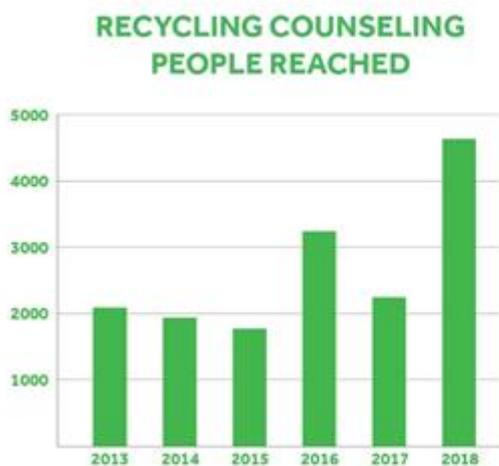


Fig 5. Waste information

Kitchens of the city are promoted to minimize the loss of food. Amount of used food is monitored every day. Over left food is sold, when available and given to associations, if needed.

Lappeenranta guides all the pre-schoolers to recycle properly via Junior University Lappeenranta Uniori. 3rd graders learn the whole circular economy of different materials. High schoolers help local small companies to decrease the waste amount and find replacing materials.



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Topic Area 6: Water

6a – Current Situation and Strategic Approach

Table 1: Benchmarking Data - Water

Indicator	Unit	Answer
Urban and domestic water consumption.	Litres per capita per day	140 l/ind/d
Proportion of water losses from the distribution network.	%	11 %
Proportion of urban drinking water supply subject to water metering.	%	100 %
Compliance with DWD - Drinking Water Directive 98/83/EC.	Yes/No - %	YES 100 %
Population connected to the waste water collecting system and waste water treatment plants.	%	92 %
Treatment rate of central waste water treatment plant for parameters: BOD ₅ , COD, N, P.	%	BOD ₅ 98 % COD 94 % N 60 % P 95 %
Compliance with the requirements of the UWWTD 91/271/EEC.	Yes/No	Yes
Ecological status of water bodies - WFD status.	Status	Lake Suur-Saimaa-excellent, Lake Pien-Saimaa-satisfying and Lake Haapajärvi-bad
Water reuse.	Yes/No - %	0 %

Lake Saimaa and other smaller bodies of water are of great value to Lappeenranta because of water acquisition, industry, tourism, fishing, transport and common recreation. Pure water is one of the priorities in the Lappeenranta 2033 strategy and transparency of Lake Pien-Saimaa is one indicator.

Water management includes production and distribution of domestic water and collecting and cleaning the waste water in Lappeenranta city center and six smaller settlement areas. Domestic water is ground water and artificial ground water. The main water supply in Huhtiniemi distributes water to 40 000 inhabitants.

Drinking water meets 99 % of time the legal requirements and recommendations. Slogan for Lappeenranta tap water is "probably the best tap water in the world".

The main waste water treatment plant Toikansuo purifies 16 000 m³ of water from Lappeenranta and two neighboring communities. Purified water is discharged by river Rakkolanjoki to Lake Haapajärvi.



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Lake Haapajärvi is an eutrophic lake and a Natura 2000 area based on birdlife conservation.

Toikansuo treatment plant is to be renewed in 2022-2026. Piloting projects develop filtering microplastics and medicaments from waste water. Purification will be improved by tertiary processing. Targets of new plant are presented in figure 1. New plant will be one of the best in Europe.

Ground water resources are widely controlled and monitored. Ground water protection plan was made in 2014. In Ilottula tetrachloroethane contaminated ground water is renovated from with new injection technology.

Storm water principal plan was made in 2012 and is to be updated next year. Seven storm water wetlands have been built in Lappeenranta urban area in 2011-2016 and nine wetlands in Lake Haapajärvi drainage area. Wetlands restrain water flow, nutrients and solid material and additionally increase biodiversity and adaptation to climate change.

In Rakkolanjoki-Haapajärvi water-system large restoration projects were implemented during 2012-2015 including drying the lake, restoring the river and leading clean water to Rakkolanjoki from Saimaa canal to improve water quality. Wide principal plans, building nine wetlands and meetings and communications were implemented during 2016-2018.

Ongoing international SEVIRA, "water meets people" -project is handling with monitoring, modelling and raising public awareness among school children and local people. Rakkolanjoki is one target area.

Regular monitoring goes on Rakkolanjoki and Haapajärvi water systems. Water quality has improved and nutrient concentrations have decreased, but ecological quality is still poor.

Results of Toikansuo Waste Water treatment Plant 2018								
	COD _{Cr}		BOD _{7ATU}		Tot P		Susp solids	
	mg/l	%	mg/l	%	mg/l	%		
1. quarter (1.1.-31.3.)	50	93	7,4	98	0,32	95	15	95
2. quarter (1.4.-30.6.)	33	95	4,8	98	0,24	97	11	96
3. quarter (1.7.-30.9.)	44	95	8,2	98	0,40	95	13	97
4. quarter (1.10.-31.12.)	50	94	11	97	0,87	91	27	94
Permission limit values / 1/4 quarter	70	80	10	90	0,5	90	15	90
* Permission limit per each sampling	125	75	30	70	-	-	35	90
N_{tot} removal efficiency mean value was 60 % 2008-2017								
Targets of new waste water treatment plant 2022-2026								
	BOD _{7ATU}		Tot P		Tot N			
	mg/l	%	mg/l	%	mg/l	%		
Permitted values	5	97	0,1	-	-	70		

Figure 1. Waste water treatment plant operation in Lappeenranta

Lake Pien-Saimaa restoration started intensively in 2009. Several projects have consisted of communication and co-operation, monitoring and research, planning, ecological education and counselling, developing and testing new innovative methods and tools. Practical actions were fish population management, constructing wetlands and a pumping station. Cirka 100 wetlands have been constructed during 2012-2019.

Developing, piloting, and implementing innovative methods and materials have been carried out since 2011; energy-efficient pumping station in Kivisalmi, oxidation pump powered by solar panel, and improving stormwater purification with new filtering materials like EM-technology and shungite mineral. Water quality in Pien-Saimaa has improved: nutrient concentrations have decreased, and massive algal blooms don't exist anymore and water is clearer.

Monitoring is a fundamental part of water system control. Lake Pien-Saimaa long-term monitoring has started voluntarily in 1987, added by several specific investigations like biological monitoring, beach control, blue-green algae monitor, microplastic research and measuring the effectivity of storm water purification pilots, Kivisalmi pumping station and oxidation pump powered by solar panel. In addition automatic floating metering station in Lake Pien-Saimaa has measured water quality since 2010.

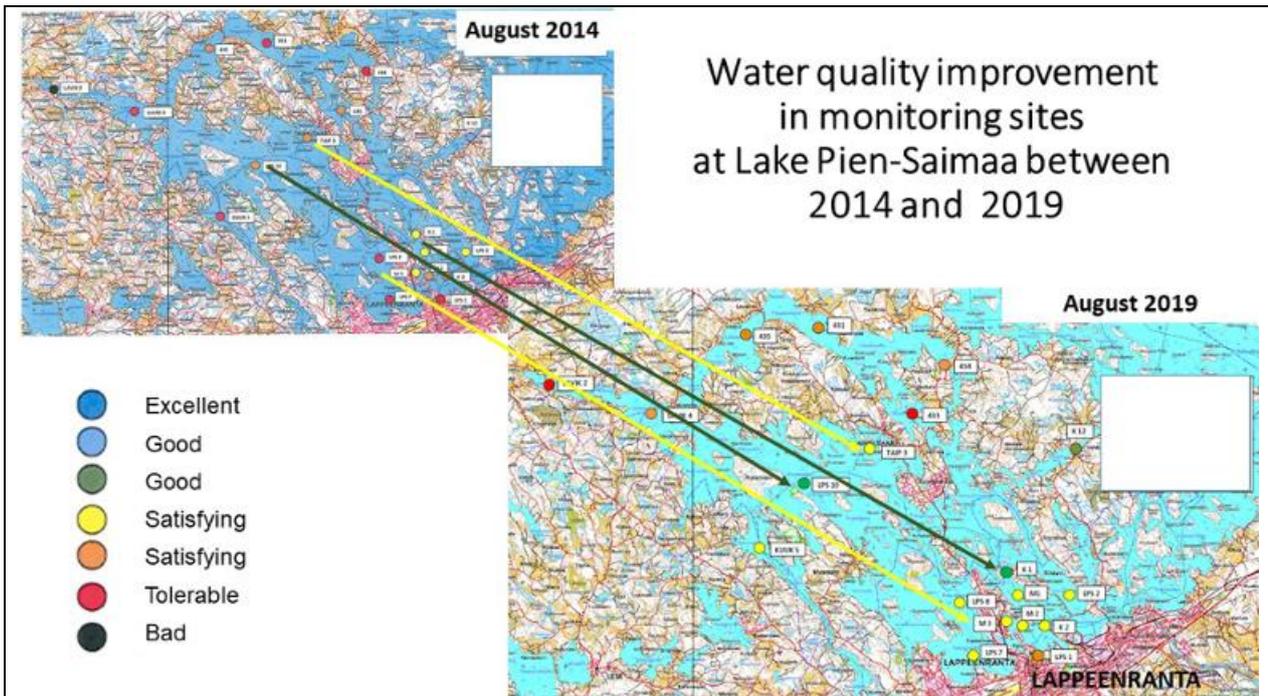


Figure 2. Water quality in Lake Pien-Saimaa 2014 and 2018

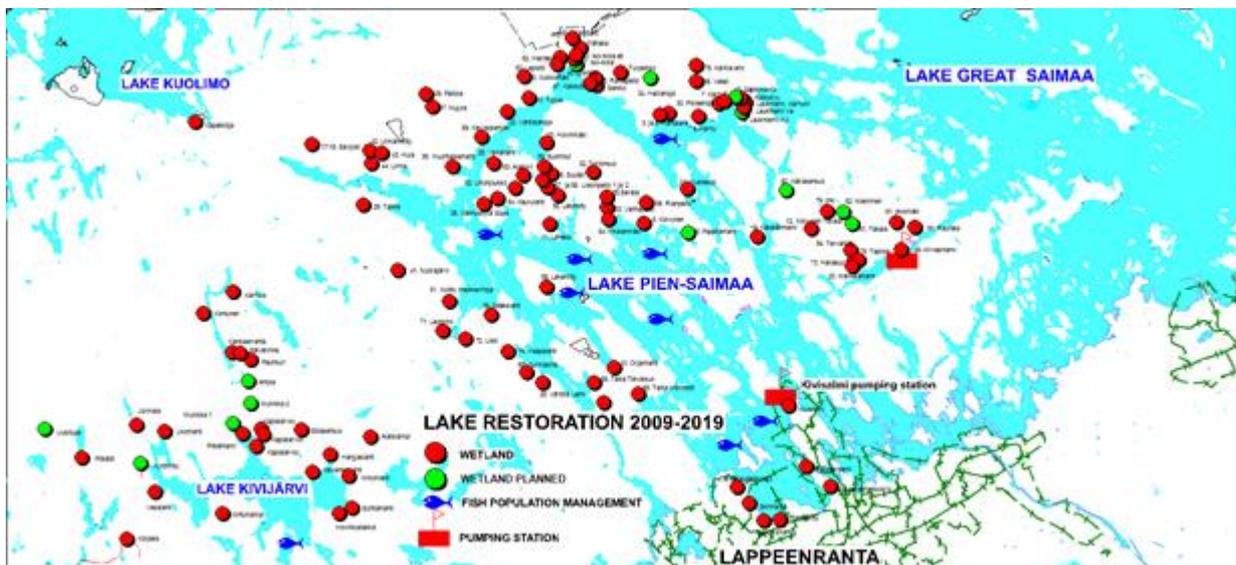


Figure 3. Lake Pien-Saimaa restoration



Figure 4. Kivisalmi pumping station

6b – Citizen Participation and Public Awareness

Communication, interaction and face-to-face contacts with citizens and all stakeholders has an important role in water restoration work. Co-operation and networks are power and must-have for the work.

Communication has been versatile including bulletins, news, websites, social media and arranging and participating happenings. Open and wide communication has increased awareness and trust.

During 2009 -2019 over 100 events, happenings, excursions, seminars, workshops, press conferences and meetings have been arranged and 5000 people participated. For example the Greenreality carnival gathers thousands of citizens in one day every year.

“Matt the Plastic” campaign inspired citizens to collect rubbish from environment. A thousand people; schoolchildren, families, societies and individuals collected 20 m³ rubbish.

Ecological education in schools and kindergartens has been in important role since the beginning. “Vera the Waterdrop” is a character and a story of water and part of Lappeenranta Junior University UNIORI, which has expanded action to all third class schoolchildren in Lappeenranta.

Most important partners have been authorities, boards of fishing grounds, specialists, local NGO societies and foundations, LUT University, local farmers, landowners and citizens.

“Saviors of Lake Pien-Saimaa”, is an informal co-operation team that gathers authorities, specialists and local NGO societies to coordinate, generate ideas and mentor restoration actions and projects.

Several project have offered face-to-face guidance and education concerning waste waters, farming methods and forestry to altogether 1700 farmers, landowners, professionals, planners, independent contractors and citizens.

Pien-Saimaa restoration was granted the award for Best Lake Restoration work in 2018 based on wide and open communication and co-operation.

New project is under planning. Communication, co-operation, ecological education and counseling will be strongly involved. Lappeenranta housing office is starting a campaign in 2020 to encourage people to save water in households.



Figure 5. Ecological education In Lappeenranta harbor



Figure 6. Events gather people together

Section C: Good Practices

In this section Lappeenranta presents three excellent practises that can be disseminated in each city all over the world.

Good Practice 1

Greenreality Network

The Greenreality Network (GRN) is an active network of over 40 companies in the energy and environment sectors. The objective is to generate business and growth through sustainable solutions. <http://www.greenreality.fi/network>

The network was established 2012 by local companies and Lappeenranta University of Technology (LUT). City of Lappeenranta acts as the coordinator. The companies obtain information about investments, demonstration possibilities and projects. Network companies have opportunities to get involved in projects and to search for new partners. The members also contribute to achieving Lappeenranta's "green" objectives, and these objectives can be promoted through investment and through the city's procurement.

Through the solutions developed in Lappeenranta and provided by the members to their customers, our global impact or "hand-print" in the reduction of the greenhouse gas emissions is much larger than what is the impact of reducing our local CO₂ emissions or "carbon foot-print".



Figure GP 1 – Greenreality Network members

Good Practice 2 JUNIOR UNIVERSITY AND GREENREALITY HOMES

The Junior University bases on the cooperation between the City of Lappeenranta and the LUT University. Contents focus on clean energy, clean water, circular economy, and sustainable business.

Learning activities support the National Core Curriculum for Basic Education, and are planned in cooperation with school teachers of the city, LUT University researchers, and companies. Annually all pre-schoolers, 3rd, 5th and 8th graders, all high school students and 200 teachers are reached. The long-term goal is to strengthen pupils' interests in sustainable lifestyle and career possibilities in the energy and environmental fields.

8th graders in Junior University have a *Sustainable living* multidisciplinary learning course including a Greenreality Home project in which they calculate the carbon footprint of their own household and deepen their knowledge about sustainable living.

Also volunteers are challenged to Greenreality Homes activities. In 2019, 45 homes participate in the sustainable living test period.



Good Practice 3

Lappeenranta operates a virtual power plant

Siemens is supplying a virtual power plant (VPP) service for buildings of Lappeenranta. Lappeenranta is probably the first city in the world to utilize the potential of flexible consumption on this scale. The service is running in nine buildings. The aim is to add it to 50 other buildings. VPP helps to balance electricity consumption by decreasing the need for reserve power and consequently cutting carbon emissions.

Within VPP service, electricity consumption will automatically be increased or decreased at the buildings to balance the grid. Lappeenranta's building stock is well-suited for a virtual power plant. Automation system is well-prepared to support virtual power plant.

The city is interested in other benefits enabled by the service. These include peak power management and the use of electricity storage, such as electric car batteries and the electricity-to-heat accumulator.

