

Fornebu – a green town built on outstanding national and international expertise

“Fornebu is to be a meeting place for new knowledge and old wisdom and a good society because the people here live, think, believe and love in different ways.”

That is the wording of the Fornebu Declaration, written in 2006. Today, Fornebu represents excellent innovation and creativity in a close interaction between the environment, architecture and people. The development of Fornebu is characterised by high environmental ambitions.

1- From an airport to Forne “town”

Fornebu was the first airport for civil, modern and international flights in Norway. The land was acquired in 1934 and the airport was finished in 1939, expanded in 1960, decided to be closed in 1992 and closed in 1998. It covers an area of around 3.5 square kilometres. The decision was made to move the air activities because the site could not be further developed and because there was a strong need for an ultra-modern airport for the Oslo region and the whole of Norway.

The work of planning the new town started in 1994 and a clarifying master plan was adopted in 1996 (KDP-1). A final master plan was adopted in 1999. The final master plan, known as KDP-2, was to allow room for 6,300 new homes, around 20,000 office spaces, extensive recreational grounds, large bird sanctuaries and areas for shopping, services and social infrastructure (kindergartens, schools, health-care sites, youth clubs, etc).



Fornebu in the future. Photomontage by Helin & Siitonen.planning group

In order to create the master plan, there was a need for strong involvement by all parties in a participating process that included everyone from local players to international experts in environmental knowledge and planning. Following an extensive description of the framework conditions that were to apply to the area, an international planning competition was organised in which participants from the USA, Denmark, Sweden, Finland and Norway took part. Other countries were also indirectly linked to the process. Finland’s Helin & Siitonen was the multidisciplinary group that came up with the best answer to the question of how to shape the framework conditions into a master plan. This concept was used as the basis for further adaptation and for the development of the new “town”.

Parallel to the process of designing the master plan, Bærum municipality had, as the planning authority, started another process to establish all the good environmental intentions that were relevant at that time and for the future. This process culminated in a programme to monitor the environment – the General Environmental Programme for Fornebu (GEP). Its conclusions were included in the legal part of the master plan - in a separate section in chapter 7 relating to the area part and supplementary provisions. It was decided that the GEP was to be an active annex to the master plan and was to be complied with by all developers in all construction operations.

Information on many topics in the Fornebu development process can be provided, but this document will only focus on the environmental efforts carried out so far.

2- The master plan: a showcase for modern environmental thinking

The work of developing the old airport site was based on the general assumptions, guidelines and integrated impact assessment included in the master plan. As a guide to achieve the local community aimed for at Fornebu, the local council had previously drawn up a set of visions and goals focusing on the environment, business development, housebuilding, recreation and the outdoor life.

The main vision can be summed up as follows: *“The development of Fornebu is to focus on people’s wishes and desires so that the area creates a sense of well-being and security for the inhabitants, local environment and other users.”*

As regards the environmental efforts, these were included in several parts of the visions and goals; both business developments and all the other functions were to be sustainable - *“The area is to be developed in a long-term perspective so that cultural, environmental, architectural and quality considerations are safeguarded.”*

It is also important to point out that: *“Fornebu’s natural resources are to be cared for and not diminished for future generations.”* Fornebu is to be visionary: *“Through the development and protection of Fornebu, the area is to be a showcase for modern environmental thinking when designing a new populated area.”* Such a sustainability philosophy in the master plan allows room to work on sustainable solutions for several environmental-friendliness topics, including energy, climate changes and climate adaptations. The sustainability philosophy permeates the planning policy that was adopted.

The abovementioned General Environmental Programme for Fornebu (GEP) grouped the topics into five large areas: transportation; energy supply and consumption; building materials and waste/mass management; climate and natural/cultural conservation; and pollution and noise. The measures are presented here in accordance with these five categories. An impact assessment and evaluation of the development work so far have been conducted and the results are presented here.

2.1- Transportation

- **Public rail transport servicing the area.** The master plan includes such a system by assuming the system will be electricity-based and thus limit pollution. This measure has been delayed. At present, a proposal regarding a modern metro system has been submitted and will soon be decided on. This measure is prioritised in the National Transport Plan adopted by the Norwegian government, which has promised to implement it soon.
- **Limited parking.** A special parking strategy has been created for the area and limits the number of cars per housing unit and per job. The strategy and rules are stricter than those which apply to the rest of the municipality. The new rules are practised today and have become an example for other projects in the municipality and other municipalities.
- **A network of walkways and bike paths.** A high-quality network of walkways and bike paths with differentiated paths for pedestrians and cyclists has been built. The goal is to encourage people to become accustomed to walking and cycling more when there are restrictions on car usage. Fornebu has been designed for the intensive use of bicycles.

- Car pools with electric cars. A car-pool system involving 6-8 electric cars so far has also been organised. This is a trial scheme and will be extended. The car pool is used by companies in the area. In addition, cars can be booked and used by private individuals living at Fornebu. The electric-car project has been established in cooperation with SmartCity Bærum.
- Temporary biogas-bus services. Most of the buses servicing the area now use greener fuel based on biogas. The biogas is produced by factories using biological waste as the raw material. The waste from Fornebu is sent to Fredrikstad, where one of the biogas factories is located.
- A local and centrally placed area centre and several community centres. The master plan located the area centre, where various services are provided, in a central position to minimise the need for transport – not just for Fornebu but for the entire peninsula, where several thousand people live. The same way of thinking was used when locating the community centres. The centres are based on a model aimed at improving the efficiency of land use and buildings known as the 3S model (co-location, co-usage and interaction). Other projects also use this model.

2.2- Energy supply , consumption and climate

Climate and energy issues play a key role in the environmental policy governing the development of Fornebu. In Norway, energy is mainly generated by hydropower obtained from rivers with many large and small hydropower plants. The actual situation today shows that all the energy consumed comes from these power plants until the reservoirs are empty. In some dry periods when the reservoirs are depleted, electricity is imported from Europe. This electricity is mainly coal-based. In any case, the balance is positive in that the Norwegian energy is on the whole environmentally friendly and does not put too much strain on the environment. Irrespective of how positive our balance is, we are aware that it is a prioritised goal to make our energy usage as efficient as possible and we are moving towards a “plus society”.

- District heating using heat from the fjord. A plant with two powerful heat pumps has been built under the Telenor building and utilises the heat in the seawater. This is one of the most environmentally friendly district heating systems in existence. The heat from the sea is “made more efficient” in the heat pump and heats up the water in a large tank in the heating plant. The heated water is then transported to customers in two parallel pipes in the ground. The high-temperature heat is transported to consumers in insulated pipe 1 under the ground. The customer is connected to the system with the aid of a customer centre with heat exchangers, where the energy is transmitted to the customer’s heating system and regulates the water volume, so that the desired temperature is achieved. After the water has been utilised, it is returned to the heating plant via pipeline 2 to be heated up and re-used. The district-heating pipes are located in the same trench as, for example, power cables, phone and data lines and water pipes. In order to be connected to the system, customers must have a water-based heating system, i.e. a radiator, floor-heating system or ventilation system with a water-based heating battery.
- The solarcell panel park at the area centre. The building’s carbon dioxide (CO₂) footprint will be 40 per cent lower than a new reference building. Low-CO₂ concrete, wood in facades and many other environment-friendly products are being used. The energy consumption will be around 60 per cent less than that stipulated by the regulatory requirements. On the roof of the area centre, a solarcell panel park covering around 2,000 square metres will provide green energy. Visitors to the centre will experience a pleasant indoor climate and a building that is adapted for environmentally friendly transport.
- Storøya kindergarten - the first Norwegian kindergarten with passive-house standard. This building uses extremely little energy for heating, ventilation and lighting. In addition, a solar collector plant has been built and provides hot water for the building and its associated sports facility. The kindergarten also has access to an energy park established in connection with the primary school in the area. The energy park can be used as an educational tool for children and young people, and consists of a micro-hydropower plant, solar panels and a wind turbine. The energy park’s motto is “We generate electricity whatever the weather!”
- Intelligent lighting. Intelligent outdoor lighting for roads, parks and squares had not been used in Norwegian towns until these ideas and materials came to Fornebu. The principle is simple: each lighting point is equipped with an electronic unit with separate identification that is connected to the networks of leads linked to a control centre. The control centre has a server with enough capacity to handle the large number of lighting points in the network. The electronic unit transmits information on the lighting point’s condition, dimming, choice of light bulbs and on-off functions. The control centre can be operated manually or programmed. The main goal of intelligent lighting is to light up those places where the lighting elements are to be found by regulating the lighting strength and perhaps the colour of the light and lifetime of the light bulbs. This is a good way of making energy usage more efficient, thus saving energy and reducing the human workload. Previously, this work had to be done manually with only an on-off function.
- Light sculpture at the Old Observation Tower roundabout. In 2004, a light sculpture was completed at the first roundabout seen when driving into Fornebu. This is a light sculpture made up of many hundreds of tiny spotlights. These use LED light bulbs in all the colours of the rainbow that change colour according to the seasons and time of day. This is pleasant not only for the inhabitants but also for all those driving into and out of Fornebu. The same intelligent lighting principle is applied: a control centre with a computer program controls the duration, dimming and colours. The light sculpture changes according to a specific pattern that is pre-programmed and used at exactly the programmed times. This makes the energy usage more efficient.
- Use of LED lights. At the time of writing, Bærum municipality, in cooperation with its neighbour Asker, has initiated a trial project concerning the use of LED light bulbs in outdoor lighting. The LED lights are expected to provide the light needed and to be energy efficient. The conclusions so far indicate that LED lights for outdoor lighting still cost a lot due to the light bulbs’ short lifetimes, and this makes using them more expensive. In addition, there are extra costs due to the frequent replacement of the light bulbs. The manufacturers have promised more efficient light bulbs. The goal is to replace all the light bulbs in all the municipality’s systems once it has been proven that LED light bulbs will make energy usage more efficient.
- Each project makes an effort to minimise its energy consumption. The environmental plan for each construction project stipulates a requirement of a report on how the developers intend to minimise the energy consumption and make it more efficient.

2.3- Building materials and waste and mass management

- Building materials. The General Environmental Programme for Fornebu (GEP), local environmental plan and specific environmental accounts require an environmental declaration to be submitted showing that the materials which have been chosen and are to be used are the most environmentally friendly in several areas, but especially in relation to the CO₂ “invested” in the product.
- The plan adopts the zero-balance principle for mass management. No mass is to leave the site. This means that everything must be deposited at the site. Only essential masses are to enter the site. Efforts are made to recycle existing masses in order to minimise transport.

- Recycling of masses as raw materials for new projects. Concrete, asphalt, stone, sand and soil from runways and existing buildings that were no longer to be used were treated for re-use. Most roads, walkways and bike paths are made from masses from the old runways. A crushing plant was established on site and turned masses into fill, roads, concrete and soil. A report and guide have been prepared.
- Waste is sorted at source and handled centrally. A centrally controlled system was built and has shafts and pipes that suck in the three waste fractions produced. These are taken to special containers where the waste is compressed. Once the container is full it is taken to a waste facility (Oslo and Fredrikstad) where the waste is sorted, recycled and made into new products, including electricity and biogas. The biogas is returned to stations that primarily supply taxis and public transport buses. This system leads to improved traffic safety and less noise in neighbourhoods.

2-4- Climate, natural and cultural conservation

- Low-carbon (CO₂) construction. The General Environmental Programme for Fornebu (GEP), environmental plan and environmental accounts encourage developers to find good solutions in this area. For example, the area centre project has used low-carbon concrete, wooden facades and energy generated by its own solar panel park, giving it a CO₂ footprint which is 40% less than that of normal buildings.
- Handling of rainwater in open systems. Bearing in mind the flooding issue and the fact that we are now experiencing higher rainfall and more periods of intense rain, it was decided to handle rainwater in open systems.
- Green roofs. In order for rainwater to be dealt with on the building's own land, several developers have started to build green roofs which retain and delay the rainwater before it is transferred to open rivers and dams.
- Safeguarding of bird sanctuaries. Existing sanctuaries were safeguarded by setting aside additional areas as buffer zones which also function well as recreational areas.
- Wide green corridors to allow ecological spread. Plants, insects and animals all need to spread in the landscape. The green corridors were designed with this in mind. Bridges were built in some places to enable this.
- Biological diversity is safeguarded. Rare plants on Norway's red protection lists have been mapped and measures have been introduced to help them propagate. An example of this is the red-listed Nordic dragonhead plant (*Dracocephalum ruyschiana*) in whose flowers the red-listed dragonhead sap beetle (*Meligethes norvegicus*) lives.
- Creation of a community centre with a focus on the environment. Storøya community centre focuses on an issue that is a key topic in education. Other schools come here to be taught about environmental science. The nature house has an agreement with schools according to which environmental experts come to hold presentations and give talks. Bird marking is a popular activity.
- Creation of a nature house at Lilleøyplassen. Several organisations have been invited to establish this co-localisation. Ornithologists, entomologists, field biologists and marine biologists meet at regular intervals and organise activities for several user groups. The organisations study and safeguard the biological diversity and disseminate knowledge. Groups from several schools come here. Lilleøyplassen has been renovated. The oldest part of the house was built in the 18th century.
- The natural landscape has been preserved. Some parts of the natural landscape have been preserved as they were. Parts of the new landscape have been recreated to be as they were before hills and ridges were removed to create the airport site.
- Cultural monuments have been preserved. Several buildings of special value have been listed, renovated and taken into use. The original designs have been preserved.

2.5- Pollution and noise

- Polluted masses were treated locally. The masses that were polluted due to airport activity were treated locally in accordance with the authorities' set values. Slightly polluted masses were placed at the bottom of fills. Small amounts containing concentrated pollution were transported to special waste disposal sites.
- Treatment dams for road water. Road water from the busiest stretch of road is channelled into a treatment dam before being released into open systems and finally into the sea. The dam is regularly treated to rid it of polluted mud.
- Focus on noise. Noise has been an issue focused on both when designing key roads and during the construction process. In the housing areas, waste has been treated at central sites to reduce the noise disturbance.

3- An experimental area and showcase for modern environmental thinking

The starting point was Bærum municipal politicians' instructions to safeguard the environment when creating the new Fornebu. This was reinforced when the then Ministry of Labour and Administration ordered landowners to conduct an overall impact assessment and then comply with an environmental follow-up programme in cooperation with Bærum municipality as the planning authority. Several national goals were also incorporated. New methods have been tried out, even if the topics were novel at that time. Several barriers and attitudes had to be broken down. The current impact assessment shows that the results are so far satisfactory and that more can be expected.

The work of safeguarding the environment has been characterised by creativity and innovation, and Fornebu has taken several steps in the direction of low-carbon solutions. The area has lacked public rail transport for a long time but the national authorities now say that this will be in place soon. We have learned that a large project should not be given a building permit until an environmentally friendly public transport system is in place. Many delegations from other towns and municipalities and from several other countries have come to inspect and analyse the results and do something similar. At present, we know that several Fornebu solutions and ways of thinking have been adopted elsewhere. Handling rainwater using open systems has become a popular strategy to prevent flooding.

4- The best national and international expertise has been used

The planning and development of Fornebu is a unique project for Bærum municipality and for Norway. Never in Norway's history has such a large and extensive area been planned and built at the same time and from scratch. Similarly, the original landowners, the Norwegian state represented by Statsbygg (the Norwegian Directorate of Public Construction and Property) and Oslo municipality, are organisations with plenty of resources and, together with Bærum municipality, they have brought in Norway's best expertise in a number of professional areas. As previously mentioned, the planning competition was an international one and that established

links with international expertise in the shaping of plans and concrete projects. That also applies to the work on environmental and energy issues. Consultancy firms have forged links with national and international networks in order to seek the best solutions.

So far, the high level of professional quality has produced good results. This has been confirmed by the fact that several projects have gone far further than the existing national requirements. Storøya kindergarten being built to zero-house standard was a great achievement given the then-existing energy efficiency requirements. Several other projects have won international prizes and four large projects have been certified according to the BREEAM (Building Research Establishment Environmental Assessment Method) certification scheme. The entire area centre, with its various services, was allocated the highest BREEAM class – Outstanding – a short while ago. The solar panel park contributed to this. BREEAM puts a strong focus on the environment, low-carbon construction and energy efficiency. The certification system uses an integrated method with nine categories: management, energy, materials, water, health, transport, land-use plan and ecology, waste and pollution. The environmental classification method is an independent one and a quality reference that reflects the building's sustainability. Fornebu has already made arrangements so that several buildings can generate their own energy and export it. An office building has been renovated to plus-house standard in Bærum municipality. Now, efforts are being made to make energy companies change their practice so that they will buy the extra energy generated by the plus-buildings.

5- A gigantic joint planning effort

As the Fornebu area was owned by the Norwegian state and Oslo municipality, this project has touched all the political and administrative levels involved in planning large projects. One factor that several people have pointed out on several occasions is how well the planning process was anchored in the local political system. The local council and its executive committee, the planning and environmental committee and other committees, and especially the mayor, have been sincerely interested in the plans for Fornebu. When there were some disagreements with state bodies, the local involvement grew even stronger. There was close collaboration and participation between political bodies and planners in the municipal administration system. The cooperation between Bærum municipality, the Norwegian state, represented by Statsbygg, and Oslo municipality was extremely productive. Here, we must praise Statsbygg's involvement and professionalism in the work on sustainable development issues with a focus on creating a low-carbon community and environmentally efficient energy solutions. A model for calculating CO2 was also prepared by Statsbygg in cooperation with Bærum municipality.

The process has benefited greatly from the involvement of many other members of society. Public meetings and major events providing information and attended by many parties have contributed good ideas to the planning process. We can particularly mention a sustainable development workshop arranged by the National Association of Norwegian Architects (NAL) and attended by several relevant players. Important ideas contributed here were used in the remainder of the process. The wide-ranging participation included young members of the various groups taking part. Developers are now utilising many good professional resources in order to develop the areas using more younger people. It should be particularly noted that the architectural competition for the Statoil building (one of the largest projects) was won by A-lab Arkitekter, which mainly consists of young architects.

6- Fornebu – a laboratory with high ambitions for modern environmental thinking

The Fornebu area will be fully developed in 2025. Based on an overall assessment in 2014, it is possible to state that around 60% of the plan has been completed. All the technical infrastructure is in place apart from the imminent metro system. Most of the business areas have already been developed, with the exception of the Koksa area. In the planning work, the Fornebu project has placed great emphasis on having sizeable recreational areas and birdlife sanctuaries with buffer zones that comprise a large blue-green structure. Around 3,800 homes out of a target figure of 6,300 remain to be granted planning permission. The landowners have asked Bærum municipality to increase the number of homes to 8,500 and the municipality is currently considering whether this is physically and financially possible.

Fornebu has functioned as a laboratory for modern environmental thinking and has introduced several measures never before tried out in Norway. In addition, several of the measures are outstanding so far north, taking into account our climatic challenges comprising a lack of sunshine and light in the winter, when temperatures may fall to as low as -30 degrees Celsius and there is a lot of snow and ice. On the other hand, we have plentiful sun, light and rain the rest of the year. In total, with all the measures listed, Fornebu has made a considerable contribution to better low-carbon construction for the pleasure and enjoyment of the inhabitants, employees and visitors. Users of Fornebu have given an informal overall score of around 5 on a scale from 0 to 6. The blue-green structure has been pointed out as one of the best qualities for ensuring well-being.

In the years to come, the green way of thinking is expected to gain an additional foothold so that the area will be developed using even better solutions to ensure an exemplary, sustainable and energy-efficient district. Perhaps all of Fornebu byen (Fornebu Town) can in the future export its energy surplus to the European electricity grid to which it is connected? With one building in Bærum municipality that is already generating energy and several in the Oslo region, this trend is now materialising. Fornebu has proven that good physical planning processes with sincere sustainable goals and creative energy, climate-change and climate-adaptation solutions help to show new development opportunities for municipalities in Norway and other countries.



The combination of heat from the fjord, environmentally friendly materials, low-CO2 concrete, plenty of insulation, green roofs, the solarcell panel park on the roof and good environmental-planning processes has led to the Area Centre at Fornebu being certified as Outstanding by BREEAM. Photomontage: KLP Eiendom.