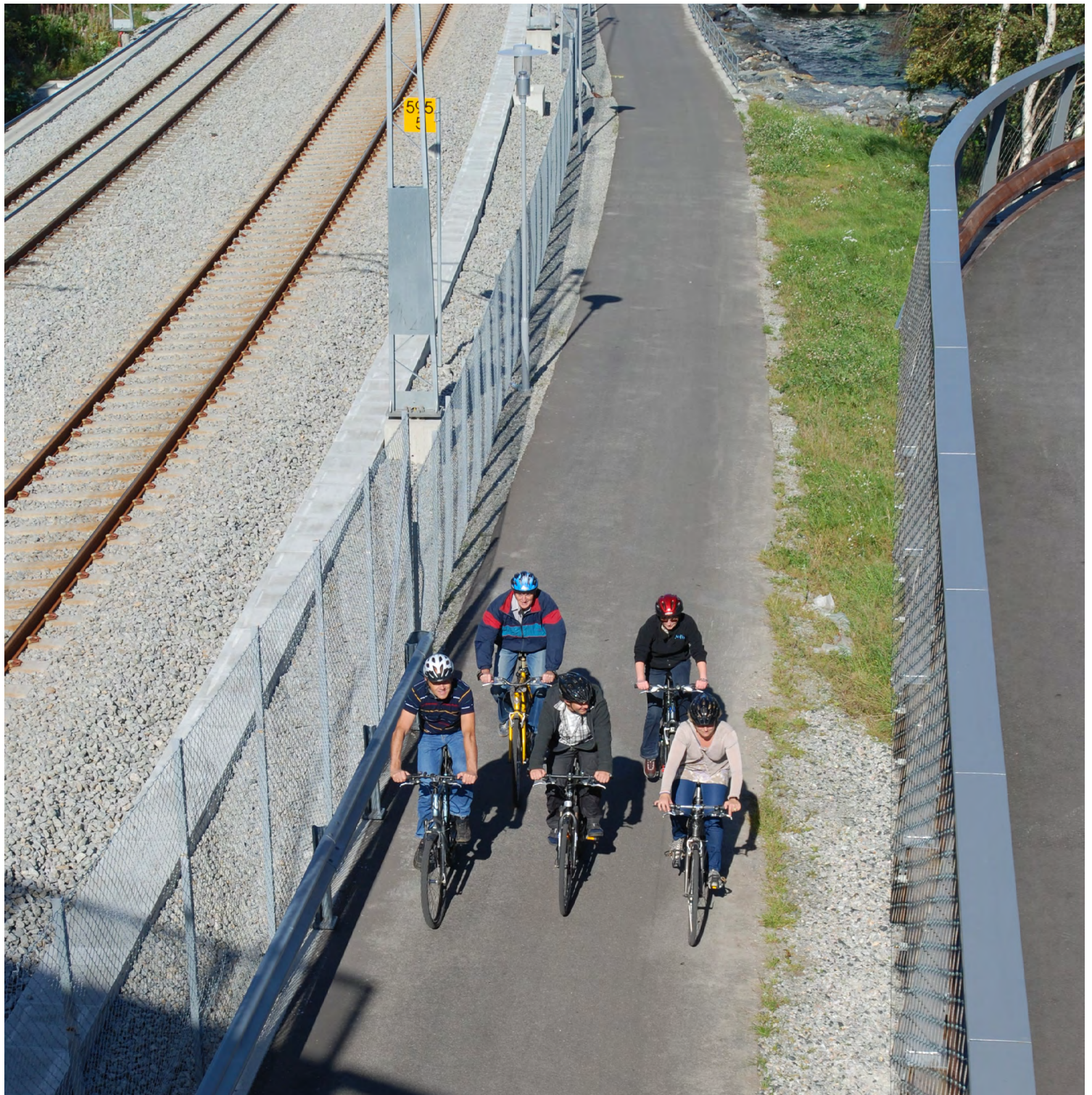


Climate and Environmental Plan 2018-2030

Adopted by Stavanger City Council
26.11.2018



STAVANGER KOMMUNE



Photos:

Front page: Angelika Hillingshäuser.

Sculpture in Mosvannsparken,

“Årvåken” by Hilde Mæhlum

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P. 57: Urban Sjøfront

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Climate and Environmental Plan 2018-2030

Stavanger Municipality's vision is "Together for a Living City". In concrete terms, this means that the municipality "Is present – Will lead the way – Is creating the future". The municipality also explains that: "Through our sustainable decisions and actions, we will provide future generations with the chance of a richer life."

Norway has signed up to the UN Sustainable Development Goals, which cover areas such as agriculture, water management, energy and consumption and production patterns, protecting ecosystems, using marine resources sustainably and actively working to counter climate change and its consequences. Many of the measures in this plan will help to achieve these objectives.

Climate change is already a fact and its consequences can be seen in the form of temperature rises and more extreme weather. The goal of the 2015 Paris Agreement is to keep the rise in global temperatures below 2 degrees Celsius, and preferably below 1.5 degrees Celsius in the lead up to 2100. Norway's national objective of becoming a low emissions society by 2050 means that greenhouse gas (GHG) emissions need to be cut from around 10 tonnes to 1-2 tonnes per person per year.

The earth's resources of raw materials and energy are not inexhaustible. Linear use and throw away thinking must be replaced by a circular mindset so that all resources can be kept in biological or technological circulation for as long as possible.

Stavanger, november 2018

Per Kristian Vareide
Chief Municipal Officer

Experience has shown that it is fully possible to achieve desired changes. Acid rain and the ozone hole, which were major concerns a few decades ago, are now under better control. Pedestrianised streets in cities where cars once reigned, waterfront footpaths in many places in Stavanger and interconnected cycling paths in every district are all the result of long-term local efforts.

Stavanger wants to be a green, climate-friendly and climate-robust city. This plan describes major and minor measures that are important for a more sustainable society and where the natural world and the environment are of value in themselves. A city with good transport systems, clean energy, little pollution, varied and viable nature, and areas designed for recreation and human interaction will also increase residents' well-being, which in turn improves public health. On 01.01.2020, Stavanger, Rennesøy and Finnøy will become a single, new municipality. Agriculture and aquaculture will be major industries in the "New Stavanger". They have also been afforded space in this plan.

Good living environments and conditions for both residents and business must be fundamental, at the same time as it should be easy to live in a climate-friendly and environmentally-friendly way thanks to major and minor choices and actions.

Thanks to everyone who contributed to the work on the plan!

Leidulf Skjørestad
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About the Climate and Environmental Plan

In brief

The most serious environmental challenges Stavanger faces are:

- emissions of greenhouse gases (GHGs) from road traffic, cruise ship tourism and energy consumption in buildings, in industry and on building sites
- seabed contamination
- periods of poor air quality due to excessive airborne dust and emissions of hazardous gases
- pressure on species and natural habitats
- emissions from aviation and marine shipping, as well as agriculture from 2020

The main objectives are:

- to cut greenhouse gases by 80 per cent by 2030 compared with 2015, and to be a fossil-free municipality by 2040
- to ensure it is safe to eat fish and seafood from all marine areas in Stavanger by 2030
- to ensure clean air for all residents
- to protect the living conditions of plants and animal life, and increase biodiversity

The measures the municipality will take to achieve this include:

- making it easier to walk, cycle, take the bus and train, and drive emission-free if you drive a car
- installing heating solutions that do not produce GHG emissions in the municipality's buildings and collaborating with other building owners and energy suppliers to achieve the same thing throughout Stavanger
- carrying out measures on the seabed where the contamination is worst
- providing support to households that purchase new wood-burning ovens with cleaner combustion and collecting a charge for driving with studded tyres
- protecting and conserving areas of natural importance and ensuring the viability of biodiversity in urban areas as well
- making more active use of the Norwegian Planning And Building Act to promote environmental measures in zoning and area plans, as well as in relation to private building applications

The municipality wants to help ensure raw materials, used materials and energy are properly managed in line with the principles of the circular economy.

The municipality will not purchase climate quotas in other parts of the world to achieve its objectives of minimising direct local GHG emissions in Stavanger.

The role of the municipality

The Climate and Environmental Plan is the municipality's strategy for ensuring sustainable development in collaboration with the rest of society. The role of the municipality is to act as an authority, facilitator and advocate in order to cut GHG emissions and preserve the natural environment.

As the planning and zoning authority, the municipality establishes guidelines that apply to throughout the municipality. The most important effort to cut GHG emissions is the work aimed at achieving urban development based on a coordinated land use and transport policy. The results of this work will include reducing the overall need for transport in the municipality.

The municipality is also contributing other measures that support climate policy such as energy solutions, parking standards, toll charges, low emission zones and facilitating cycling, walking and public transport. By setting high environmental standards for procurements and stipulating requirements for the municipality's units, the municipality can help to mature markets, e.g. for zero-emission vehicles and machinery on building and construction sites. A more detailed internal Climate and Environmental Action Plan for the municipality's units will be prepared later.

Relationship to other plans

Stavanger's Municipal Master Plan was adopted in June 2015 with the aim of preserving natural assets and cutting GHG emissions. When it is next revised, further measures will be introduced to secure fossil-free energy and heating solutions and to encourage a fossil-free transport sector. The increased need for passenger transport should be met by walking, cycling and journeys via public transport – the so-called zero growth target. The Municipal Master Plan also describes challenges associated with the need for restructuring in the business sector and society's vulnerability to climate change.

The Climate and Environmental Plan, which is a municipal sector plan, describes in detail how the objectives and intentions of the Municipal Master Plan can be transformed into action. Electrification of the transport sector and new renewable and local energy solutions will provide opportunities for cutting GHG emissions and creating jobs. "Smart solutions" can also help in line with Stavanger's "Smart City" project.

Reference is made in some of the thematic areas to more detailed technical plans. These include Stavanger's biodiversity action plan, master plan for the water supply, aquatic environment and wastewater, Green Plan, and climate adaptation strategy.

This plan is based on Stavanger's current municipal boundaries. However, given the decision to merge Stavanger with the municipalities of Rennesøy and Finnøy from 01.01.2020, extra attention has been paid to some themes, such as agriculture and the marine environment.

The structure of the plan

The Climate and Environmental Plan sees the climate and the environment as connected. Effective climate measures can be both technological and biological, and many measures will have a positive impact in more than one area.

Challenges, objectives, means, measures and performance indicators are described for each theme in the plan. Which UN Sustainable Development Goals the measures can help to meet is also shown in a separate appendix. A separate action plan has been drawn up as a supplement to the Climate and Environmental Plan 2018-2030. This covers the period 2018/19 -2022 and will be revised more frequently than the Climate and Environmental Plan.

Organisation of the planning work

Following input from several political committees and a public consultation process, the planning programme for the Climate and

Environmental Plan was adopted in February 2017. The chief municipal officer's management team was the steering group for the planning work. A project group consisting of around 20 specialists from relevant municipal departments and intermunicipal partners contributed technical content. A consultation process for the draft plan ran from May to June 2018. Environmental organisations, the business sector, neighbouring municipalities and others took part in consultation conferences. The plan was revised following an assessment of the submissions received during the consultation process.

The risk of not achieving the objectives

It will require efforts from the municipality, other authorities, residents, the business sector and others to achieve the objectives in the Climate and Environmental Plan. Some of the risk factors associated with not achieving the objectives are described below.

- **Financial resources**

The costs associated with many of the measures in the action plan are high and require political decisions. Prioritising important climate and environmental measures in the municipality's action and economic plan (HØP) is important if the objectives are to be achieved.

- **Personnel resources**

Enough competent personnel are required to follow up and implement the measures, especially in the transport and energy sectors, for information and to get the city's residents engaged.

- **Carrot or stick?**

Some of the measures proposed in the action plan could be regarded as incentives for some, but as restrictions for others. Gaining acceptance for the changes that are regarded as necessary may be challenging since this could entail changing habits, travel patterns, etc.

- **Conflicting objectives and dilemmas**

In several areas, the climate and environmental objectives may conflict with other

objectives the municipality and society have. One example is growth within tourism, where increased air and marine traffic also entail increased emissions. General growth in consumption, travel and other things can also result in increased GHG emissions, the consumption of finite resources and losses of natural areas and biodiversity, in Norway or in other countries.

Local and global responsibilities

Much of what happens in Stavanger impacts the environment and the climate, both locally and globally. It is the local challenges that we have the best chance of resolving because it is here that the municipality and other stakeholders have the most means. At the same time, negative consequences in other parts of the global are also part of our local responsibilities.

The international standard for measuring GHGs, the Greenhouse Gas Protocol, categorises GHG emissions into three scopes: Scope 1 are the direct local emissions from sources such as energy consumption and transport, Scope 2 are emissions linked to the production of energy, and Scope 3 are emissions and resources throughout the value chain that are linked to material use, infrastructure, transport, etc. in production and product sales.

This plan primarily focuses on solutions to the local challenges. However, the consumption of raw materials and energy for the production of food, construction materials and other products, as well as emissions from long journeys with global consequences, are also discussed. Reducing our global footprint is an important part of the local responsibilities. The circular economy, reuse and material recovery, energy saving and life cycle analyses for building projects are examples of this in the plan.

The UN Sustainable Development Goals, which were adopted in 2015, also discuss themes that are important when it comes to ensuring that people across the world are able to live good lives. All municipal planning will be based on the Sustainable Development Goals. The measures in the Climate and Environmental Plan are a contribution, in the local community and/or other places in the world.

SUSTAINABLE DEVELOPMENT GOALS



Facts about greenhouse gas emissions

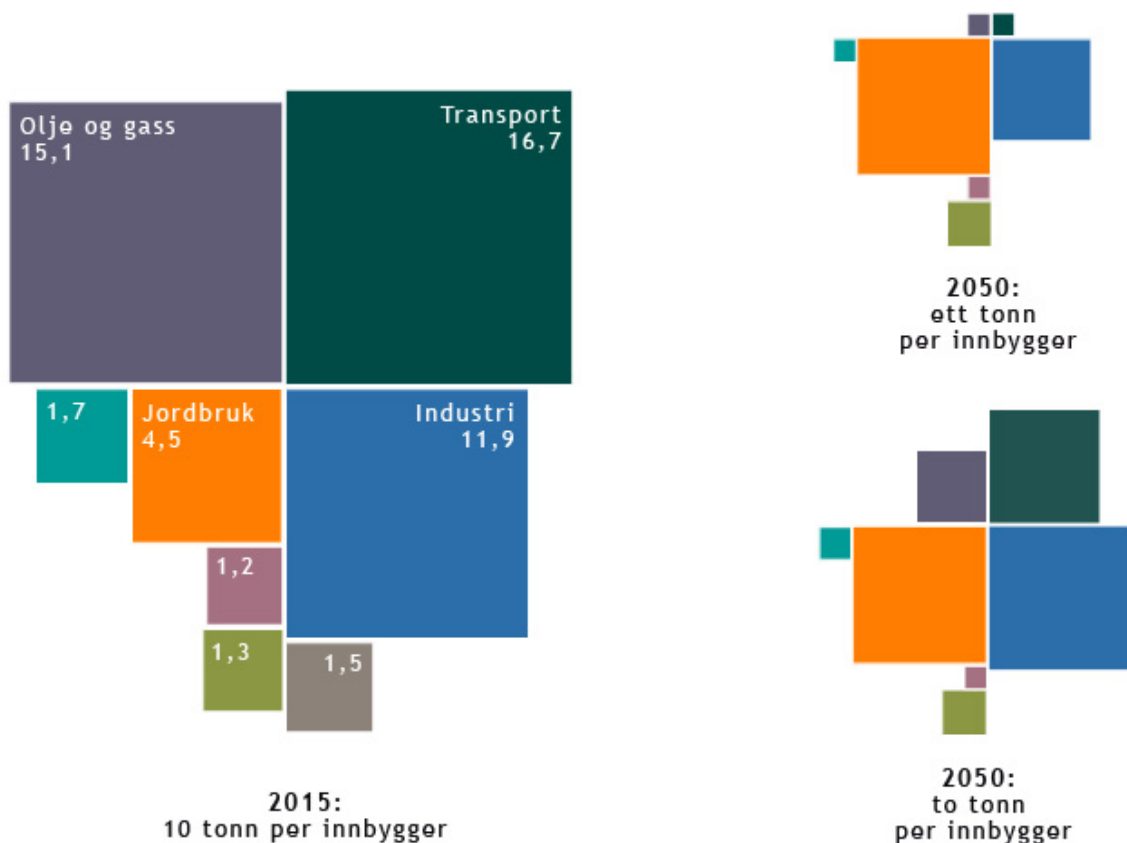
National and local emissions

National statistics for greenhouse gases (GHGs) include all emissions from Norwegian territory, i.e. oil and gas extraction, industry and mining, energy supply and heating, transport (with the exception of international marine shipping and aviation), fishing, agriculture and other sources.

A proportion of this is statistically allotted to the municipalities in Norway and counted as direct local emissions. The statistics now

include more emission sources than before: road traffic, other mobile combustion, marine shipping, heating, industry, agriculture, energy supply, waste and wastewater, as well as a proportion of aviation.

In 2017, Norway's emissions totalled 52.4 million tonnes CO₂ equivalents¹ (tCO₂e), according to Statistics Norway.² This amounts to 9.89 tonnes per resident. The direct GHG emissions in Stavanger have been calculated as an average of 1.99 tonnes per resident for 2017.



■ Energiforsyning ■ Bygg ■ Avfall ■ Andre utslipp

Figure 1 Greenhouse gas emissions in 2015 and two scenarios for 2050 (low emissions society)
Source: Norwegian Environment Agency

1 The most important GHGs are converted to CO₂ values based on their degree of climate impact. In this plan "CO₂" is used to mean "CO₂ equivalents" or "CO₂e".

2 Preliminary figures as at 15.08.2018

Objective and base year for reducing GHG emissions

The objective in the Norwegian Climate Change Act is that Norway's GHG emissions will be cut by at least 40 per cent by 2030, based on emission levels in 1990. By 2050, Norway should be a low emissions society, as shown in Figure 1, with GHG emissions of 1-2 tonnes per person. This entails an 80-95 per cent cut in current emissions.

Since the statistics for local emissions are most accurate for the last few years, changes in emissions for Stavanger were calculated on the basis of the 2015 figures from Statistics Norway. At that time, the GHG emissions in Stavanger were around 330,000 tCO₂. The figure below shows the development of GHG emissions in Stavanger from 2009 to 2016.

The objective in the plan is to cut greenhouse gases by 80 per cent by 2030 compared with 2015, and to be a fossil-free city³ by 2040.

Many municipalities have developed climate budgets, which estimate the impact different measures will have in terms of cutting GHG emissions. Stavanger Municipality has now done the same. Such a budget is a management tool and can also serve as a basis for measuring achieved results and perhaps boosting efforts. Costly measures must also be studied and adopted politically, with the associated assessment of the impact they will have in achieving the objectives.

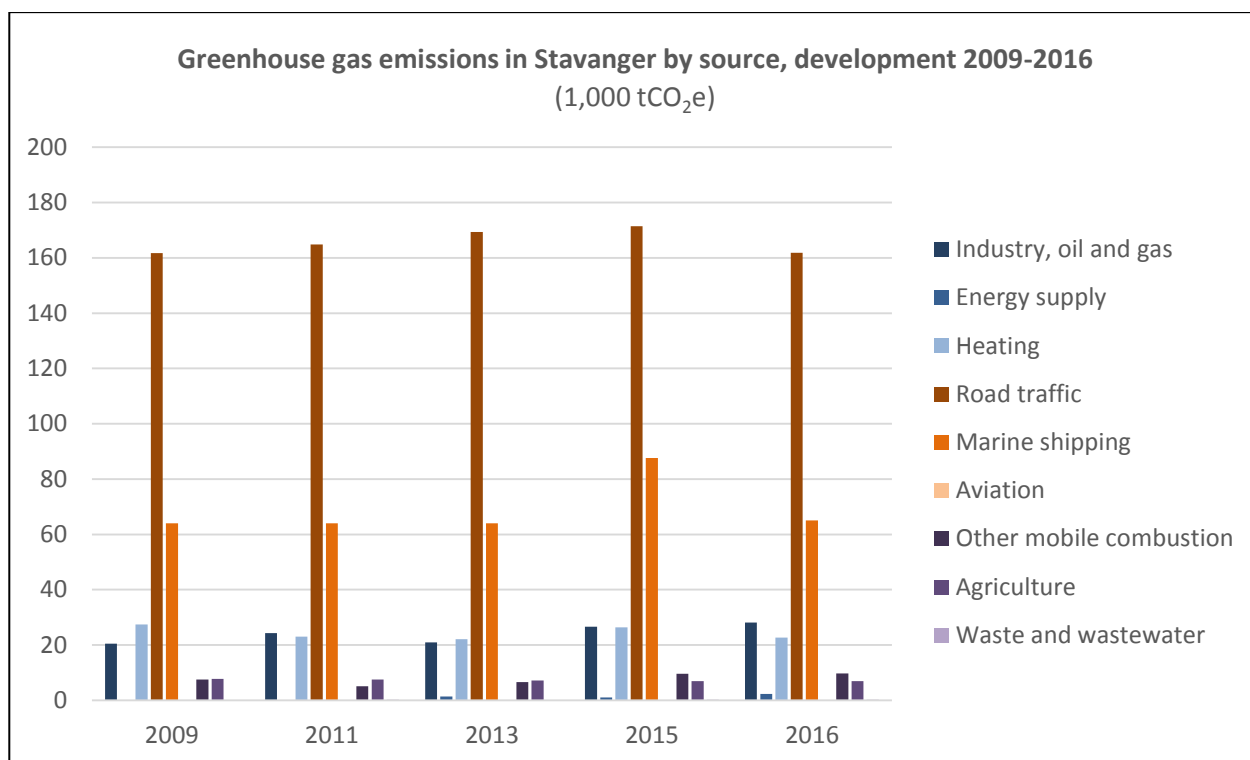


Figure 2 Greenhouse gas emissions in Stavanger by source, development 2009-2016

³ No oil, coal or fossil gas will be used for transport or heating buildings.



1 Transport

In brief

Here, transport primarily means transport on land by car, bike, public transport or on foot. Ferries, cruise traffic and aviation are also discussed. Around 52 per cent of GHG emissions in Stavanger come from road traffic. Cars also produce noise, cause wear on roads and kick up hazardous airborne dust. This chapter particularly focuses on climate challenges and measures.

The most serious challenges Stavanger faces from transport are:

- the high proportion of transport carried out using cars
- GHG emissions from cars, buses and goods transport
- airborne dust and hazardous gases from road traffic
- noise, especially from road traffic, but also from aeroplanes and ships
- emissions from air and ship traffic

The main objectives are:

- cutting direct GHG emissions from the transport sector by 80 per cent by 2030 and by 100 per cent by 2040
- making it easier to carry out everyday chores without a car in Stavanger
- meeting any increased need for transport through cycling, walking and public transport

In order to achieve this, the municipality will:

- facilitate more cycling routes and pedestrian routes, and properly maintain them
- collaborate with the county authority on improving public transport in the region, including the Busway (Bussveien)
- expand opportunities for charging electric cars and electric lorries, especially in co-ownerships and housing cooperatives
- contribute to the work on cutting emissions from ships that call at Stavanger



Overarching guidelines for transport

The National Transport Plan 2018-2029 (NTP) contains objectives and strategies designed to ensure that GHG emissions from transport will be cut with the aid of vehicle technology, more environmentally-friendly fuel, changed travel habits, more efficient commercial transport and transferring goods transport to both ships and rail, as well as emission cuts in the construction, operation and maintenance of infrastructure.

Exemptions from charges, free passage or reduced prices at toll stations and on ferries, as well as the opportunity to drive in public transport lanes, are helping to increase the number of electric cars and other zero-emission cars.

The government has announced a gradual increase in the proportion of biofuels for road traffic from 8 per cent in 2017 to 20 per cent in 2020. It is a stated objective that all new private cars should be emission-free in 2025 (White Paper No. 41 (2016-2017)).

“The Urban Package Nord-Jæren” and the city growth agreement were adopted in 2017. They have since been merged into the Urban Environment Package and involve the government contributing funds if the Nord-Jæren region manages to achieve the zero growth target for private car traffic. The Urban Environment Package includes, among other things, the 50 km long Busway and the 13 km long Sykkelstamveien (cycling path) between Stavanger and Sandnes via Forus. Development and densification must take place along the public transport routes. The measures should contribute to more people walking, cycling and travelling by public transport, and improve traffic flow for the required commercial transport.

Zero growth in private car traffic is, on its own, not enough to achieve the municipality’s objective for GHG cuts. Figure 3 shows two scenarios for CO₂ emissions from road traffic in Stavanger, assuming Stavanger sees the same development as Norway as a whole. The calculated development path is based on the assumption that the vehicle fleet will continue to develop as it has in 2010-2015 in

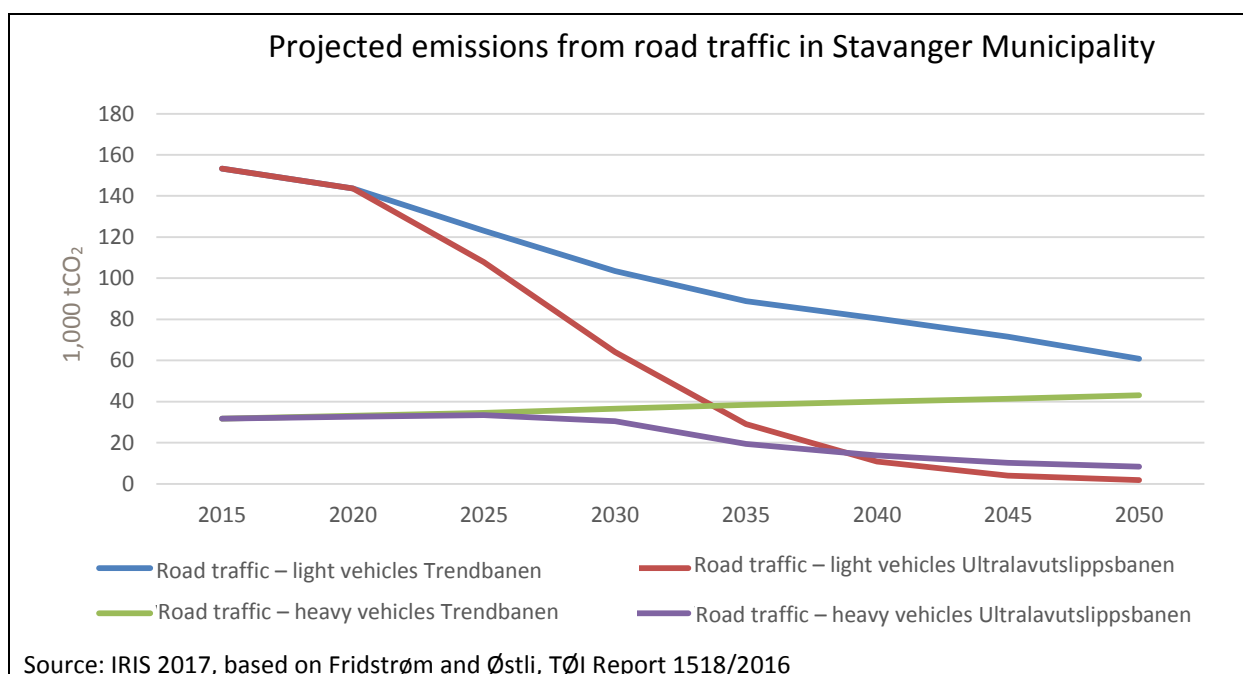


Figure 3 Projected CO₂ emissions (1,000 tonnes) from road traffic in Stavanger in the lead up to 2050⁴ Source: IRIS 2017, based on Fridstrøm and Østli, TØI Report 1518/2016

4 If the development in Stavanger mirrors the development expected for Norway as a whole.

the lead up to 2050. The “ultra-low emissions path” assumes that the objectives of the National Transport Plan (NTP) for 2018-2029 will be fulfilled.

This plan is based on the ultra-low emissions path, but sets as an objective that the transport sector will be fossil-free as early as 2040.

Development of passenger and commercial transport

Transport within the city limits

Population growth in the Stavanger region in recent decades has led to an increased need for both passenger and commercial transport. Approximately 500,000 journeys were made per working day in Stavanger in 2017.⁵ This is almost 120,000 more than in 1998. During the same period, the number of journeys by bike and on foot also grew strongly. The proportion of cyclists and pedestrians in the total number of journeys has increased, as shown in Figure 4.

Half of car journeys are 5 km or shorter and every fourth car journey is 2 km or shorter. Commercial transport in the form of heavy transport (larger vehicles) accounts for around 20 per cent of CO₂ emissions from road transport (Bayer, 2017). This does not include



Cargo bike

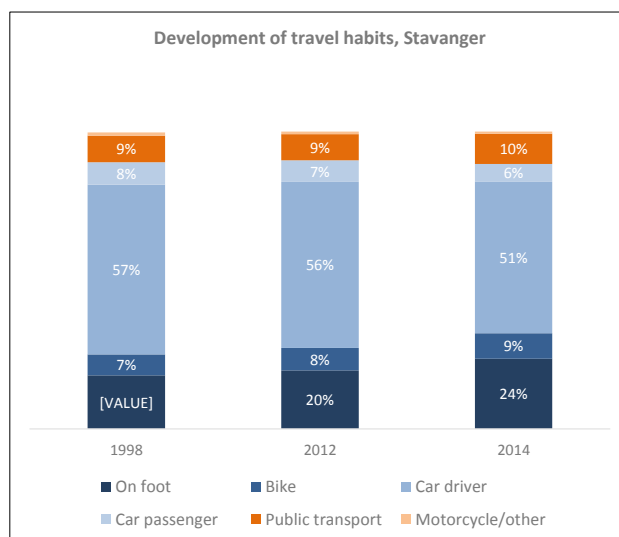


Figure 4 Development of means of travel distribution in Stavanger. Source: Travel habit surveys 1998, 2012 and 2014

emissions from smaller commercial vehicles. The development of the retail trade and on-line shopping will impact the development of transport going forward and will change the need for commercial transport.

New mobility trends

Electrification of the car fleet and new digital solutions have contributed to the development of new vehicles and opportunities for car sharing and carpooling. Examples include car collectives, private car borrowing schemes, or carpooling via various websites and apps. Bilkollektivet ASA has deployed five cars in Stavanger and a rental car firm is now also offering carpooling. Experience shows that a car sharing car can replace 5-15 private cars.

The number of electric cars has grown quickly and in 2017 electric cars accounted for 30 per cent of new car sales. Within 10-15 years, most of the vehicle fleet will have been replaced. Autonomous vehicles, i.e. self-driving vehicles and, eventually, driverless cars, are also expected to become more common. Electric bikes and cargo bikes are also becoming more common in cities.

Climate and environmental impact of long journeys

The travel habits survey shows that 36 per cent of long journeys taken by residents of Stavanger, i.e. 100 km or more, are taken by

⁵ Estimate based on Stavanger’s population on 01.01.2017 and travel habits in 2014.

car, 52 per cent by aeroplane and the rest by bus, ship and train. It also shows that Stavanger has a high proportion of air travel compared with other Norwegian cities.

The travel habits survey shows that 36 per cent of long journeys taken by residents of Stavanger, i.e. 100 km or more, are taken by car, 52 per cent by aeroplane and the rest by bus, ship and train. It also shows that Stavanger has a high proportion of air travel compared with other Norwegian cities.

One of Stavanger's stated objectives is to focus on tourism and travel, including through facilitating cruise traffic. In 2017, 181 cruise ships carrying an estimated 340,000 passengers called at Vågen in Stavanger.

The Western Norway Research Institute has estimated the GHG emissions from flights and cruise traffic to and from Stavanger in 2016 at 135,000 tCO₂. These emissions were not included in local emissions at the time, but are included from 2018 thanks to the Norwegian Environment Agency's new calculation model. GHG emissions linked to international flights and cruise traffic are not recorded in either the country the passengers depart from or arrive in.

Objectives for transport

Primary objective

In 2030, direct GHG emissions from the transport sector have been cut by 80 per cent and by 100 per cent in 2040.

Secondary objectives

- 70 per cent of passenger transport takes place by bike, foot and public transport in 2030, measured by number of passenger journeys
- Streamlining commercial transport and urban logistics
- Average journey length will be shorter
- GHG emissions from light vehicles have been reduced by 80 per cent by 2030 and by 100 per cent in 2040
- GHG emissions from heavy vehicles have been reduced by 20 per cent by 2030 and by 100 per cent in 2040
- Port operations, express boats and ferries are fossil-free by 2030

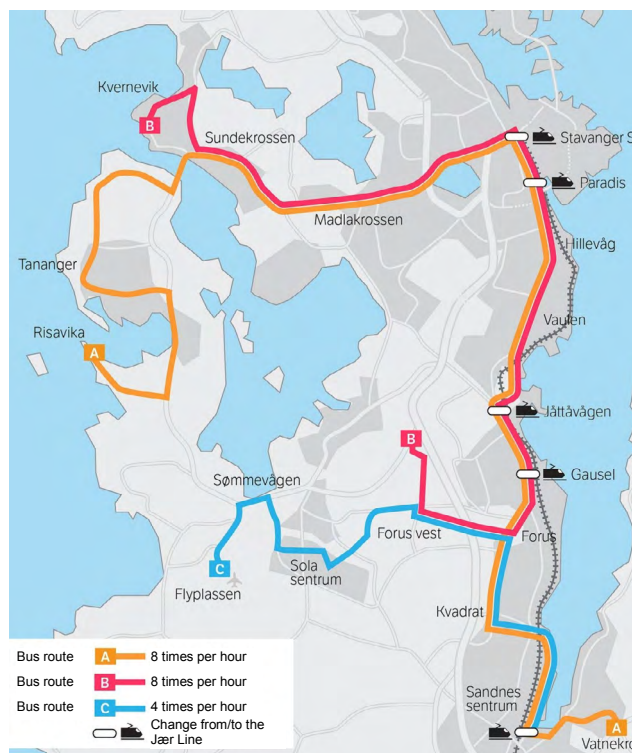


Figure 5 Map of the Busway 2023

Source: Rogaland County Authority

- Reducing the negative impact of long journeys to and from Stavanger
- Stavanger Municipality will strive to ensure its vehicle fleet is emissions free by 2025.

Means and measures

Road traffic within the city limits must be cut in order to achieve the zero growth target. The municipality will seek to work with neighbouring municipalities, the county authority, the business sector and residents. Ensuring seamless changes between means of transport is essential to making travel without using a private car easy and attractive.

Mobility points for changing between ships, buses, rail, city bikes, car sharing cars, etc. have been incorporated into the municipal sector plan for Stavanger city centre and the area plan for Madla-Revheim. Other service functions such as package pick-up, recycling points, bike repairs, distribution points for goods and other things may also be located at mobility points.

Cooperation on the means and better facilitation for zero-emission technology, both for

cars and ships/ferries, will be crucial for cutting GHG emissions in Stavanger. Intelligent transport systems (ITS) will also contribute to more efficient transport solutions and thus lower emissions.

These specific measures have been commenced or planned:

Public transport

The Jærbanen railway line is an important basis for public transport in Nord-Jæren. Several major transport projects are under construction. Sections of the Busway routes will be opened as they are completed in the lead up to 2023. Scheduled services in Nord-Jæren will be expanded by 20 per cent in 2016 and the bus fleet renewed so that it satisfies the latest emissions requirements (Euro VI). Five electric battery-powered buses are also in use. The objective is for the buses to be emission-free. Cycling and walking conditions along the routes will also be improved. Buses outside the Busway network will also experience better traffic flow.

The public transport company Kolumbus became a "mobility provider" in 2017 and is working to ensure that buses, ships, trains, bikes, walking and car sharing work together seamlessly to make getting from A to Z without a car easy.

Transport by car and charging strategy

The new toll zone linked to the Urban Environment Package Nord-Jæren with 38 stations and higher rush hour charges will finance the measures in the package and regulate traffic. Efficient commercial transport will be prioritised during the development of Transport Corridor West and European route E39. The facilitation of walking, cycling and public transport as alternatives to private cars should also provide better road capacity for commercial transport.

The parking policy must contribute to units with many employees, or that many people visit, locating themselves centrally in the city limits where transport other than by car is available. A "charging strategy for the establishment of charging infrastructure in Sør-Rogaland" was adopted by the Municipal Council for the Environment and Development (KMU) in autumn 2017. 160 charging

points for electric cars were available to the public in 2017 and this will increase to around 270 during 2018. A fast charging station for taxis will be established at Jernbanelokket parking area in 2018.

Stavanger Municipality will strive to ensure its vehicle fleet is emissions free by 2025. Exemptions are made for vehicles for which technically acceptable emission-free solutions are not available and where existing vehicles in 2025 will not yet be ready for replacement.

Bikes

Sykkelstamveien between Stavanger and Sandnes will enable fast cycling without hindrances. Almost 200 electric city bikes for rent have been deployed in 46 locations within the city of Stavanger and the service will be expanded in the region. The "Hjem-JobbHjem" (HomeWorkHome) concept offers discounted monthly season tickets for buses and trains, as well as the free use of electric city bikes for employees of companies in Nord-Jæren that have signed an agreement. As of September 2018, 404 companies were taking part with a total of around 50,000 employees. The scheme may be expanded to include car sharing and electric cars.

Marine shipping

The county authority will stipulate strict environmental requirements for ferry transport to Vassøy and Byøyene. A new contract will be awarded for the Finnøy route from 2020. "Low emissions" have been set as a minimum requirement in the call for tenders. In 2018, the county authority also received EU support for the development of an electric express boat. The boat will operate between Stavanger and Hommersåk, and later similar boats will be tested in other European cities in the "TRaM" project.

Cruise traffic and ports

According to an EU directive (Directive 2014/94/EU) from 2014, port cities should facilitate shore power for ships by 2025 if demand, financial and environmental considerations call for this. In 2017, the Port of Stavanger received approval to install shore power for supply vessels. The costs associated with making this available for cruise ships as

well are being studied. Shore power, or the use of batteries on board, will result in lower emissions of GHGs, particles and hazardous nitrous gases since diesel generators are replaced by electricity during stays in port.

Stavanger Municipality is partnering with the tourism industry and other Norwegian port cities on an initiative aimed at the lobbying the government to put in place common Norwegian regulations, with a view to cutting emissions from cruise ships both in port and at sea.

An index for assessing ships' environmental impact during stays in ports, the Environ-

mental Port Index, is also being developed. This system will allow ships that achieve the best scores to be rewarded via environmentally differentiated port charges.

Awareness work

Campaigns, information on smart travel options and awareness and action generating work will be carried out via the mobility package, HjemJobbHjem, city bikes, "Stavanger på sykkel" and the annual Environment Sunday. In December 2013, the City Council decided that in general the municipality itself will procure zero-emission vehicles.

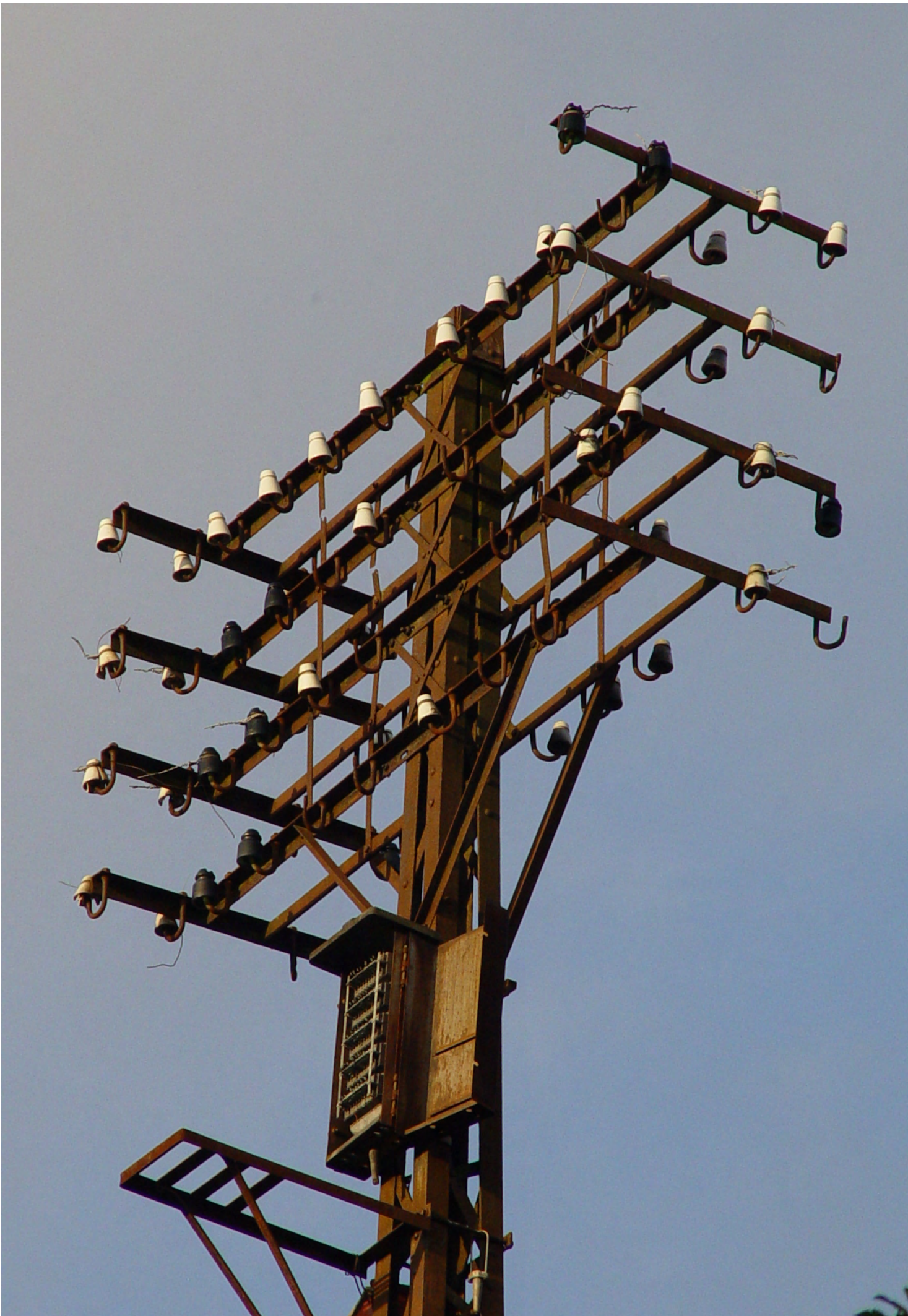
A detailed overview of further measures can

Performance indicators

- **Statistics for GHG emissions in Stavanger from light and heavy vehicles**
- **Number of charging points for electric cars available to the public**
- **Development of the vehicle fleet and its composition**
- **Number of people who are members of car sharing schemes**
- **Means of travel distribution for passenger transport and by journey purpose**
- **Means of travel distribution for long journeys**
- **Indicators for land use and parking, detailed in the city growth agreement and travel habits survey**
- **Traffic index for road traffic (vehicles), bike traffic and pedestrian traffic based on counts from permanent registration points and municipal counting points**
- **Statistics for renting city bikes and kilometres ridden**
- **Counting public transport journeys**
- **Number of calls by cruise ships that get an environmental discount (Environmental Port Index)**
- **Number of households that do not own their own car**

The municipality will also report on the distance from homes and workplaces to larger centres and public transport hubs, and on variables associated with parking. These are requirements linked to the Urban Environment Package.





2 Energy and material use in building and construction

In brief

Around 11 per cent of local GHG emissions in Stavanger come from stationary energy, i.e. energy used for purposes other than transport. This chapter covers energy and material use in buildings, municipal technical systems and construction work, and energy use in industrial installations.

The largest local challenge related to energy and material use is GHG emissions from fossil energy sources.

The main objectives are:

- GHG emissions from buildings and construction sites have been cut by 80 per cent by 2030 and by 100 per cent by 2040
- increase the proportion of the energy consumption that uses local renewable energy sources

In order to achieve this, the municipality will:

- phase out all fossil-based energy sources in municipal buildings by 2020, and on municipal building and construction sites by 2021
- set stricter environmental standards for new municipal buildings
- obtain an overview of energy sources and consumption patterns throughout the city and, in collaboration with building owners, work to replace fossil energy with fossil-free or emission-free energy

Local energy sources and new opportunities

Total energy consumption in Stavanger in 2016 amounted to 1,790 GWh.⁶ Electricity produced by hydropower is the main source of heating in buildings in the Stavanger area. Oil and kerosene are used for heating and industrial processes in some homes and commercial buildings in Stavanger. The use of oil and kerosene for heating will be banned in all types of buildings from 2020. Around 550 tanks in homes and commercial buildings were registered in autumn 2018.

The last few years have seen the construction of Lyse's natural gas and biogas network, district and local heating networks, and a biomass plant. Since 2007 and the tightening of the building regulations, the use of heat pumps with energy absorption from the air or energy wells has become a standard energy solution. So far, solar and wind energy have not been used that much, but energy from other renewable sources is being tried out. Biochar can be produced from green waste through an anaerobic combustion process called pyrolysis. The heat can be used directly in a local heating system, while the charcoal is a good soil conditioner that also captures large quantities of CO₂. Stavanger Municipality has commenced a trial project for this with the support of the Norwegian Environment Agency.

⁶ 1 GWh (gigawatt hour) = 1 million kWh (kilowatt hours)

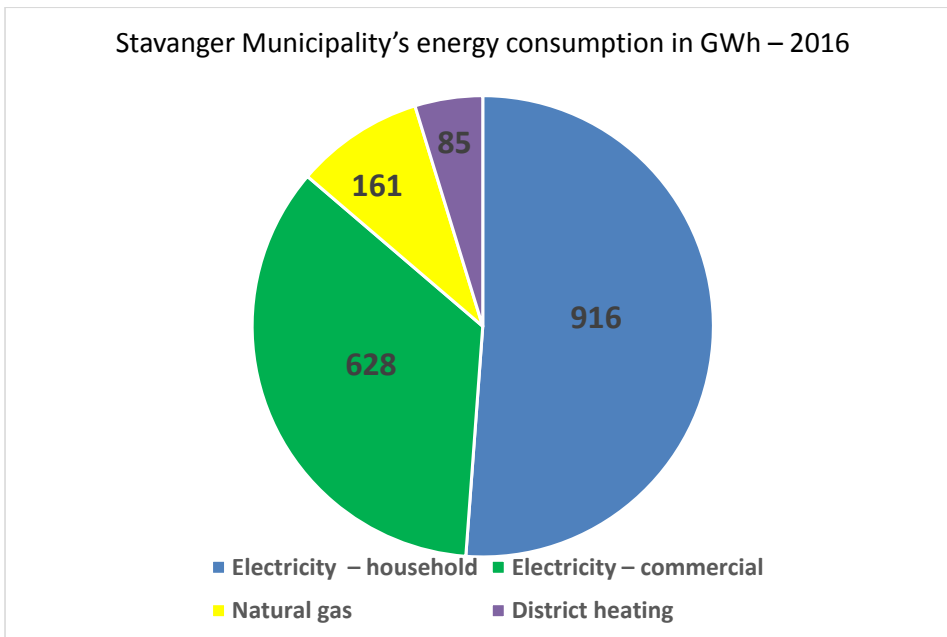


Figure 6 Energy consumption in Stavanger in 2016. Source: Stavanger Property

The potential for biogas from agriculture and aquaculture in the region is great, but requires expensive infrastructure. Several major industrial companies in Stavanger are working on systematically cutting GHG emissions from stationary energy and their machinery.

A regional strategy was adopted for heating and energy in 2015. This covers Stavanger and six surrounding municipalities. It sets out a plan for connecting to Lyse's district heating network, which uses heat from the waste incineration plant in Forus, in areas where Lyse has a licence, and locally adapted solutions in other areas. Developers can choose other energy solutions if these are better for the environment than district heating.

According to the regulations, new commercial buildings exceeding 1,000 m² must have an "energy flexible" heating system. In many cases this means the use of waterborne systems for heating. This provides flexibility with respect to the energy source, but becomes relatively more expensive as the need for heating falls due to better insulation in

line with the building regulations. Stavanger Municipality stipulates a local requirement that all buildings exceeding 500 m² must have waterborne heating and that 60 per cent of heating needs must be met by renewable energy.

GHG emissions from various energy sources

There are a variety of methods for calculating emissions from energy sources (Strømnes, 2017)⁷. The emission factors used for the different sources of energy can have an impact on the choice of strategy for achieving climate targets.

The Norwegian Environment Agency and Statistics Norway do not count emissions linked to electricity given that it is generally produced using hydropower. In order to follow the development over time and compare Stavanger with other Norwegian cities, the official municipal data from Statistics Norway, without expected GHG emissions, will be used in future measurements and reports. Stavanger will also show what the outcomes would have been with other emission factors as a means encouraging lower energy consumption. Irrespective of the selected emission factor, the objective is to use energy resources efficiently. By minimising the need to expand the supply

7 See the excerpts from the NIRAS Report "Vurdering av utslippsfaktorer for ulike energikilder" ("Assessing emission factors for different energy sources") in Appendix 3

of energy, the natural world and environment can be spared from interventions and emissions.

Waste incineration at Forus Energigjenvinning provides electricity, as well as heat for the district heating network. Plastic waste made from fossil carbon produces GHG emissions, but these will be significantly reduced when IVAR's sorting plant for household waste in Forus is commissioned from 2019. In 2018, Lyse NEO phased out natural gas for peak loads in the district heating plant in Forus and replaced it with climate neutral biogas. Lyse's local heating plants also use a proportion of biogas, depending on availability. The plant at Urban Sjøfront in Stavanger East will be connected to the district heating system in 2020.

Waste incineration is considered "energy supply" in the National Environmental Accounts (Norwegian Environment Agency, 2018) and was reported to the UN with an emission factor of 550 kg CO₂ per tonne of incinerated municipal waste in 2016 (Statistics Norway, 2016, p. 236). The municipality will show Stavanger's proportion in its annual status reporting.

Energy use in the municipality's buildings

Stavanger Municipality owns and operates around 650,000 m² of buildings for municipal purposes and is a major consumer of energy. Electricity accounts for approximately 96 per cent of this. The municipality applies the so-called Kyoto Pyramid principles in its building projects. These involve first minimising the need for heating and electricity and then using solar energy before choosing a heat source. Municipal buildings are generally heated by fossil-free sources. Fossil fuel sources must be completely phased out of existing municipal buildings by 2020.

Figure 7 shows electricity consumption in municipal buildings from 2012 to 2017. Electricity consumption has fallen by around 15 million kWh, i.e. 15 GWh. This is in spite of the increase in floor space. Natural gas and district heating account for 1.3 GWh and 2.4 GWh, respectively. Expansion of the district heating network and conversion from natural gas to biogas could free up high-value electrical energy.

40-70 per cent of the energy used in municipal buildings is used for heating, tap water

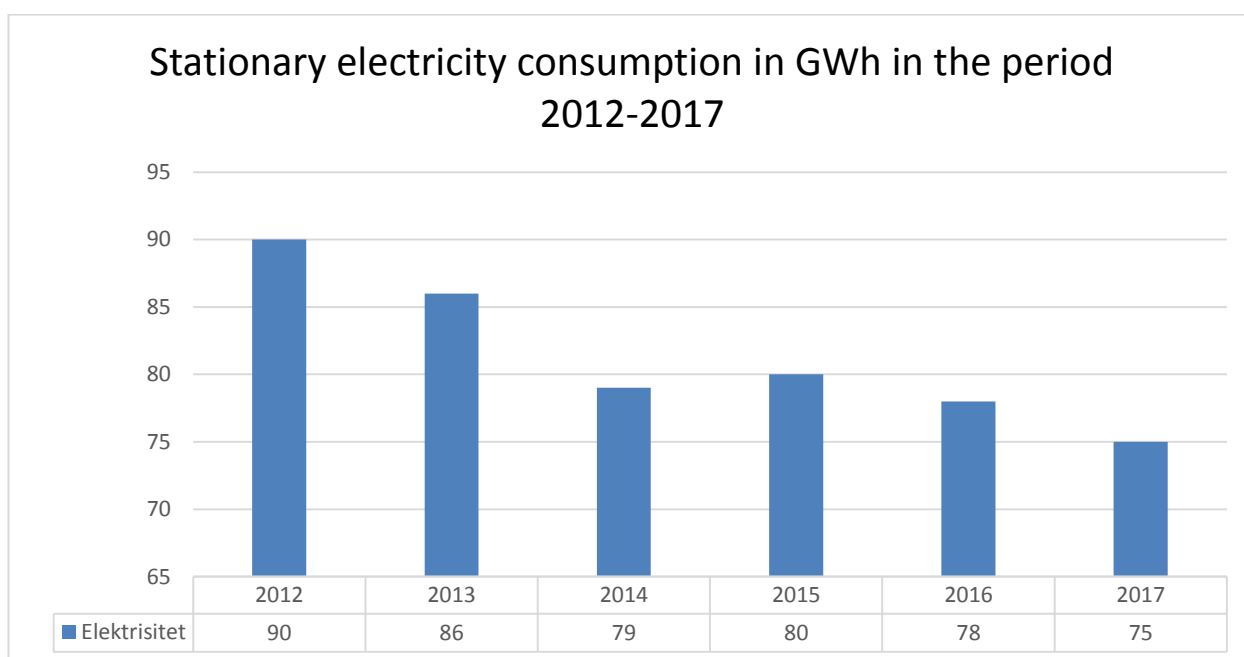


Figure 7 Stationary electricity consumption in Stavanger Municipality's service buildings 2012-2017
Source: Stavanger Property

and fan operation. These three energy items are the areas where efforts must be increased to achieve the climate objectives and further reduce energy consumption. Better demand management, utilising local energy sources and increasing the use of solar electricity may be good measures. The increased use of, for example, solar cells integrated into building facades and roofs could replace much of the electricity consumed through general use and heating.



Figure 8 Energy from wastewater in municipal buildings in Stavanger city centre
Source: Stavanger Municipality

In the national “Framtidens Byer” (Future Cities) project that ran from 2009 to 2014, the municipality gained important experience from both homes and other buildings with a passive house standard.

Stavanger Municipality is taking part in the EU project “Triangulum”⁸ from 2015 to 2020, and the energy centre, which distributes heating and cooling for 20,000 m² in three municipal buildings, obtains renewable energy from the city’s wastewater tunnel in the area. The buildings are shown in Figure 8.

Figure 8 Energy from wastewater in municipal buildings in Stavanger city centre
Source: Stavanger Municipality

Material use

As the amount of energy supplied to buildings decreases, construction materials will account for a larger proportion of a building’s climate impact. These are not counted

as local emissions, although cutting these emissions is nevertheless an objective. The City of Oslo stipulates requirements that building projects must promote the reuse of materials and prioritise eco-labelled and recyclable materials in line with the circular mindset (Oslo Municipal Undertaking for Educational Buildings and Property, 2015).

Requiring environmental product declarations (EPDs) for individual building elements or materials increases opportunities to choose good environmental solutions. It will also raise the awareness of the suppliers. Wood, which is a renewable and climate-friendly material, will be part of the solution to achieving ambitious climate requirements.

Emission-free building and construction sites

The building and construction industry is responsible for substantial CO₂ emissions in cities: 18 per cent in Oslo, 13 per cent in Trondheim and probably around the same amount in Stavanger. Construction activities also have negative impacts in the form of noise, dust, particles, NO_x and the contamination of groundwater, surface water and soil.

Stavanger Municipality’s objective is to achieve fossil-free building and construction sites in 2021, and emission-free sites in 2030. Here, a “Construction site” means a place where larger works are being carried out to, for example, ready an area for development or road building, trenches for pipes and cables, etc. This often involves moving large quantities of soils. A “building site” is temporary, while the actual building is taking place. Sheds, the on-site transport of goods and drying the building once the roof is watertight are some of the major sources of GHG emissions.

Figures from Statistics Norway show that GHG emissions in the building and construction industry are rising, ref. Figure 9.

Energy use in the building and construction industry is largely due to large quantities of soil being transported long distances, little

8 EU-project SCC01 #646578

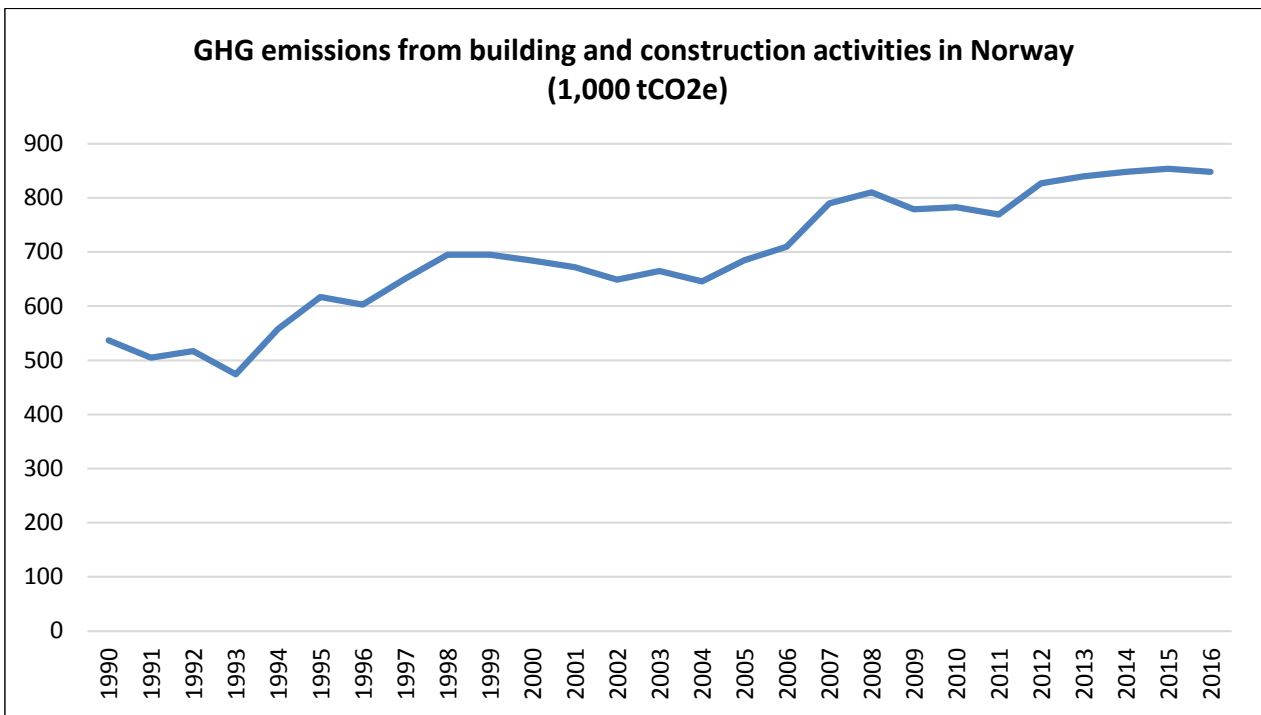


Figure 9 GHG emissions from building and construction activities 1990-2016
Source: Statistics Norway

reuse and the disposal of large quantities of soil. The county authority has taken the initiative to draw up a regional plan for soil management.

Stavanger Municipality invests around NOK 900 million in building and construction every year. The municipality can stipulate environmental requirements regarding the energy sources chosen for machinery in building and construction processes, as well as for the solutions in the building itself.

The largest excavators on construction sites and drying equipment in buildings are the biggest contributors to CO₂ emissions. Electric excavators are currently only available in the smallest weight classes (8-10 tonnes), although prototypes of larger machines have been developed. The construction machinery on a normal construction site will probably be electrified by 2030, with fossil fuels (sustainably produced hydrogen or biofuels) as an intermediate solution. This should act as the basis for the requirements the municipality stipulates.

Buildings are usually dried using diesel generators. The emissions can be reduced by using, for example, fossil-free gas or district heating.

Objectives for stationary energy and material use

Primary objectives for GHG emissions

Direct GHG emissions from buildings and building and construction sites have been cut by 80 per cent by 2030, based on 2015 levels, and by 100 per cent by 2040.

Secondary objectives for the city

- By 2030, direct GHG emissions from stationary energy have been cut by 80 per cent.
- A complete overview has been produced of energy sources and consumption patterns in Stavanger in a collaboration between Stavanger Municipality and energy suppliers
- Natural gas as a heating source has been phased out within the city limits by 2030
- The utilisation of local renewable energy resources is increasing
- By 2040, all building and construction sites are emission-free.

Secondary objectives for the municipality's building and construction

- By the end of 2018, the overview and monitoring of the energy consumption in all municipal buildings and other municipal technical systems is in place

- Energy management in line with ISO 50001 has been introduced by 2019
- All fossil-based energy sources have been phased out in municipal buildings by 2020
- New buildings and totally renovated buildings gradually achieve lower GHG emissions. The development pathway moves from passive house, via zero-energy building and plus building to zero-emission building⁹ in 2030
- By 2021, all municipal building and construction sites are fossil-free and by 2030 emission-free.

Means and measures in the municipality

Provisions in plans

The current Municipal Master Plan contains provisions and guidelines on environmental profiles for new buildings and building renovation covering factors such as energy use, material selection, transport and soil management.

The Municipal Master Plan also states that energy solutions and measures based on renewable energy from local thermal resources should be prioritised, for example, geothermal, heat from seawater, surplus heat and district heating. Low value energy should be chosen for heating buildings and tap water, and all new buildings should be built with highly energy-efficient solutions.

Area transformation

No comprehensive overview exists of energy sources in Stavanger's buildings. Stavanger Municipality wants to procure such an overview so it can, together with building owners, assess areas where renewable energy can replace fossil energy. Various financial support schemes exist for such measures, including from Enova.

Conscious planning and procurement

The Norwegian Public Procurement Act stipulates environmental requirements for buyers aimed at minimising environmental impact and promoting climate-friendly

solutions. The municipality can stipulate environmental requirements and criteria in all phases of procurement processes where these are relevant. Expensive durable materials can be chosen instead of cheaper materials with short lifetimes.

Strict environmental requirements will help ensure the market adapts to stricter climate and environmental requirements, and the municipality can lead the way for other stakeholders. Specific environmental objectives, close cooperation with environmental consultants, planning and facilitating emission-free building sites and environmentally-friendly materials result in lower emissions and energy consumption. Using the BREEAM NOR environmental certification scheme, one can classify environmental ambitions and produce climate and environmental accounts for both new and renovated buildings. Life cycle costs (LCC) and GHG accounts are prepared for all municipal buildings in their preliminary project phase, and more detailed calculations in the detailed design, tender and building phases, as well as upon completion, are becoming more common.

Stavanger Municipality currently uses some recycled materials, including asphalt, in road building and other construction works. Increased reuse, with a weight on durability and environmental qualities, is an objective. The municipality also reuses some old materials from their own activities in buildings, parks, etc.

Energy monitoring in municipal buildings

The operations and energy centre in the municipality, which was established in 2011, monitors almost 150 of the municipality's buildings via an operations control centre (OCC) and an energy monitoring system (EMS). Non-conformities and energy leaks are thus quickly identified. By the end of 2018, all buildings that can adopt central control will be connected to the centre.

Other municipal technical systems, such as pumping stations for water and wastewater, as well as systems associated with bathing areas, playgrounds, sports facilities, etc. must

⁹ See Appendix 2 for definitions

also be included such that energy consumption is monitored and reported. Reducing leaks in water mains is an additional measure aimed at reducing the use of both energy and chemicals.

When premises, buildings and homes are leased, the municipality will aim for fossil-free heating and the best possible energy classification. The same applies to renegotiations or developments regarding existing leases.

The measures are described in more detail in a separate action plan.

Performance indicators

Municipal buildings:

- Energy consumption (electricity) in municipal buildings
- Number of municipal buildings connected to central energy monitoring
- Number of documents in the form of EPDs, GHG accounts, "as built" for new buildings, measured energy consumption and from which energy source, after use of the building starts
- Climate accounts for the energy consumed in the municipality's buildings, by type of service building and energy source
- Climate and energy accounts for building and construction sites showing the energy used by the various machines and vehicles, sheds and building heating/drying, various energy sources, as well as CO₂ emissions
- Number of BREEAM certified new buildings exceeding 5,000 m²
- Measured energy consumption in kWh/m² in buildings. This measures the effect of energy reductions over time, since it takes increases in floor space into account.
- Number of leases that require fossil-free heating

The whole of Stavanger:

- Consumption of stationary natural gas from Lyse
- Climate accounts for energy consumption
- The proportion of renewables in energy production, both for municipal buildings and for the city as a whole.
- Degree of local renewable energy resources utilised, such as biomass, geothermal, heat from wastewater, wind, solar, etc. Show available resources and how much of these are being utilised, e.g. for heating buildings.

Vi gjenvinner alt vi finner!

Kyss og klem,  NATUR OG
UNGDOM



3 Consumption, reuse, recovery and waste management

In brief

Goods consumption in Norway has doubled since the 1970s. Every resident of Stavanger generates an average of 425 kg of waste per year. Some non-renewable raw materials may run out if we do not use them wisely.

The main objectives are:

- as little consumption of materials as possible
- use things for as long as possible, repair and recover as much as possible
- manage hazardous waste in an environmentally responsible manner
- become a plastic bag-free municipality and sharply reduce the use of single-use plastic
- reduce the waste from each resident from 425 kg per year to 300 kg per year

In order to achieve this, Stavanger Municipality will:

- facilitate and support measures that promote repair and reuse
- work with organisations and neighbouring municipalities to reduce food waste
- work to ensure that a larger proportion of waste from households, businesses and municipalities can undergo material recovery

Sustainable consumption and the circular economy

Goods consumption in Norway has doubled since the 1970s. Our “ecological footprint” shows that we would need more than three earths if everyone on the planet lived the same way we do (Global Footprint Network, 2017). Some non-renewable raw materials in the natural world, e.g. some metals and minerals, could be used up.

The “cradle to cradle” principle, or the “circular economy”, is a guiding principle and focus area in the EU, and has also been incorporated into Norway’s waste strategy (White Paper No. 45 (2016–2017)). To ensure sustainable development and maintain security of supply, material consumption must be kept as low as possible, including through sharing things and equipment. Products must be manufactured in a way that ensures

they can, to the fullest extent possible, return to their original form at the end of their lives and remain in technical or biological circulation for as long as possible. The circular economy principle has also been incorporated into the resource and waste plan for the IVAR region for 2016-2022, which Stavanger Municipality helped draw up and has signed up to.

Objectives for consumption and waste

There are four focus areas in the IVAR region’s resource and waste plan.

Bioresources in circulation: The proportion of wet organic waste in residual waste should be below 20 per cent. Material recovery of bioresources must be prioritised

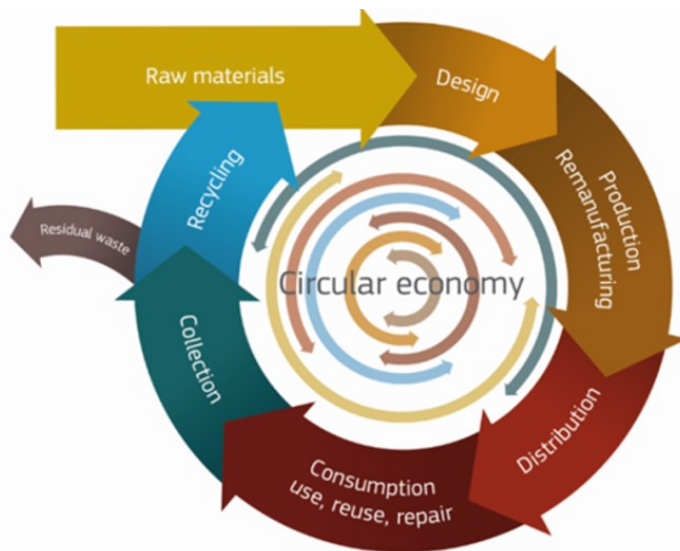


Figure 10 The circular economy
Source: EU report "Towards a Circular Economy."

over incineration and utilised as locally as possible. Extracting the carbon component of biowaste and transferring it to permanent carbon sinks (biochar) should be assessed.

Waste reduction: Increased reuse of used objects, more repairs of things that would otherwise be thrown away and less household food waste.

Material recovery: At least 75 per cent of all household waste should be source separated with the aim of ensuring that everything will undergo material recovery by 2030.

Management of hazardous waste/WEEE The proportion of hazardous waste and WEEE in residual waste from households will be kept below 0.5 per cent in total. At least 90 per cent of residents are aware of how they should properly dispose of hazardous waste and WEEE.

Stavanger Municipality has also established its own climate and environmental objectives:

- Household refuse must be collected using zero-emission vehicles, to the extent this is technically feasible and with the understanding that the collection must be safe and uninterrupted.
- By 2025, all waste that is incinerated or delivered for incineration, both house

hold and commercial waste, must have first passed through a sorting plant. This applies to all waste collected in the municipality, whether it will be incinerated locally or elsewhere.

- By 2040, GHG emissions from the incineration of waste have been reduced by 90 per cent compared with 2017.

Means and measures

Consumer Information

Information campaigns will inform consumers about how to dispose of hazardous waste properly and provide other environmental information, e.g. about microplastics and pollutants in everyday products.

Reuse and recovery

In addition to second-hand shops and websites such as finn.no, several new measures have been established to prevent usable products becoming waste. IVAR's "swap shed" at the recycling station in Forus had more than 160,000 visitors in 2017. They took away with them more than 760 tonnes of used items. The municipality organises the collection of bulky waste, textiles, garden waste and hazardous waste via "hentavfall.no". It also facilitates greater reuse and reduces volumes of waste through courses in home composting, support for cloth nappies

and events such as “open garage sales” and “repair cafés”.

In 2016, 56,000 tonnes of household waste were generated in Stavanger and 65 per cent of this was source separated. Once IVAR’s sorting plant in Forus opens in 2019, at least 75 per cent of the household waste is expected to undergo source separation. Plastic and paper will be sorted further into different types and qualities, and thus provide high-value raw materials for new production.

The municipality does not have the right to dispose of commercial waste, but does have a supervisory responsibility to ensure that waste that is similar in nature to household waste is processed in an environmentally responsible manner. The municipality is working to ensure that such waste is, wherever possible, delivered to a sorting plant. It is also relevant to look at reuse centres for both private and public units.

Reduced food waste

Food waste describes the quantity of edible food that will be thrown away. In 2015, Norway generated 355,000 tonnes of food waste worth NOK 20 billion, according to matsvinn.no. 217,500 tonnes of this came from consumers, which represents every eighth bag of shopping. In autumn 2017, the Norwegian authorities and the food industry signed a sectoral agreement aimed at halving food waste in Norway by 2030 (Ministry of Climate and Environment, 2017). Awareness raising work, courses and guidance for consumers are also required.

Every year, around 5,500 tonnes of leftover food is collected from institutional households on Nord-Jæren. This goes to biogas production. However, studies show that preventing this food waste occurring in the first place would be far better for the climate than producing biogas from the same quantity (Norwegian Environment Agency, 2014). “Matsentral Rogaland” was established in 2018 by the Norwegian Salvation Army and others in order to organise the collection and distribution of surplus food to disadvantaged people. The municipality also carries out campaigns targeted at consumers, including via social media.

Increased sorting of bulky waste

Stavanger Municipality wants to encourage existing private sorting plants in the region to sort as much as possible for material recovery. Among other things, in the not too distant future some types of wood waste could be recovered.

In addition to this, the municipality will encourage IVAR IKS to establish a scheme for the reception and sorting of bulky household waste from containers, e.g. from redecorating and major clear-outs, such that as much of this as possible can also go to material recovery. Stavanger Municipality will also ask IVAR to allow residual waste from the municipality’s own units to first pass through the sorting plant prior to incineration.



Emptying of underfloor container

Emission-free waste collection

Almost 1,000 underfloor container systems have been installed in Stavanger since the beginning of 2005, primarily in new, densely populated residential areas and areas where fire is a major risk. These have replaced free-standing bins or containers and have automatic gauges that show when they are full. This allows them to be emptied as needed, which means that they have substantially reduced heavy vehicle traffic.

Household waste in Stavanger Municipality is generally collected using biogas-powered refuse collection vehicles. The municipality has received support from the Norwegian Environment Agency's Klimasats programme to procure its first fully electric refuse collection vehicles for ordinary container collection.

Climate accounts

Stavanger Municipality has produced annual climate accounts for the collection and recovery of household waste since 2007. These clearly show that material recovery is the single most important measure for reducing GHG emissions in the waste industry, since it spares the environment from significant emissions compared with the production of new materials (Schjoldager, 2017). The lower emissions, which in 2016 amounted to 200 kg CO₂ per resident, benefit the global environment.

Further measures are described in more detail in a separate action plan.

Performance indicators

- **Quantity of household waste per person (annually)**
- **Sorting rate for household waste**
- **Net GHG emissions from refuse collection, kg per resident**
- **Number of home composting households (no brown bin)**
- **Number of hazardous waste collection orders received via "hentavfall.no"**

4 Green areas and biodiversity

In brief

Stavanger is a densely populated city with relatively small green areas. This packed city needs space for both urban life and diverse flora and fauna. The main challenge is to safeguard these green spaces, adapt them and make them accessible to the public without destroying their natural qualities.

These are the main objectives:

- **Stavanger will be a lively municipality where the proximity to, and accessibility of, green structure and urban spaces help ensure good public health and rich lives.**
- **Stavanger will be a fertile, green municipality that safeguards and strengthens its natural assets.**

In order to achieve this, Stavanger Municipality will produce a separate “Green Plan” that describes the objectives, means and measures in detail.

Plant and animal life are vital components of ecosystems, including in cities. Vegetation, watercourses and marshes also play important roles in capturing CO₂ and curbing the consequences of climate change.

Stavanger has over many years developed continuous green areas for activities and recreation. They are also important habitats for wild animals and biodiversity, which makes exploring the natural world even more exciting. Development and densification often result in the loss of species diversity and green spaces. They also result in poorer air quality and less space for recreation and physical activity, thereby resulting in poorer general well-being and public health. In addition to this, more impermeable surfaces mean extreme precipitation will create major problems.

The Green Plan, the municipal sector plan for Stavanger’s green structure, will focus on themes such as outdoor recreation, natural diversity and nature-based solutions. It will show how Stavanger can remain, and be further developed as, a municipality with good green qualities while simultaneously undergoing densification. Some important elements are:

- safeguarding and developing natural diversity, and facilitating more nature and biodiversity in Stavanger, especially in city centre areas and densely populated areas
- protecting and creating new blue and green structures that can help to capture increased precipitation and other effects of climate change
- continuing to manage and maintain green areas without toxic chemicals, and avoiding the use of peat, in order to preserve the living environments of animals and plants and avoid releasing the GHGs stored in peat marshes
- developing better, more continuous and easier to access green areas and green urban spaces near homes
- establishing more parks and green urban spaces, especially in densification and transformation areas
- facilitating green structures and urban spaces as cultural arenas, as arenas for learning about urban flora and fauna, and as arenas for urban farming
- facilitating more daily recreation, outdoor play and physical activity
- giving every child in kindergarten and primary and lower secondary school opportunities for practical and theoretical learning about how ecosystems work, in cooperation with environmental centres and organisations within the marine environment, land environment and food production



5 Agriculture

In brief

Agriculture includes farming and forestry. Soil, trees and plants capture and store carbon, and buffer and purify water. Many plant and animal species depend on the cultural landscape. At the same time, some emissions and pollutants come from current agricultural production.

The most serious challenges associated with agriculture the Stavanger region faces are:

- phosphorous runoff into watercourses, which can result in an excess of nutrients and algae blooms
- GHG emissions from heating greenhouses, domestic animals and artificial fertiliser
- the use of chemicals that can harm organisms and pollinating insects
- loss of biodiversity
- reduction of topsoil

These are the main objectives:

- preserving soil and agricultural areas as important carbon sinks and increasing their carbon capture
- preventing the reduction of topsoil
- reducing GHG emissions
- conserving and strengthening biodiversity, marshlands and other important habitats
- keeping raw materials, nutrients and other resources in circulation for as long as possible and processing resources and by-products that are currently not in use
- reducing pollution and the harmful effects of chemicals and machine use

As a nature-based business, agriculture utilises biological processes that produce food, wood, raw materials for bioenergy and other products. Agriculture is also a resource for environmental and landscape management, experiences and learning. Grazing keeps the countryside open and adds to the humus layer. Cultural landscapes support many animal and plant species, and are therefore important for natural diversity. Soil, marshes, trees and plants are important carbon sinks. Natural areas and agricultural areas are important for purifying water, as well as for buffering and retaining water in the event of heavy precipitation.

The framework conditions for agriculture are largely established at a national level. Increasing Norwegian food production, en-

suring there is robust and efficient agriculture throughout the country, and at same time reducing climate and environmental impacts are all political goals (White Paper No. 11 (2016-2017) – Agriculture Policy).

While Stavanger is not a major agricultural municipality today, its agricultural land and the industry's importance will increase significantly after its merger with Rennesøy and Finnøy in 2020. "New Stavanger" will have around 86 km² of agricultural land, which is about eight times the current size of Stavanger's present agricultural area. Pastures account for around half of this. The productive forest area covers around 50 km². The animal husbandry in the area is intensive and produces a lot of milk, meat and eggs. "New Stavanger" will be the municipality

with the highest sheep husbandry and egg production in Rogaland. In addition to this comes substantial greenhouse production, primarily of tomatoes. No less than 41 per cent of Norwegian tomatoes are produced in the municipalities of Finnøy and Rennesøy.

In cities throughout Norway, urban farming on various types of allotments and community supported agriculture, where farmers and consumers farm collectively, are rapidly growing in popularity. Agriculture close to cities and cultivating food within city limits are important when it comes to increasing people's understanding of how food is produced and what conditions are necessary for safe, good food. Cultivation on allotments has proved to be a method of producing very good crops in small spaces. Recreational cultivation is also good from a public health perspective, both the cultivating itself and the dietary changes it results in with increased vegetable consumption.

Organic food is grown without synthetic chemical sprays and artificial fertilisers. As of 2018, there were around ten organic producers in the municipalities of Stavanger, Rennesøy and Finnøy. Their produce includes vegetables, berries and eggs. There are around 50 organic farmers, including milk and meat producers, in the whole of Rogaland (Debio.no). The amount of organically farmed land in Rogaland increased by 5 per cent from 2016 to 2017, but still accounts for just 0.7 per cent of the land. The national average



Grazing sheep replace lawn mowers

is 4.4 per cent. Rogaland produced around 3.5 per cent of Norway's organic mutton/lamb and 2.9 per cent of organic laying hens in 2017.

Sales of organic food in Norwegian grocery shops have been growing strongly for many years. Eggs represent the highest proportion at 8.7 per cent, while potatoes and other vegetables account for 4.5 per cent. (Norwegian Agriculture Agency, 2017). Stavanger Municipality took part in the national "Økoløft" project from 2009 to 2015, and a number of municipal units used a proportion of organic food.

Environmental challenges in agriculture

Greenhouse gases

Overall, agriculture is responsible for around 8 per cent of GHG emissions in Norway. Nationwide, the emissions from the production of red meat, i.e. pigs, cattle, sheep and goats, are around 5-10 times larger than from other food production (White Paper No. 41 (2016-2017)). Methane (CH₄) and nitrous oxide (N₂O) from various biological processes associated with food production account for a large proportion of the GHG emissions from agriculture. These can be reduced, but cannot be avoided completely, unlike GHG emissions from some technical processes. Methane from ruminant digestion accounts for around half of the GHG emissions from agriculture. The impact methane has on the climate is about 20 times stronger than that of CO₂. Nitrous oxide primarily comes from spreading artificial fertiliser and animal dung. Its impact is almost 300 times stronger, but it is, as for methane, more short-lived. Emissions from agriculture can be reduced by, among other things, aiding good drainage, using lighter machinery and using the correct amount of fertiliser. Changing the composition of animal feed can also help.

The fuel used for machinery and heating production buildings and greenhouses also contributes to CO₂ emissions. So does farming marshland, which holds a lot of carbon.

In the municipalities of Rennesøy and Finnøy, some of the local GHG emissions come from heating greenhouses using natural gas. Agriculture can adopt alternative methods for

heating and transport such as biogas, heat from seawater, electricity or biodiesel. The combination of good access to animal dung and fish waste from the aquaculture industry and heat and CO₂ intensive greenhouse production could allow for synergy effects from the construction of biogas plants.

Soil erosion and nutrient runoff

The use of too much fertiliser and temporarily open fields, combined with a lot of precipitation and more frequent torrential rains, can result in runoff to watercourses and the sea, as well as an excess of nitrogen and phosphorus, which is a finite, non-renewable mineral. In Stavanger, Hålandsvatnet is the water body most exposed to an excess of nutrients. Local discharges from fertiliser stores, silos and round bales can also lead to water pollution. In Finnøy and Rennesøy, most of the land is under grass and there is little soil erosion. The water quality in the sea is generally good. However, high animal densities and widely dispersed wastewater present challenges regarding the quality of water in stream systems and sill fjords in the municipalities of Finnøy and Rennesøy.

Threats to natural diversity

Active agricultural operations and continuous cultural areas are important for maintaining biodiversity. Without active agricultural operations, agricultural areas regrow and species adapted to open landscapes disappear. At the same time, agriculture is under considerable pressure to become more efficient and intensify operations with a view to larger parcels of land and continuous areas (better local reallocation). Edge zones, fields in flood prone areas, and trees are important landscape elements that provide habitats for many plant and animal species.

Falls in insect populations, including the massive drop in bee populations in the west, have been blamed on pesticides aimed at insects, fungi, plant diseases, etc. (Norwegian Biodiversity Information Centre, n.d.). The intensification of agriculture, with monoculture and few flowers, is putting further pressure on bees and other insect populations. Around a third of all the food we eat requires pollination by bees. Spraying logbooks must be kept for all of the chemical agents used in agriculture and other measures must

be considered first. Stavanger Municipality stopped spraying its green areas in 2014.

Machinery use

Heavy agricultural machines can compact soil, which makes nutrient uptake harder for plants, creates problems for organisms in the soil that need oxygen, and increases emissions of nitrous oxide and the risk of runoff. They also use more fuel and it is easier to convert to alternative fuels with lighter and small machines.

Imported concentrate feed

While pastures and outlying fields throughout the country are being taken out of use, up to 45 per cent of the diet of today's dairy cows is concentrate feed, which is largely made of imported soya. In many countries, rainforest is being cut down to grow soya. GHG emissions from this production and from the loss of the trees' CO₂ capture is not included in Norwegian climate accounts, but nonetheless constitute part of Norway's carbon footprint and represent a major problem globally.

Objectives for agriculture

Circular economy

The circular economy must be a fundamental principle which is translated into practice by raw materials, nutrients such as phosphorus, and other resources being kept in circulation for as long as possible. Ensuring as much fertiliser, concentrate feed, etc. comes from local resources is in line with this principle. At the same time, many resources that currently go to waste could be processed into other products.

Protecting the natural world and the environment

Stavanger wants to protect and enlarge areas of biodiversity and valuable habitats and land, including those that are important carbon sinks. The negative impact agriculture has on the environment must be reduced. This includes pollution from chemicals and machine use, nutrient runoff into watercourses and the sea, and its negative effects on biodiversity. Properly managing agricultural plastics and other waste as environmental waste is also important.

Reduced greenhouse gas emissions

Agriculture must contribute to GHG emission cuts in line with the objectives of the Regional Plan for Agriculture in Rogaland and Stavanger Municipality's Climate and Environmental Plan. One of the objectives of the county plan is to make production in the greenhouse industry carbon neutral by 2030. One objective for Stavanger Municipality is to be a fossil-free municipality in 2040, i.e. where all transport and heating is based on fossil-free energy sources.

Local food, community supported agriculture and organic cultivation

Stavanger also wants more producers to switch to organic production to meet the increased demand for local and organic food, and to ensure that consumers have a chance to get to know producers and learn "the story behind the food". By 2030, there should be at least 15 organic farms and nurseries and five community supported farms in "New Stavanger".

Means and measures

Fossil-free heating and transport

GHG emissions from transport and heating will be able to be cut in line with the development of biofuels, zero-emission vehicles and solutions for fossil-free heating, e.g. biogas or biomass. This would also enable the utilisation of surplus organic materials from farm animals, forestry, aquaculture and the nursery industry.

Finnøy Municipality has provided grants to study the production and use of biogas for heating greenhouses. The industry is constantly working on reducing energy consumption through measures such as heat pumps, better lighting systems and reusing CO₂. The Green Mountain data warehouse in Rennesøy produces enormous amounts of heat and the industry is assessing using this for tomato production (NRK Rogaland, 04.07.2018). The possibility of producing biochar in conjunction with nurseries, which may result in "climate negative" heat production, might be another future solution.

Climate smart agriculture

The "Climate Smart Agriculture" project is a collaboration between agricultural organisations, the Norwegian Agricultural Advisory Service and several large umbrella organisations within food production. The project's main activities are training advisers, developing agriculture's "climate calculator", presenting good examples, and providing advice at an individual farm level.

Municipalities can impose restrictions on the cultivation of marshland, both due to the release of GHGs and for the sake of biodiversity. Forest management and replanting are effective environmental and climate measures.

When farmer numbers fall at the same time as individual farms get bigger, the parcels of land often lie some distance from each other. This entails a lot of driving with tractors and other heavy vehicles, including on public roads. Parcels of lands should be gathered together wherever possible to reduce driving distances and thus emissions. One good tool for achieving this would be land consolidation. However, this cannot be decided by local authorities.

Countering the loss of topsoil in line with the new regional soil protection strategy is also a very effective climate measure since soil captures even more carbon than plants.

New fertiliser product regulations

The Ministry of Agriculture and Food has drawn up national regulations for the use of fertilisers. The objective is to achieve the best possible utilisation of fertiliser for plant production and as a source of bioenergy. At the same time, runoff and emissions to air will be reduced (Norwegian Agriculture Agency, 2018).

As of September 2018, the draft regulations have not been circulated for consultation. However, they contain a tightening of the rules for storage and spreading times, as well as for the addition of phosphorus. They should have a positive impact and result in less runoff, especially in the autumn when it rains a lot. This could have consequences for animal density and provide incentives

to process fertiliser into other products, e.g. biogas, as part of the bioeconomy.

In summer 2018, local fertiliser product regulations came into force in Stavanger and several neighbouring municipalities. These entail a ban on spreading fertiliser after 1 September.

Grants and support schemes

The Regional Environment Programme (RMP) and Special Environmental Measures in Agriculture (SMIL) are grant schemes intended to help reduce water and air pollution, protect biodiversity and generally support environmentally-friendly operations. In addition to financial support, advice and guidance services are also available from places such as the county governor's office, the Norwegian Agricultural Advisory Service and farming cooperatives.

The municipality can reward measures such as organic cultivation, community supported agriculture, etc. The municipality can also use a proportion of organic food in its units and help to stimulate local/Norwegian production.

Information for consumers

Stavanger Municipality runs Gausel visitors farm and works with Ullandhaug organic farm. Both are farms and resource centres that provide information and vocational training. Finnøy Municipality works with a hostel on a farm that offers arrangements for pupils and further such schemes could be supported.

The Stavanger Botanic Garden also provides information about food production on nature's terms. Finnøy hosts an annual tomato festival which gives people a chance to learn more about the nursery industry and agriculture in general. A number of farms have farm shops or sell at local markets and pass on food cultural directly to consumers. Røsslyngen Beitelag and Klostergården are examples from Rennesøy Municipality.

Diet and climate-friendly food

The dietary advice from the Norwegian government recommends eating lots of vegetables, fruit, berries, wholemeal corn products,

and fish, and limited amounts of processed meat and red meat. The advice has been assessed in relation to sustainability (Norwegian National Council for Nutrition, 2017) and there is a lot of agreement between the health advice and the UN Sustainable Development Goals. Norwegian meat consumption increased by around 50 per cent from 1989 to 2016.

Large areas of Norway – and in Rogaland and on the islands especially – are best suited to growing grass/coarse fodder production. People can only gain nutrition from grass through the milk and meat of ruminants, i.e. cattle and sheep. A small reduction in methane emissions is possible, e.g. through changing the composition of feed and fertiliser spreading practices. More radical changes to Norwegian agriculture will require a longer perspective in a partnership between politics and market stakeholders.

Campaigns such as “meat-free Monday” appeal to consumers to reduce their meat consumption for the sake of the climate and their health. The provision of “climate-friendly food” will be increased in municipal kitchens and units.

The municipality will, by virtue of its purchasing position, introduce requirements concerning locally sourced and locally produced food.

Action plan and performance indicators

Some measures have already started and may continue/be enhanced in the future. A more specific action plan for blue-green industries will be drawn up following the merger of the municipalities.

6 Air quality

In brief

Stavanger experiences periods during the winter when the air is polluted with hazardous gases (NOx) and particles (airborne dust). These can result in acute and chronic disorders such as asthma and other lung disorders, as well as increased mortality. Children, seniors and foetuses are especially vulnerable.

The main cause of poorer air quality in Stavanger is pollution from road wear and particles and gases from combustion engines. Heating with wood-burning stoves also emits particles. Cold, clear winter days with little precipitation especially can result in poor air quality.

These are the main objectives:

- The quality of the air is no longer hazardous for residents – there is no longer a need for health warnings.
- The limit value for the largest particles, which are called PM10, is not exceeded more than seven times in one year.

To achieve this, Stavanger Municipality introduced a studded tyre charge in the winter of 2017/18, as well as a grant scheme for residents who replace old, polluting wood-burning stoves with new ones.

Means and measures

Stavanger Municipality works with neighbouring municipalities, the county authority and road authorities to ensure that fewer people are exposed to hazardous airborne dust. An action plan for better quality air in the city has been adopted. The municipality and Norwegian Public Roads Administration take measures to reduce airborne dust from road wear when necessary.

The switch to diesel engines with Euro 6/VI technology and increase in electric cars are helping to cut emissions of nitrous gases. The studded tyre charge in Stavanger will contribute to 90 per cent of motorists not using studded tyres. The municipality also provides grants for households that replace old wood-burning stoves with clean-burning models. In 2018, a new air quality measuring station was established in Schancheholen, in addition to the existing ones in Kannik and

Våland. A new measuring station in Forus/Godeset is also being considered.

The public can find up-to-date data for Stavanger on the website of the Norwegian Institute for Air Research (NILU): www.luftkvalitet.info. In the winter season, residents can also subscribe to daily alerts via email or SMS.





Performance indicators

- Quantity of nitrous gases and airborne dust. The Norwegian Pollution Regulations specify limit values and national targets provide guidelines.
- Number of grants for clean-burning wood stoves
- Number of studded tyre charges/proportion of studded tyres
- Studded tyre-free proportion of the municipality's vehicle fleet
- Development of the vehicle fleet and its composition (the same indicator can also be found in the chapter on transport)
- Emissions from ships

7 Noise

In brief

Noise is an environmental problem that affects a lot of people. The municipality wants to protect residents from nuisance noise that may have an adverse impact on health. According to the Norwegian Institute of Public Health, loud nuisance noise can result in sleep problems, various physical and mental disorders, and generally someone's impair quality of life. An absence of noise is a prerequisite for enjoying the full value of a cultural environment, as well as outdoor and recreation areas. The largest classified and county roads in Stavanger are the most noisy, and more than 15,000 residents of Stavanger state that they feel bothered by road traffic noise.

These are the main objectives:

- Noise problems will be reduced to a minimum in accordance with government guidelines and targets, as well as the current noise plan adopted by Stavanger.
- Noise reducing measures will be carried out in schools and kindergartens with noise levels above 65 dB and the most exposed homes.

To achieve this, Stavanger Municipality produced an action plan in 2018 and is working with the Norwegian Public Road Administration and county authority on measures for classified and county roads.

The municipalities in Nord-Jæren surveyed noise from road traffic, railways, aviation and ports in 2017. This is a statutory requirement and is carried out every five years. According to the survey, no municipal roads in Stavanger produce indoor noise in excess of the limits.

Several schools and kindergartens are exposed to noise, as are residents along the largest roads. It is the owner of the road who is responsible for measures. Measures have commenced in connection with, for example, the construction of the Busway in Hillevåg, Vaulen and Forussletta, as well as the E39's Eiganes tunnel and classified road 13 Ryfast.

Noise from railways affects 600 residents of Stavanger. Part of Madla District is affected by aircraft noise and around 500 residents in Stavanger are exposed to noise in excess of 50 dB from cruise ships. Densification of the city and concentrated urban development in city centre areas may result in a conflict with the objective of reducing the number of

people bothered by noise since city centre areas can be exposed to noise.

Means and measures

Less traffic will result in less noise. Quiet zones have been added as a separate consideration zone in the current Municipal Master Plan for Stavanger. The provision says that no sources of noise may be established that increase the level of noise.

The Ministry of Climate and Environment's guidelines for considering noise in land use planning, T-1442/2016, specify recommended outdoor noise limits. These must always be complied with in planning and building cases, and be made legally binding in zoning cases.

New projects such as Sykkelstamveien along the E39 and the Busway along several of the main roads will help to reduce traffic and thus noise along these stretches of road.

The anti-noise action plan, which was adopted in autumn 2018 and covers the period up to 2023, describes the roads and stretches most exposed to noise in more detail.

These areas are described in more detail in Stavanger Municipality's anti-noise action plan for 2018-2023.

Of those for which Stavanger Municipality is responsible, the following areas will be prioritised in the following order:

1. Kindergartens
2. Schools
3. Communal and play areas in residential areas and outdoor areas
4. Recreation areas and quiet areas.



8 Aquatic environment

In brief

Clean water is vital, both as drinking water and for aquatic flora and fauna. Water quality and biodiversity are affected by agriculture, aquaculture, sewage, pollutants, littering, climate change and other factors.

The Norwegian Water Regulations specify requirements that the municipality, in cooperation with the county governor, county authority and enterprises that have a negative impact on water quality, strive to meet.

The most serious challenges Stavanger faces are:

- runoff and emissions from agriculture to freshwater, which result in an excess of nutrients and blooms of poisonous algae, especially in Hålandsvatnet
- pressure on valuable habitats and flora and fauna due to developments, emissions or other human interventions

These are the main objectives:

- All streams, lakes and coastal waters in Stavanger should have good water quality for fauna and flora, bathing and other purposes.
- Plant and animal life in and around water should be protected from interventions, littering, pollution and other things that could destroy their basis of existence.

In order to achieve this, Stavanger Municipality will:

- in cooperation with other municipalities and specialists, work to minimise runoff from agriculture
- protect important habitats and flora and fauna by facilitating natural habitats and limiting interventions
- support beach clean-up campaigns



The situation in Stavanger

Water quality

Current and earlier agricultural activities are the biggest challenge for streams and lakes, especially for Hålandsvatnet. An excess of nutrients in the water and on the seabed results in increased plant production, which sometimes includes poisonous algae. The plants consume oxygen at the expense of fish and other animals.

The Port of Stavanger and the Hafrsfjord area are also priority areas for improvement.

Drinking water and wastewater

In Stavanger, around 99 per cent of the population is connected to the municipal water supply and around 98 per cent is connected to the municipal wastewater system, which runs to IVAR's water treatment plant in Mekjarvik. Where wastewater and storm water are transported in a common system, diluted effluent can run directly into a water body when it rains too much. Excess rainwater is only discharged into the sea, not into freshwater. However, it is still an environmental challenge for Stavanger Municipality. Reducing the amount of wastewater that ends up in spillways and systematically monitoring spillways will be a priority task during the plan period.

The marine environment and species

Stavanger has 146 km of coastline, which includes the mainland and islands. This is home to habitats such as eel grass, kelp forests and soft bottom areas that are of value as locally and nationally important habitats. Stavanger Municipality is working to protect marine biodiversity and local seabird populations.¹⁰ A number of islets are designated natural environment consideration zones in the Municipal Master Plan, which prevents access during nesting periods and entails actively clearing vegetation to ensure good nesting areas for seabirds.

10 Ref. Action plan for biodiversity – primary objectives: Protect beach zone and important marine populations in a manner that protects their existing qualities. Avoid interventions in natural beach zones.

Objectives for the aquatic environment

Stavanger Municipality's master plan for the water supply, aquatic environment and wastewater (2011-2022) and the regional plan for water management (2016-2021) specify objectives for the ecological and chemical status of water bodies, as well as for drinking and bathing water quality, and state that wastewater management should not have negative consequences for the aquatic environment.

The master plan for the water supply, aquatic environment and wastewater was revised in 2018 and the new objective is that less than 2 per cent of produced pollution should be discharged into spillways, i.e. emissions of diluted effluent into the sea. The current national industry target is that the amount should be less than 5 per cent. More clearly specified objectives, means and measures for sea and beach areas will be established in the Green Plan. Appendix 5 contains an overview of the status of, and deadlines for target achievement for, Stavanger's water bodies.

Means and measures

The work relating to the Water Regulations must be anchored in the Municipal Master Plan to ensure cooperation and cross-sectoral work, including with the county governor and county authority. Measures in the water and wastewater sector will be implemented in line with the master plan for the water supply, aquatic environment and wastewater.

The municipality supports beach zone clean-up campaigns organised by Ryfylke Friluftsråd, Hold Norge Rent and others. Water quality is regularly tested at the city's bathing locations during bathing season and information is provided via both websites and the media. Eco-certification of beach zones, with the requirements this entails, may be a relevant measure that will be assessed in the Green Plan. Measures linked to marine littering, microplastics runoff, etc. are described in the special chapter on plastic litter.

Performance indicators

- **Drinking water quality:** Deviations in physical/chemical and bacteriological water quality – target: zero deviations
- **Wastewater management:** Proportion of wastewater production that ends up in water bodies in event of overflow – target: < 2 per cent
- **Water bodies' biological status:** Indicator: Status analysis – target: GOOD
- **Bathing water quality:** Thermotolerant coliforms in bathing location – target: GOOD

More indicators will be defined based on the measures recommended in the new Green Plan and in the revised master plan for the water supply, aquatic environment and wastewater.



9 Aquaculture

In brief

There are around 30 aquaculture locations in Finnøy and Rennesøy. Finnøy Municipality is home to a large salmon slaughterhouse and an aquaculture park. Aquaculture is dependent on good water throughflow and replacement, as well as sufficient water depth. The aquaculture industry is heavily regulated and subject to strict environmental requirements and requirements regarding environmental monitoring.

The aquaculture industry must be environmentally sustainable and designed to take account of the aquatic environment and biodiversity. This is a prerequisite for permission to produce seafood and increase production.

Important areas where aquaculture impacts the environment:

- Pollution and emissions
- Feed resources
- Land use
- Disease and parasites
- Genetic mixing with wild fish and escapes

The role of the municipality

Aquaculture is generally regulated by national and regional authorities pursuant to the sector's legislation. The municipality is responsible for land use planning and must ensure that marine areas for aquaculture do not come into conflict with the environment and other stakeholders. As the aquaculture authority, the county authority ensures that environmental considerations are addressed when locations are approved.

After starting on a small scale in the 1970s, Norwegian aquaculture is now a major industry and Norway is the world's largest exporter of farmed salmon.

Some of the first entrepreneurs in the aquaculture industry started in Finnøy Municipality with the small scale farming of salmon and a salmon slaughterhouse. Today, Finnøy is the largest aquaculture municipality in Rogaland, with 20 locations, a salmon slaughterhouse and Rogaland Havbrukspark. The job of the aquaculture park is to act as an incubator for founders and future aquaculture entrepreneurs and to provide opportunities for collaboration with researchers and academia, including on breeding cleaner fish that eat salmon lice.

Aquaculture is a major industry that is rapidly evolving and could help to feed a growing

world population with healthy food. It is therefore important to identify forms of operating that result in the least possible negative environmental impact. The management of marine areas must be coordinated between the municipalities and a regional plan for aquaculture marine areas was adopted by the county council in 2017.

Environmental challenges in aquaculture

Pollution and emissions

The objective is for no aquaculture locations to experience larger emissions of nutrient salts and organic material than the area (recipient) can tolerate. Emissions from aquaculture facilities consist of feed residues, fish excrement, medications and copper-containing impregnation agents. In Rogaland,

the environmental status both directly below and in the area around the vast majority of facilities is good. However, if Norwegian production is going to increase manyfold, in line with national objectives, these emissions could become a problem if the locations are unsuitable.

Copper is used both as a feed additive and to impregnate the nets. Surveys by the Norwegian Institute of Marine Research demonstrate copper in the seabed around aquaculture facilities in Rogaland, including around Finnøy and Rennesøy. More research is required into the effects this will have on marine life. The industry is working on new impregnation methods.

Feed resources

The objective is to ensure that the industry's need for raw materials is met without the overexploitation of wild marine resources. Importing soya also represents a challenge with respect to sustainability, the climate and the use of topsoil. Cooperation between blue and green sectors, and cultivating micro and macroalgae, insects and bacteria may be part of the solution.

Area use

The municipalities are responsible for land use planning and can allocate space for aquaculture in the land-use element of a municipal master plan. Some areas are defined as multi-use areas, which can result in conflicts between aquaculture and, for example, the natural world, traffic and angling. According to the regional plan for aquaculture marine areas, the municipalities should primarily set aside operating areas for the aquaculture industry on the water surface as single-use areas, while moorings can be in multi-use areas.

New farming methods and technology that have yet to be developed but that have less impact on the environment might need operating areas. A good knowledge base is required here to find the most suitable areas. Dispensations are often granted if there is a need to expand or make other changes in a location. 8 km² of marine area is used for aquaculture in Rogaland and around a third of this was approved through dispensations. Municipalities in which aquaculture

is relevant should establish area use more clearly because the requirements for impact analyses are stricter in such planning processes than they are for dispensations.

Disease and parasites

The objective is to ensure that diseases in aquaculture do not reduce wild fish stocks and that as many of the farmed fish as possible grow to slaughter size with as little use of medications as possible.

Seawater is the natural habitat of salmon lice and they feed on the mucus, skin and blood of salmon. When the aquaculture industry expands, the lice gain many new hosts and this increases the infection pressure on wild fish. Lice treatments have resulted in pollution and resistance to some agents such as hydrogen peroxide. A lot of antibiotics used to be used in the aquaculture industry to fight bacterial diseases. This has been significantly reduced due in part to prevention with vaccines.

Using cleaner fish, e.g. lumpfish, is a biological means of combating salmon lice. They are generally used in most of the facilities in Finnøy Municipality.

Escapes and mixing with wild fish

The objective is for aquaculture not to result in permanent genetic changes to wild fish stocks (Norwegian Directorate of Fisheries, 2009). Every year, some farmed fish escape from their pens and can then mix with wild fish in the same area. This could weaken the wild fish, which are genetically adapted to their habitat. The spread of diseases and parasites like salmon lice can also harm wild fish. Norway has an international responsibility to protect stocks of Atlantic salmon, which largely spawn in Norway. Systematic efforts to counter escape have reduced the problem in recent years.

Climate impact

The energy used to run aquaculture facilities often comes from diesel and results in GHG emissions. In a single year, the emissions from a medium-sized facility can equal the emissions from 70 cars. Using energy from renewable sources such as solar and wind could cut these emissions where it is not possible to use shore power. Aquaculture actors

in Finnøy are looking at the possibility of installing sea windmills on the facilities. The storage and transport of farmed salmon is highly energy-intensive because of the need for refrigeration. No less than 95 per cent of Norwegian farmed fish are exported to Europe, the US and Asia, which results in transport emissions.

Regulation of the aquaculture industry

The aquaculture industry is one of the most regulated industries. The Norwegian Aquaculture Act and associated regulations stipulate strict requirements regarding sustainable operations.

The government has introduced a “traffic light” system for the Norwegian coast, which is used to assess the tolerance limits of the natural world and the environment. A total of 13 areas stretching from the Swedish border to Varanger are assessed in relation to environmental status. The number of lice is used as an indicator. Green indicates an acceptable environmental status and the industry is allowed to grow here. In a yellow area the status is moderate and here production can “be frozen” at its current level. An unacceptable environmental status results in a red light and here it will be appropriate to reduce production. This system is designed to motivate the industry to operate sustainably and to invest in technology and operating forms that reduce its negative impact on the marine environment. The marine areas of the new Stavanger Municipality currently have a yellow status.

Relevant measures

The aquaculture industry practises a comprehensive system of internal control and reporting to the authorities. The industry has itself drawn up a strategy called “Havbruk 2030 – tenke globalt, handle lokalt” (“Aquaculture 2030 – think globally, act locally”). The strategy shows how the industry will become more sustainable in the lead up to 2030 through the interaction between self-imposed and government-imposed measures.

“Integrated aquaculture” is one possible approach that entails cultivating several different species at the same time. This would function as more of a natural ecosystem than the current monoculture system of fed fish. The commercial waste from, for example, farmed salmon could then serve as a natural fertiliser, as raw materials for the production of bioenergy, or as food for species further down the food chain. Closed-system facilities especially provide opportunities for collecting fish excrement and other organic material. These can then be used in the production of bioenergy. Rogaland Havbruks-park will continue to work on zero-emission aquaculture.

At a local level, the municipality’s job is to allocate suitable, dedicated commercial areas in the sea via the land element of a municipal master plan in such a way that they come into as little conflict with other stakeholders as possible. The Norwegian Mapping Authority is currently producing a base map that will show every resource and interest in the sea and “New Stavanger” is taking part in a pilot project in the area.

A more specific action plan for blue-green industries will be drawn up following the merger of the municipalities.



10 Environmental toxins in products

In brief

Environmental toxins can be found in skin care products, toys, clothing, furniture, food, electronics and other everyday products. They can accumulate in the bodies of people and animals, and be passed on to new generations. They can destroy the ability of people and animals to reproduce, and they can change the genes of future generations. Young children are especially vulnerable to the effects of pollutants.

The objective is to ensure that consumers in Stavanger are familiar with pollutants found in everyday products as well as with their environmentally-friendly alternatives. The municipality will conduct information campaigns.

Environmental toxins are chemical compounds with low biodegradability (they are persistent) that can accumulate in living organisms/the food chain (bioaccumulators) and are toxic. 60-70 years ago, people in Norway had six to seven pollutants in their blood. After the Second World War, the chemical industry exploded and now foetuses are exposed to pollutants even before they are born. We now have between 200 and 400 harmful chemicals inside us, according to the Norwegian Institute for Air Research (NILU) (Rapp, 2014).



Ecolabelled products

Means and measures

A number of products are eco-labelled. Many of these are included in Stavanger Municipality's purchase agreements. For example, the Nordic Swan Ecolabel encompasses cleaning agents, body care products, laundry detergents, as well as equipment and consumables for the home, office, health sector,

and much more.

The municipality carried out a "toxic-free life" campaign in 2015-17 and provided consumer information via websites, conferences and the media. New campaigns will be aimed at both its own departments and consumers in order to reduce exposure to pollutants and to prevent such environmental toxins being released into the environment. This will be coordinated with hazardous waste and sustainable consumption-related consumer campaigns.

Performance indicator

Number of consumer information campaigns conducted

11 Contaminated ground on seabed and on land

In brief

In some parts of Stavanger, the seabed is contaminated with pollutants. The situation is worst in a few areas around Buøy and Hundvåg, and along the coast from Kalhammeren and eastwards around Storhaug to Hillevågsvatnet. There are also contaminated areas on shore and anyone who wants to excavate or build here must carry out further investigations and produce a plan for dealing with the soil.

Most of the pollution was caused by earlier industrial activities. Pollutants can harm your health and you should not eat fish or seafood from polluted marine areas.

The objectives are:

- to ensure it is safe to eat fish and seafood from all coastal areas around Stavanger by 2030
- to ensure that contaminated soil on shore is dealt with in an environmentally responsible manner

Stavanger Municipality will:

- Work with the Norwegian Environment Agency and others to cover over or remove soil in the contaminated areas so that pollutants are not spread and to prevent new pollutants ending up in the sea
- Investigate potential sources of new emissions
- Inform developers and the public about areas on shore where pollutants may be present and what they must do before they can excavate or build

Contaminated seabed

Stavanger and 16 other port areas in Norway with heavily contaminated seabed are working with the government to map the pollution and reduce it. Finds include tar compounds, PCBs and heavy metals. Mercury and PCBs are the most toxic and they can be passed on via fish and seafood to people.

The Norwegian Food Safety Authority warns young children and pregnant and breastfeeding women not to eat self-caught fish from the worst areas in Stavanger (Norwegian Food Safety Authority, 2017) and also not to eat the livers of self-caught fish in skerry areas throughout Norway (Norwegian Food Safety Authority and Norwegian Environment Agency, 2017)

Contaminated ground on shore

As far as Stavanger's land areas are concerned, the municipality has produced a warning map showing areas where pollutants may be present. This is based on information about their history and earlier activities. The Norwegian Environment Agency has also collected information about contaminated ground that can be found on the agency's website and provides more detailed information about the locations that have been investigated (Norwegian Environment Agency, n.d.).

Means and measures

The municipality has informed residents in the areas with the worst contaminated



Figure 11 Warning map for Stavanger. Source: Stavanger Municipality

seabed and set up signs warning against fishing, with text in multiple languages. After a thorough survey, work on covering over polluted sediments started in 2017 in order to stop as much dispersal and new supply of pollutants as possible. Around 160-170,000 m² of contaminated seabed in Bangavågen and around Klasaskjæret and Hillevåg/Paradis was covered over in 2017. Smaller areas near Jadarholm, Kvernevik and Kalhammeren were covered over in 2018.

The seabed will also be tested in the future to measure pollutant content and risk assessments will be conducted of contaminated seabed. Measures will be implemented if necessary. Inspections of the sources of pollutants from land will be followed up. More tests will be made of storm water runoff and sand trap basins will be emptied more often.

Anyone who wants to excavate or build on Stavanger's land must investigate whether the ground is contaminated and, if it is, produce an action plan. The plan must be approved by the municipality before work may

commence. All lightly contaminated earth/soil that must be treated must be dealt with regionally in suitable storage locations – currently Svåheia in Eigersund Municipality. Following the merger with the municipalities of Rennesøy and Finnøy, Stavanger Municipality will take the initiative to expand the warning area.



Sign warning against fishing at Grønvika

Performance indicator

Occurrence of pollutants in sediments and fish/marine fauna – environmental monitoring after measures have been implemented to show whether the occurrence/quantity has been reduced.

12 Plastic litter

In brief

A lot of plastic ends up in the natural world where it can harm the environment and wildlife. In the sea, plastic can be broken down into microplastics. These tiny pieces of plastic can contain pollutants. When plastic is eaten by small marine animals and by fish, it can ultimately end up in people's bodies.

The objectives for plastic litter are:

- as little plastic as possible ends up in the environment in Stavanger
- consumers know which products may contain microplastics and how to avoid them
- become a plastic bag-free municipality and sharply reduce the use of single-use plastic
- reduce the waste from each resident from 425 kg per year to 300 kg per year

In order to achieve this, the municipality will:

- replace rubber granulate on artificial grass pitches with environmentally-friendly materials
- introduce a ban on the sale and use of helium balloons on the municipality's property
- inform residents about microplastics in everyday products
- work to reduce the amount of plastic packaging, construction plastic, etc. that ends up in nature
- by 2020, cease to use disposable packaging/plastic cutlery in own premises, buildings and units.

The amount of plastic litter in the ocean is currently gaining a lot of attention. Plastic waste covers vast areas of the world's oceans and researchers believe that by 2050 there will be more plastic than fish in the sea if the current trend continues (World Economic Forum, 2016). Plastic can do a great deal of harm to animal life, both on land and in the oceans. Land and marine animals and birds can be injured by objects, they can be strangled by ropes and fishing equipment, and they can swallow plastic and other rubbish that fills their stomach and causes death by starvation.

According to studies conducted by the Norwegian Environment Agency, 8,000 tonnes of plastic ends up in the sea in Norway every year and 950,000 tonnes on a global basis. It can take hundreds of years before plastic biodegrades, as Figure 12 shows, and many plastic objects will be broken down into microplastics. Microplastics have been found in many food sources, such as honey, beer and bottled water (Norwegian Environment Agency, 2016).

Sources of plastic litter

Worn-out rubber from vehicle tyres is Norway's largest land-based source of microplastics that end up in the sea at 5,000 tonnes per year. It is followed by rubber granulate from artificial grass pitches at 1,500 tonnes, paint at 1,000 tonnes, textiles and plastic pellets. Microplastics in cosmetics account for just 0.1 per cent or 9 tonnes.

Quite a lot of plastic is used in agriculture, including around round bales and for tunnels/covering fields. This can be broken down by the weather and wind, carried away by flood waters, or remain in the soil as small bits of plastic/microplastics. Building and construction activities also generate quite a lot of plastic packaging that can go astray. However, these are subject to strict waste management and source separation requirements.

In recent years, large and small pieces of plastic cable have accumulated in the skerries in some locations in Rogaland. These are the remains of blasting cables used for tunnelling and have

accompanied the soil/rock that is used for fill in the sea. The Norwegian Public Road Administration has now switched to cables that sink down with the soil/rock to the bottom of the sea where they are locked in by the fill.

Helium balloons can also be a source of plastic litter. Balloons are often released as part of an event. Helium balloons rise quickly and will end up as rubbish in some unknown location on land or at sea with the harm this can cause to the natural world and animal life.

Means and measures

Artificial grass pitches without micro-plastics

Stavanger Municipality has around 30 artificial grass pitches. The municipality has conducted trials on one football pitch with infill made from organic, biodegradable materials based on sugar cane. This material turned out to be too light. All new pitches and old pitches ready for replacement will be replaced with environmentally-friendly alternatives as soon as such materials with good usage

properties are developed. The Norwegian Environment Agency has produced draft regulations that are intended to ensure that rubber granulate does not go astray. According to the plan, these will come into effect on 01.01.2019. Stavanger has commenced work on installing collection schemes for existing pitches with plastic infill.

Ban on helium balloons

The keep Norway tidy organisation, Hold Norge Rent, has launched a common sense code for balloons (Hold Norge Rent, n.d.) and Stavanger Municipality will introduce a ban on the sale and release of helium balloons on municipal property. It will seek to incorporate the ban into the police regulations and the municipality's events manual.

Reduction in single-use plastic

Although plastic does not account for the majority of the litter in public places, it is bad from an environmental perspective. The Municipality will contact the hospitality industry in the city centre to look at the possibility of using multi-use or biodegradable packaging for take away food

Consumer Information

Clean-up campaigns and information campaigns aimed at consumers about microplastics and pollutants in everyday products will be conducted. These will be coordinated with other environmental information, such as how to dispose of hazardous waste responsibly.



Figure 12 Decomposition of plastic. How long does it take?
Source: miljøstatus.no

Performance indicators

- Number of artificial grass pitches with environmentally-friendly infill
- Quantity of plastic waste in Stavanger city centre
- Quantity of litter collected on beach clean-up days

13 Radon

In brief

Radon is a radioactive gas that forms in the ground. It can penetrate buildings and be damage people's health if breathed in. The government has specified limit values for how much radiation can be in a building.

The objectives are:

- all buildings owned or leased by Stavanger Municipality are below the limit for taking action
- municipal buildings where radon persistently exceeds the thresholds are fitted with permanent solutions to avoid radon seeping into the building
- the municipality's residents know they can investigate radon levels in their home

In order to achieve this, the municipality will:

- measure radon levels in all of its buildings in 2018 and take action where required
- inform residents about radon measurements and about relevant consultants who can implement measures

Radon can penetrate buildings through, for example, cracks in foundations and unsealed pipe penetrations. Breathing in radon exposes the lungs to radiation. Around 300 Norwegians die every year from lung cancer caused by radon radiation.

The Radiation Protection Regulations set limit values for radon levels in indoor air. Measures should be implemented when the level in one or more used rooms exceeds 100 becquerel per cubic metre of air (Bq/m³). Radon levels should always be lower than the current limit value, which as of August 2018 is 200 Bq/m³. The NGU's map of radon deposits shows low or moderate levels in Stavanger, but with some level of uncertainty.

Means and measures

Homeowners and landlords are responsible for conducting measurements and any radon mitigation measures. Stavanger Municipality will conduct new measurements of radon levels in all municipal buildings in 2018. Measures will be implemented in buildings that show excessive radon levels, e.g. better fans or indoor ventilation, or radon wells that lead the radiation away from the building. New buildings require a radon screen or other measures to prevent radon entering the building.

The municipality collaborates with a company that offers radon measurements in the homes of the municipality's residents. This is advertised in the local newspaper every autumn, and information can be found on the municipality's website. If radon levels prove to be too high, the company can be contacted to implement measures.

Performance indicators

- Number of schools, kindergartens and other municipal buildings surveyed
- Number of non-conformities in relation to measurements
- Number of schools, kindergartens and other municipal buildings in which measures have been implemented
- Measured radon levels after the implementation of measures
- Number of canister test kits sold to private individuals after the annual advertisement

14 Climate change adaptation

In brief

The climate is changing and this is leading to milder winds, more extreme rainfall and higher sea levels in the Stavanger region. The municipality needs to plan in order to minimise the harm to people, the natural world, buildings and technical systems in the future.

In order to do this, the municipality will investigate the potential consequences of climate change and prepare a special strategy and plan for climate adaptation.

Climate change is happening already, despite local, national and international efforts to cut GHG emissions. The consequences could be far-reaching, both for the municipality and for society as a whole.

Stavanger Municipality has spent several years working to improve its knowledge and tools so it can better tackle the challenges climate change will bring. The municipality has taken part in a number of development and research projects and is part of the national climate change adaptation network, iFront. The preparedness department bears overall coordination responsibility and in addition to this several of the municipality's other departments have worked on climate change adaptation within building and construction, green spaces and roads, and infrastructure for waste and wastewater.

Stavanger Municipality is taking part in an EU project, UNaLab (UrbanNatureLabs) between 2017 and 2022, which focuses on



climate change adaptation using nature-based solutions (NBS). The project started in 2017 and aims to establish a European framework for climate change adaptation using nature-based solutions. UNaLab will produce a road map for a climate-adapted city in 2050 for Stavanger. This will provide valuable input for the work on the climate change adaptation strategy.

Strategy and plan for climate change adaptation

The Municipal Master Plan and the municipal planning strategy from March 2017 advise that even more attention should be paid to climate change adaptation. The municipality will conduct a special risk and vulnerability analysis that will, among other things, estimate the effects if the target for a maximum temperature rise of 2 degrees Celsius, as set out in the Paris Agreement, is not achieved. Based on this analysis, the municipality will prepare a climate change adaptation strategy that will provide the basis for the municipality's first climate adaptation plan.

High tide at Vågen

Participation and involvement of residents

In brief

The municipality will not be able to do everything required to achieve its climate and environmental objectives alone. Residents, the business sector, organisations and others will be important partners. Hard-hitting, professional and targeted climate and environmental communication is required to invite residents to get actively engaged and to work systematically with others.

Good communication is important to ensure that the municipality's climate and environmental goals are achieved. Stavanger Municipality currently provides information about climate and environmentally-friendly everyday actions on the municipality's website and in social media, through the media and at talks, gatherings and events.

Many other Norwegian municipalities have produced informative websites and other publications containing good stories about everyday environmental choices, results from resident surveys, information about events, support schemes for environmental measures, and other things.

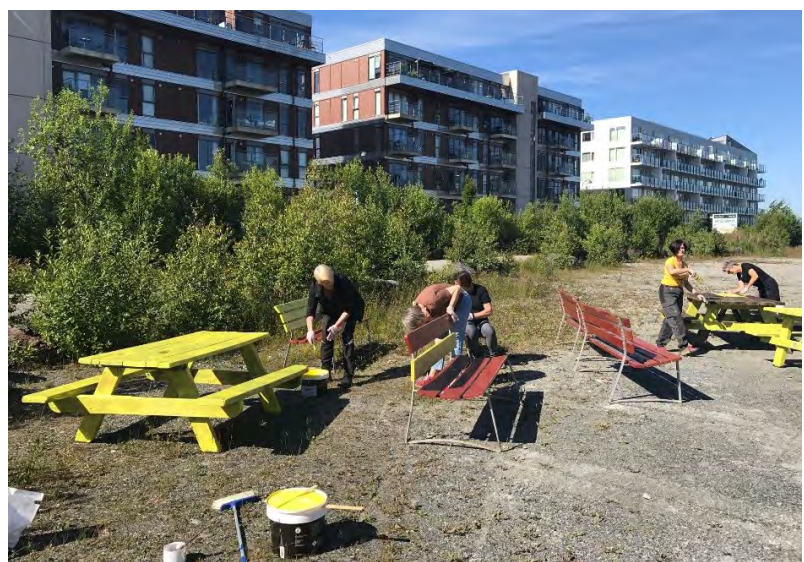
Means and measures

The district committees will play an important role as climate and environmental advocates. This will be incorporated into the committees' rules.

The proposal is to strengthen Stavanger Municipality's efforts within climate and environmental communication, and to ensure that a comprehensive communication strategy is prepared for this work.

Important areas of work could be

- facilitating meeting places, dialogues with residents and resident participation
- communicating opportunities, solutions and good stories that improve the residents' quality of life while providing climate and environmental benefits
- cooperating on resident-oriented activities and communication related to the climate and environment with other municipalities and public authorities, as well as organisations, the business sector, and research and educational institutions
- actively participating in a regional climate and environmental forum with the aim of learning more, exchanging experiences and conducting joint activities
- specially facilitating practical training in the climate and environment for kindergartens and schools



Voluntary work at Lervig

The municipality as an environmental and climate advocate

In brief

The municipality can influence many of the residents' choices and actions. The municipality is also a major organisation that buys many goods and services and can influence both residents and the business sector to make environmentally responsible choices.

The objectives for the municipality's work as a climate and environmental advocate

- greater environmental engagement among residents
- greater awareness about environmentally responsible choices when making purchases, both for the municipality's employees and for suppliers
- environmental leadership in all of the municipality's units
- collaborating on measures and sharing lessons learned in various networks

The overview below shows the most important means the municipality has for achieving these goals.

Financial grants

Stavanger Municipality provides support for a number of climate and environmental activities organised by others. Various organisations have agreements with the municipality regarding maintenance work in nature areas, communication and training, while others receive support for individual measures such as events, clean-up campaigns, seminars, etc. The municipality provides residents with grants to buy cloth nappies as well as discounts on containers for thermal composting, and a deposit scheme for replacing old wood-burning stoves was introduced in 2018.

Several other municipalities have set aside larger annual amounts for climate and environmental initiatives. In 2017, Bergen distributed NOK 1 million (Bergen Municipality, 2017), while Oslo Municipality has a climate and energy fund that provides support for measures such as insulation, solar cells and wind energy, charging stations for electric cars, replacing wood-burning and kerosene-burning stoves, and many other measures (Oslo Municipality, n.d.). The state-owned company Enova has a series of grant schemes

related to renewable energy, both for private individuals and for companies.

In 2018, Stavanger Municipality established a climate and environmental fund that makes it possible for more stakeholders to apply for support. The fund's coverage areas, criteria, funding, application procedures, etc. still require work.

Procurements as a tool for achieving environmental goals

The municipality's procurements should help to meet the needs of residents and the municipality, achieve its objectives in the area of the environment, and at the same time demand, or contribute to, the development of new solutions. A major purchaser such as Stavanger Municipality can lead the way for other municipalities and public agencies, and for the city's residents. The regulations for public procurements should help to protecting the climate and the environment.

Stavanger Municipality actively fulfils its social responsibilities by demanding and consuming goods and services that are produced in accordance with high ethical, social, and environmental standards, in line with the guidance from the Agency for Public Management and eGovernment (Difi) on good

procurement practices (Difi, 2017). The environmental requirements will be developed further, from encompassing consumables and transport services to also encompassing building materials, construction machinery and the services associated with them. The municipality is also a member of the Ethical Trade Initiative and became a Fair Trade City in 2007, which increased the awareness of fair-trade products in municipal units. "Veileder for miljøhensyn i anskaffelser i Stavanger kommune" ("The guide to environmental considerations in procurements for Stavanger Municipality") is used as a tool for the municipality's operations.

In special cases, the municipality will be able to demand development or products that require special funding, so-called innovative procurements. This will require resources for the processes and for any research and development work. Opportunities for this exist, including in the EU system, regional research funds and via county governor's offices. Stavanger Municipality has experience from several innovative procurement processes and has developed its own procedure, called "knowledge-based procurement".

Vekstfondet supports green initiatives

Vekstfondet ("Growth Fund") was established in 2016 with capital of NOK 40 million. Its purpose is to help create jobs and increase value creation. The climate and environment is one of its stated focus areas, along with welfare and public health, digital infrastructure, and attractiveness, which includes culture and food.

The fund prioritises long-term measures that support these focus areas and contributes to innovation and resolving various social challenges.

Green Investments

Stavanger Municipality manages major assets on behalf of the city's residents in the form of, among other things, properties, stakes in various companies and financial assets. In autumn 2016, the City Council decided that Stavanger Municipality would become a pioneer in green (climate-friendly) financial management. The framework for green invest-

ments was established by the municipality's rules for financial and debt management.

The municipality has total assets under management of around NOK 550 million, which are invested in things such as green equity funds and green bonds. Such investments help to provide capital for projects with a positive climate and environmental impact. The municipality is also considering issuing green bonds to finance its own green projects. Moreover, the municipality has looked at the possibility of limiting investments in fossil energy.

In 2017, the government decided that the governmental climate investment fund now called Nysnø would be established in Stavanger. The fund can invest in companies, nationally and internationally, and will raise Stavanger's profile as a key region for finance and renewable energy.

Climate partners

"Climate partners" is a network collaboration between public and private enterprises aimed at cutting GHG emissions and stimulating green social and business development. It operates in Agder and Hordaland, and started operations in Rogaland in February 2018, with a coordinator in Rogaland County Authority. Stavanger Municipality is a member, together with nine other companies and public enterprises. Members commit to preparing annual climate accounts for their activities, planning and implementing measures to reduce GHG emissions, introducing environmental certification or environmental management systems, and working to cut emissions in other ways.

Grønn By

Grønn By ("Green City") is an independent foundation that works on sustainability and environmental awareness in the Stavanger region. Its partners are significant organisations and companies that influence social development in the region by virtue of their activities. Grønn By is an important network between public and private enterprises. Stavanger Municipality is a member of Grønn By and actively participates in events such as green breakfasts/seminars and study trips.

Environmental management in Stavanger Municipality

Stavanger Municipality has high ambitions when it comes to cutting GHG emissions from its own activities and making sustainable environmental choices. Environmental management is an important tool for reducing harmful environmental impacts and minimising the municipality's own climate footprint. The objective is to ensure that all municipal units have implemented environmental management by the end of the plan period.

Eco-certification

Stavanger City Council has decided that all municipal units must be eco-certified, either as by Eco-Lighthouse or by Green Flag. Three of the buildings in Stavanger Municipality's central administration have been certified as headquarters in the Eco-Lighthouse programme. The headquarters, i.e. central administration, has thus already met many criteria on behalf of all of the units in the municipality. Consideration is being given to covering the units' certification costs centrally.

Internal Climate and Environmental Action Plan

A separate Climate and Environmental Action Plan for the municipality's own activities is being planned for 2018/2019. Nominating and following up environmental coordinators in all of the units will be one of the measures, and an internal climate and environmental forum will be expanded with the aim of inspiring and providing advice to the units.

Climate and environmental award

An internal and/or an external climate and environmental award will be established that will recognise the work of units or organisations towards more sustainable development. An annual environmental award could focus on good measures and inspire others.

Political committees

Stavanger Municipality's Agenda 21 Committee is a political forum for dialogue aimed at strengthening the work on the environment and sustainable development, both in the municipality's own operations and in relation to the municipality's residents. Its purpose is

to raise environmental awareness and encourage voluntary organisations, individuals and companies to change their habits in a more sustainable direction.

As the municipality's environmental council, the Municipal Council for the Environment and Development (KMU) has a special responsibility to ensure that the municipality's adopted climate and environmental objectives are followed up in accordance with plans, laws and regulations.

International cooperation and solidarity

Climate and environmental challenges are global and require cooperation at an international level. Stavanger Municipality is affiliated with, and a member of, several national and international networks that work for sustainable development. The municipality is participating in various projects that are seeking local solutions to global climate and environmental challenges.

The municipality's European office in Brussels gives it access to information that is important for the business sector in the Stavanger region. The Horizon 2020 research programme will remain an important tool that Stavanger Municipality can use in its climate and environmental work.

Through its work in networks and international forums, Stavanger is building itself up an international stakeholder where cities can learn from each other. As an energy capital, Stavanger and the region have major advantages within expertise and technology that can also be used in connection with climate and environmental challenges. Both formal and informal networks that the municipality is part of create opportunities for partnerships and project collaboration.

An overview of the agreements and networks that Stavanger Municipality participates in can be found in Appendix 6.

A review of the various networks and agreements is planned in order to examine what benefits the municipality derives from them and how the municipality might possibly get more actively engaged to gain even more benefit.

Performance indicators

- **Number of innovative procurement processes commenced**
- **Number of eco-certified units in the municipality**
- **Proportion of third-party eco-certified suppliers (annual survey of the most important)**
- **Number and proportion of third-party eco-labelled products purchased by the units**

Appendix 1: Glossary

Bioenergy	Energy released by using biomass. This can be in solid, liquid or gas form. Bioenergy is regarded as renewable since the biomass will quickly be replenished.
CO₂ equivalents (CO₂e)	A designation used to enable comparisons of the ability of different greenhouse gases (GHGs) to heat up the atmosphere. GHGs are converted to CO ₂ values, which are called CO ₂ equivalents.
Direct and indirect emissions	GHG emissions are regarded as direct or indirect. Direct emissions can be directly ascribed to an activity, such as driving or heating with fossil fuels. These are also called "local emissions". Indirect emissions are not produced by the actual activity itself, but in the production of the goods or services. This often happens somewhere other than where the goods are used and are also called "global emissions".
Energy well	A hole bored into the ground in connection with the extraction of geothermal heat. The temperature can be increased with the aid of a heat pump. The heat is conducted into a closed circuit and can be used for heating via a waterborne system.
Energy carrier	A mechanism or substance that can store energy so it can be used somewhere else at a later time. Examples include electricity, district heating, oil and gas.
Renewable energy	Energy sources included in the earth's natural cycles and that are replenished in fewer than one hundred years. Examples include wind power, hydropower, solar energy, biofuels, etc.
Fossil energy	Energy that comes from oil, gas, coal and coke that has been extracted from the ground. Oil includes all petroleum-based products such as petrol, diesel and light and heavy oils. Fossil energy is, unlike bioenergy, not renewable.
Fossil-free zone	A geographically delineated zone in which fossil energy sources are not used for transport, heating or other purposes.
Source separation and sorting	Source separation describes sorting waste at its source, e.g. in the home. If the waste is further sorted at a central sorting plant, even more waste will be recovered. The sorting rate is derived from the quantity of source separated and sorted materials.

Climate footprint

An area's climate footprint includes all of the manmade GHG emissions that come from direct and indirect emissions caused by the residents and enterprises in the area. It also includes emissions linked to the production of goods and services, and not just their use.

Climate neutral

In a climate neutral organisation or geographical area, the GHG emissions and the measures that reduce these emissions are in balance. Plans are drawn up to cut emissions and the remaining emissions are compensated for by purchasing approved climate quotas, e.g. to support reduction measures elsewhere on the globe. Stavanger Municipality's strategy for becoming a fossil-free society does not include purchasing climate quotas to compensate for direct local emissions.

The Norwegian Consumer Authority (2009) has produced a guide on using the term "climate neutral" in Norway.

Greenhouse gases

Gases in the atmosphere that absorb heat radiation from the earth. This radiation is immediately emitted in all directions, both out to space and back down to the earth's surface. They ensure that the average temperature of the earth remains at about 15°C, instead of the -19°C it would be without the greenhouse effect. Increasing the quantity of GHGs also raises the temperature of the earth. Carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and the fluorinated gases CFCs, HCFCs, HFCs, and SF₆ are regarded as the most important GHGs.

Low emission zone

A geographically delineated area in which the local authorities are trying to improve air quality using means targeted at the emission properties of vehicles.

Pollutants

Chemical compounds with low biodegradability (they are persistent) that can accumulate in living organisms/ the food chain and are toxic. They can damage the health, fertility and genetic material of living organisms.

Zero-emission zone

A geographically delineated area with no local emissions (nitrous oxides and airborne dust) and no GHG emissions (carbon dioxide).

Circular economy

A principle for economic activities aimed at ensuring that resources remain in biological or technological circulation for as long as possible. The lowest possible levels of raw material use, waste, emissions and energy consumption are important, as are reuse, sharing and borrowing.

Solar cells	Solar cell panels are made to produce electricity. They are affixed to roofs or stands that face the sun. They are also called photovoltaic systems.
Solar traps	Solar trap systems can be affixed to roofs or other flat surfaces that face the sun. A dark, absorbent surface is heated by solar energy. The heat is conducted away by a circuit containing a liquid or gas so that it can be used to directly heat buildings or tap water.
Peak load	The output that the ordinary energy system is unable to deliver on those days when the demand for energy is exceptionally high. The output for ordinary needs is called the base load.
Time-differentiated toll charges	A toll charging system with higher rush hour charges and lower charges during the rest of the day.
2 degrees Celsius target	<p>195 UN members at COP21 in Paris adopted a climate agreement with the objective of keeping the global temperature rise below more than 2 degrees Celsius from the preindustrial age to 2100, and preferably at only 1.5 degrees Celsius.</p> <p>Researchers on the UN Climate Panel point out that a 2-degree Celsius rise is the limit for what they believe the natural world can tolerate before climate change becomes serious and uncontrollable.</p>

Appendix 2:

Definitions of energy standards for buildings

Passive houses are buildings that use little energy for heating compared with ordinary types of houses. The term “passive” comes from the use of passive measures for reducing energy needs. Examples of passive measures include extra insulation and well-insulated windows. There are special standards that define passive houses.

A **zero-emission building** is a highly energy-efficient building that “compensates for” GHG emissions during the building process by producing energy using, for example, solar cells. In order for the accounts to balance, the building must deliver more energy in a year than it uses. In this way, the emissions are balanced over the lifetime of the building. The choice of materials is an important part of this calculation.

The Research Centre on Zero Emission Buildings (ZEB) defines different levels of zero-emission buildings depending on how many phases of the building’s lifetime the energy the building produces is meant to compensate for (Fufa et al., 2016). Common to all of the levels of ambition is that the project has to be self-sufficient with high-efficiency energy and a low CO₂ footprint. Unlike pure GHG savings, a plus building is a means of compensating for the GHG emissions attributable to the building by using the building to produce a similar amount of renewable energy.

Energy objectives:

Passive house	Defined in the standard NS 3701 Criteria for passive houses and low energy buildings – Non-residential buildings.
Passive house standard	Comply with the passive house standard as far as it is technically and financially appropriate. Achieve a minimum energy class of B.
Zero-energy building	A zero-energy building produces renewable energy that matches the building’s annual consumption.
Plus building	A plus building produces renewable energy that exceeds the building’s annual consumption.
Zero-emission building	A zero-emission building compensates for the emissions during the various phases of the building’s lifetime by producing renewable energy.

Appendix 3

Recommended emission factors for various energy sources/carriers



Recommended emission factors for various energy sources/carriers:

Energy source/carrier	Recommended emission factor (g CO ₂ e/kWh)	Comments/source
Electricity	361-8.3 x (Tyr-2010) year Tyr 2010 < 2055	Source: The ZEB Report "Proposal for CO ₂ -factor for electricity and outline of a full ZEB-definition".
District heating in general	Calculated based on documentation from the supplier.	Major local variations in solutions and emissions mean that emissions from district heating should be calculated for each specific building/area that will be connected to the district heating network. If these are not available, the factors below should be used.
District heating – base load from waste incineration	0	Assuming that the waste hierarchy is addressed such that waste reduction, reuse and material recovery are prioritised over incineration.
District heating – base load and/or peak load from natural gas	255	With a combination of waste incineration and natural gas, a percentage share of the peak load is calculated using fossil energy for the relevant plant. In 2016, this share was an average of 42 per cent for Lyse Neo, which results in a factor 107 g/kWh.
Solar cells	41 Calculated based on documentation from the supplier and calculated energy production.	Major differences between different solutions. The factor is only used for estimates in early phases. Source: IPCC Working Group III, Mitigation of Climate Change Annex III
Bioenergy – wood	14	Source: Klimagassregnskap.no
Bioenergy – chippings	14	Source: Klimagassregnskap.no
Bioenergy – briquettes	14	Source: Klimagassregnskap.no
Bioenergy – pellets	25	Source: Klimagassregnskap.no
Biogas	0	For gas from Lyse's mains, this assumes an agreement on guarantees of origin. In general, biogas should primarily be used for transport purposes. Stipulate requirements for climate accounts for the production of biogas.
Biocrude	25	Source: Klimagassregnskap.no
Natural gas	255	Source: Klimagassregnskap.no
Propane	298	Source: Klimagassregnskap.no
Heating oil	315	Source: Klimagassregnskap.no The Storting (Norwegian parliament) has approved a ban from 2020.

From the report "Vurdering av utslippsfaktorer fra ulike energikilder" ("Assessment of emission factors for various energy sources") NIRAS 2017

Appendix 4

Example of environmental product declaration (EPD) – excerpt



Linoleum



According to ISO 14025

Environmental Product Declaration Linoleum



Martha Washington Hospital, Charlottesville, VA
Kahler Slater, Inc.

Committed to Sustainability.

Armstrong® is committed to delivering solutions that reduce the environmental impact of the buildings you create, from product design and raw material selection, to how our products are produced and delivered.

This Environmental Product Declaration (EPD) was developed to document the sustainability of our products. Inside this ASTM certified ISO compliant EPD is the following:

- Product application and use
- Product ingredients and their sources
- Information on how Linoleum flooring is produced
- Life Cycle Assessment (LCA) results including global warming potential and primary energy usage
- Total impacts over the life cycle of the product
- Performance attributes

Linoleum is designed to be both durable and beautiful, making it a great product for commercial applications.

Linoleum	
Functional Unit – 1 m ² of 2.5 mm Linoleum 1 year service life	
LCA IMPACT* MEASURES	TOTAL
Primary Energy (MJ)	168.7
Global Warming Potential (kg CO ₂ equivalent)	5.60
Acidification Potential (kg SO ₂ equivalent)	5.49E-02
Eutrophication Potential (kg PO ₄ ³⁻ equivalent)	1.24E-02
Ozone Depletion Potential (kg R11 equivalent)	3.89E-08
Photochem Ozone Creation Potential (kg Ethene equivalent)	3.66E-03
PERFORMANCE ATTRIBUTES	
Acoustics NRC (Absorption)	0.05
Static Load (psi)	125 – 450
Light Reflectance	up to 54%
ASTM F2034	Meets
Flooring Ingredients: Linseed Oil, Wood/Cork Dust, Limestone, Jute (backing), Aluminum Hydroxide, Tree Resins, Titanium Dioxide, Color Pigments	
* Based on CML 2010 Impact Factors	
Visit armstrong.com/transparency for further information.	

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10.0 Life Cycle Assessment (continued)

Figure 7 shows the sources of primary energy separated into non-renewable and renewable resources. Figures 8 and 9 show the contribution of different resources to renewable and non-renewable primary energy. All figures refer to energy sources used to manufacture Linoleum in 2011.

Figure 7. Sources of Primary Energy

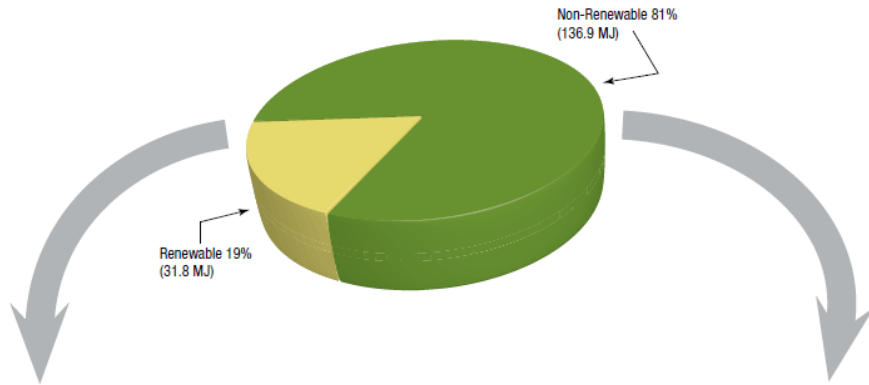


Figure 8. Renewable Energy by Source

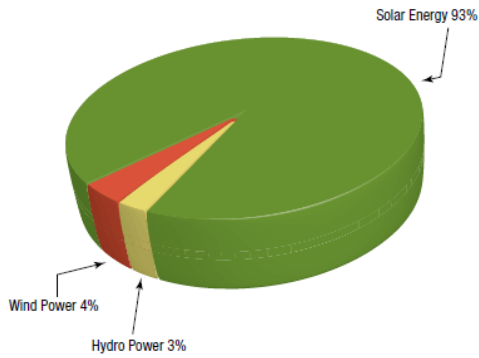
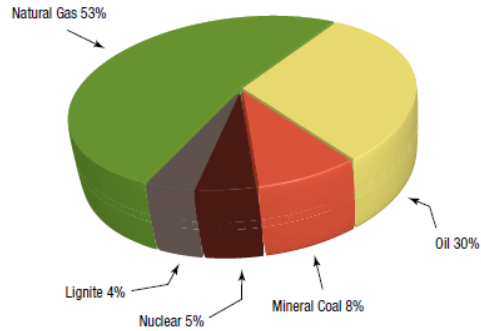


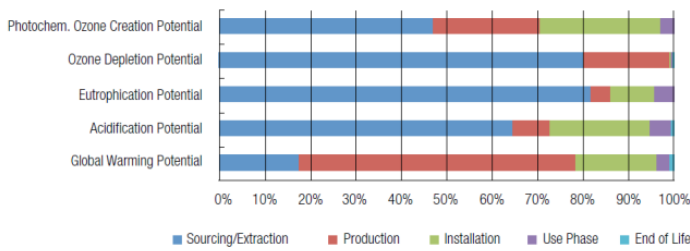
Figure 9. Non-Renewable Energy by Source



10.0 Life Cycle Assessment (continued)

Figure 6. Life Cycle Impact Results for 2.5 mm Linoleum (1 year)*

Figure 6 shows the relative importance in percentage terms for the raw material Sourcing/Extraction, Production, Installation, Use, and End of Life stages for 2.5 mm Linoleum.



*Based on CML 2010 Impact Factors.

Table 9. TRACI 2.0 LCA Results for 1 m² of 2.5 mm Linoleum for 1 Year with Medium Maintenance Intensity

IMPACT MEASURE (TRACI 2.0)	SOURCING / EXTRACTION	PRODUCTION	INSTALLATION	USE PHASE (1 yr)	END OF LIFE	TOTAL
Global Warming Potential (kg CO ₂ equivalent)	0.98	3.40	1.00	0.15	0.06	5.59
Acidification Potential (kg mol H ⁺ equivalent)	2.04	0.26	0.66	0.14	0.02	3.13
Eutrophication Potential (kg PO ₄ ³⁻ equivalent)	1.26E-02	3.77E-04	4.26E-04	5.81E-04	2.54E-05	1.40E-02
Ozone Depletion Potential (kg CFC11 equivalent)	3.68E-08	8.93E-09	1.37E-10	1.09E-10	3.33E-11	4.60E-08
Smog (kg O ₃ equivalent)	0.45	0.08	0.20	0.02	0.01	0.75

Appendix 5

Stavanger's water bodies – status and deadlines for target achievement

Name of water body	Eco status 2015	Eco status 2012	Deferred deadline for environmental objectives
Streams into Hafrsfjord	Moderate		GEP 2027 (HMWB)
Møllebekken	Very poor		
Foruskanalen	Moderate		GEP 2027 (HMWB)
Hålandsvatnet	Very poor		GES 2033
Litle Stokkavatn	Moderate		
Mosvatnet	Poor		GES 2027
Hafrsfjord		Very poor	GES 2027, GCS 2027
Port of Stavanger		Moderate	GCS 2027
Stavangerfjorden, inner		Moderate	GCS 2027
Stavangerfjorden, outer		Moderate	
Gandsfjorden, outer		Moderate	GCS 2027
Byfjorden-Åmøyfjorden		Good	
Tasta-Ulsneset		Good	GCS 2027
Hidlefjorden	Good		
Vistebukta	Good		
Stream catchment area for Store Stokkavatn		Poor	
Breiavatnet	Moderate		
Vannassen	Moderate		
Hillevågsvatnet	Undefined		GCS 2027
Store Stokkavatn		Good	

GES = Good Ecological Status, GCS = Good Chemical Status, GEP = Good Ecological Potential. HMWB = water bodies modified for socially beneficial purposes. Water bodies designated as heavily modified (modified for socially beneficial purposes) are subject to a less strict objective called good ecological potential (GEP).

Appendix 6

Environmental agreements and collaboration forums Stavanger Municipality participates in

Klimavoteprojektet (“The climate quota project”)

In 2007, the Stavanger Municipal Executive Board decided to set aside funds each year to compensate for GHG emissions from the municipality’s air travel. The amount, NOK 200,000 as per 2018, must be used to support climate measures in the municipality’s twinned towns: Nablus on the West Bank and Antsirabe in Madagascar. A new agreement was signed in 2015 to specify the purposes of the measures. Examples of measures include planting trees, maintaining forests and developing biofuels.

The agreements are for one year at a time, but run until one of the parties terminates them. If the projects cannot meet the terms and conditions in one year, consideration will be given to investing the municipality’s funds in other climate quota projects, such as My Climate, www.myclimate.org.

International environmental agreements and collaboration forums

The Aalborg Charter and the Aalborg Commitments

Stavanger Municipality signed the Aalborg +10 declaration in 2005. This is an extension of the Aalborg Charter from 1994 and has been signed by around 700 local democracies from around the world. The themes of the declaration cover environmental, economic and social/ethical aspects of sustainable development.

Covenant of Mayors

Stavanger Municipality signed the Covenant of Mayors, a European Commission initiative, in 2008. The targets in the covenant are a 20 per cent reduction in GHG emissions by 2020, using 1990 as the base year, with a renewables proportion of 20 per cent. The emissions target for new participants has been raised to a reduction of at least 40 per cent by 2030. They must also approve a plan for how they will achieve the reduction target and adapt to climate change. The Covenant of Mayors is intended to help the political leadership of European cities establish networks and arenas for discussing measures and policies for achieving these targets.

ICLEI

ICLEI – Local Governments for Sustainability – is a global environmental network for cities and regions. Stavanger Municipality has been a member since 1991.

EUROCITIES and ERRINN

Stavanger Municipality is an associate member of EUROCITIES. This is a network for major cities in Europe and currently has 135 members in 39 different countries. EUROCITIES works to spread good examples of urban development among its members. Relevant themes linked to climate and environmental issues are clean air, green cities, circular economics, and sustainable and affordable energy.

In the European Regions Research and Innovation Network (ERRINN) Stavanger is represented via the region’s European office, which also holds one of the seats on the network’s board. Regions from more than 20 European countries participate, and the themes for cooperation include bioeconomics, marine-based industry, energy and climate, transport, water and smart cities. This network has particularly been engaged in issues surrounding health, energy and smart cities.

Climate KIC

In 2017, Stavanger Municipality became a member of Climate KIC – a public-private partnership linked to the EU's European Institute of Innovation and Technology. "KIC" stands for "Knowledge and Innovation Community". From education, entrepreneurship and innovation should emerge economically sustainable products or services that help mitigate GHG emissions and the consequences of climate change. The focus areas are transformation in cities, sustainable production systems, funding partnerships for green measures, and sustainable land use.

Global Parliament of Mayors

The Global Parliament of Mayors, GPM, was established in the Hague in 2016. Mayors from all over the world meet every year to discuss global challenges that can be fully or partly solved by cities and smart urban development.

In September 2017, around 100 mayors met in Stavanger to work on structure and management tools. These are intended to empower the forum with a view to addressing the major global challenges of our time, including global warming and migration.

World Energy Cities Partnership (WECP)

This network, with 19 member cities from all over the world, facilitates research and business collaboration and shares the lessons learned from common challenges. Climate change is one of these. Stavanger Municipality was one of the initiative-takers behind WECP in 1995 and Mayor Christine Sagen Helgø was its president from 2013 to 2015. Greater Stavanger is the Norwegian secretariat and maintains the ongoing contact with the network.

In 2009, WECP signed the Calgary Climate Change Accord (CCCA) following an initiative by Calgary, Canada, aimed at cutting CO2 emissions by 20 per cent by 2020 in relation to the emission levels in 2005. The accord also contains a long-term goal of an 80 per cent reduction by 2050.

Other networks and projects

In collaboration with Greater Stavanger and the Stavanger region's European office in Brussels, the municipality builds networks and gains access to resources through projects. The EU Framework Programme for Research and Innovation, Horizon 2020, supports the "Triangulum" energy project, which, among other things, is developing a heating system for multiple municipal buildings based on surplus heat from wastewater. Stavanger is working with several other European cities on this project and the technology being developed will be transferred to other cities in Europe.

UNaLab (Urban Nature Labs) is also a project under Horizon 2020, where Stavanger, together with partners from cities and city networks in Europe, South America and Asia, is developing innovative, cost-effective and economically profitable nature-based solutions for water management and flood preparedness.

Stavanger Municipality and Kolumbus AS participate in a mobility project together with, among others, London, with the aim of cutting GHG emissions by encouraging more cycling and use of public transport.

At a local level, Stavanger Municipality is part of the "Fornybar Stavanger" ("Renewable Stavanger") network, which is linked to the Chamber of Commerce, and at a national level, the municipality participates in the "Storbynettverket" ("City Network"), which is linked to the organization ZERO and the Norwegian Association of Local and Regional Authorities (KS).

Appendix 7:

UN Sustainable Development Goals – contribution to their achievement

The 17 UN Sustainable Development Goals were adopted in 2015 and apply to every country in the world. They replace the previous Millennium Development Goals, which were primarily aimed at developing countries. The Sustainable Development Goals recognise that the environment, economy and social development are connected.

1. End poverty in all its forms everywhere
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3. Ensure healthy lives and promote well-being for all at all ages
4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5. Achieve gender equality and empower all women and girls
6. Ensure availability and sustainable management of water and sanitation for all
7. Ensure access to affordable, reliable, sustainable and modern energy for all
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9. Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation
10. Reduce inequality within and among countries
11. Make cities and human settlements inclusive, safe, resilient and sustainable
12. Ensure sustainable consumption and production patterns
13. Take urgent action to combat climate change and its impacts*
14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17. Strengthen the means of implementation and revitalise the global partnership for sustainable development

The primary objectives and detailed secondary objectives can be found on: <https://norad.no/om-bistand/dette-er-fns-barekraftsmal/barekraftsmalene-hovedmal-og-delmal/>

The UN Sustainable Development Goals – the Climate and Environmental Plan’s contribution

	1 No poverty	2 Zero hunger	3 Good health and well-being	4 Quality education	5 Gender equality	6 Clean water and sanitation	7 Affordable and clean energy	8 Decent work and economic growth	9 Industry, innovation and infrastructure	10 Reduced inequalities	11 Sustainable cities and communities	12 Responsible consumption and production	13 Climate action	14 Life Below Water	15 Life on land	16 Peace, justice and strong institutions	17 Partnerships for the goals
Transport									X	X		X					
Energy and material use							X		X	X	X						
Consumption, recovery and waste			X						X	X	X	X					
Green areas and biodiversity		X	X			X			X	X		X			X		
Agriculture		X	X						X	X	X	X			X		
Air quality			X						X	X							
Noise			X							X							
Aquatic environment		X	X			X			X	X				X			
Aquaculture		X	X							X	X			X			
Pollutants			X							X	X						
Contaminated ground			X			X				X				X			
Plastic litter			X			X				X	X			X	X		
Radon			X							X							
Climate adaptation										X					X		
Participation				X	X					X	X					X	X
The municipality as an advocate										X						X	X

Appendix 8

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