FROM AIRPORT TO SUSTAINABLE COMMUNITY

APPLICATIONS

TRANSPORTATION
ENERGY
NATURE & CULTURE
WASTE & MASSES
POLLUTION
The refurbishment of the 340-hectare Fornebu site - Oslo's airport until 1998 - is one of Norway's largest and most ambitious development projects, including new housing, businesses, recreation and conservation projects. One of two landowners at Fornebu, the Norwegian state, and its organ for construction and land development, Statsbygg (Norwegian Directorate of Public Construction and Property), have been heavily involved in work on Fornebu since 1995.

Environmental responsibility is a chief concern in all Statsbygg projects, and the redevelopment of Fornebu represents Statsbygg's greatest challenge yet. By balancing competing interests for industrial, residential and recreational land development, and satisfying public and private aspirations for both the region's environmental profile and its utility for the community, Statsbygg is ensuring that the construction and development at Fornebu measures up to the expectations of involved parties today as well as residents and administrators of later generations. This brochure describes Statsbygg's efforts in environmental land management at Fornebu.
On October 8th 1998, all air traffic to Oslo was officially redirected from Fornebu to the newest pride of Norway - Oslo Gardermoen International Airport, a gleaming new facility 42 km northeast of the city. An airport since 1939, Fornebu would be refurbished to help solve Oslo’s need for residential and industrial space.

Norway has been on an economic upswing since the 60s, and Oslo, in particular, has grown considerably in the past two decades. While the city has fought to protect its green image and its recreation areas, property values in some areas have doubled and tripled. The continued growth of the city is dependent upon its ability to provide housing at a reasonable price and space for a burgeoning IT and knowledge-based industrial sector. Fornebu, it was believed, would be the perfect place to make this happen.

Fornebu is also a place of great natural beauty. It is a low-lying peninsula consisting of 340 hectares with a relatively mild and stable climate that has given rise to a rich variety of flora and fauna.

The Norwegian Parliament and the government set national goals to steer development. They dictated that the area should be planned from a regional and local perspective and as a whole, independent of ownership. Existing developed land at Fornebu should remain as commercial space, while shorelines should serve as recreational space. Some land would have to be earmarked for residential development, while landowners prepared the site for effective public transport. Lastly, Norwegian authorities stipulated that sustainability and environmental management and performance should be emphasized.

A design in place
The planning process for Fornebu began with a number of suitability studies. With these studies, the landowners and authorities invited firms to deliver tenders for a masterplan for the Fornebu site. A group comprised of Architects Helin & Siltonen Oy Ab, Miljøbyråen Ab, YS-Bolagen and OY Engel Ab, all from Helsinki, won the international competition.

Their solution depicts a large, green park with a pond in the middle, and green landscaped corridors branching out in all directions towards the shoreline and fjord that surrounds Fornebu. Transportation is directed towards pedestrian walks and bicycle paths, with an inner ring road for local traffic, and an outer half ring for heavier traffic. Buses and light rail meet public transport needs. Housing is concentrated in the innermost areas, while business and dwellings share space in areas already developed.
The number of residences planned at Fornebu has been a source of debate. Municipality guidelines dictate low-density development and state road authorities report that the main road to Fornebu must be expanded to tolerate extra traffic. However, the Norwegian Ministry of Environment, the governmental planning department, concluded to build a minimum of 6,000 residences.

Industrial development at Fornebu will be dominated by modern workplaces within IT and knowledge-based businesses. Telenor, Norway’s leading telecommunications company, has already built a new headquarters there, with 137,000 square meters of office space and 6,000 employees. In addition, Parliament decided to join forces with private investors to create a national knowledge centre based on IT at Fornebu. As a result, a new company called IT Fornebu Technoport bought a large piece of land and has now started to refurbish the airport terminal.

Fornebu’s capacity for working places is another debate that depends greatly on the area’s transport system. The architects’ master plan proposes 20,000 employees at Fornebu, but road authorities assert that the main road in to Fornebu must first be rebuilt to tolerate such heavy commuting traffic.

Initial steps by Statsbygg
Fornebu is located in the municipality of Bærum, and Bærum – as the local planning authority – has headed planning (zoning and transportation) for the area, in close co-operation with the main landowners: the city of Oslo and the Norwegian State, represented by Statsbygg (Norwegian Directorate of Public Construction and Property). Municipalities in Norway traditionally take responsibility for construction of infrastructure and green space in new
developments. Bærum, however, left these projects open to landowners and developers.

In order to break a deadlock, Statsbygg decided, in accordance with the city of Oslo, to head a project to build the infrastructure as well as green areas with landscaping. As a result, Statsbygg can effectively monitor environmental performance and goals, like cleaning and recycling polluted soil, concrete and large quantities of asphalt, while it also takes charge of balancing masses internally and limiting transportation. The project is well under way and the first part of the new, relocated main road was opened in June 2002.

But further development, including housing, awaits results from negotiations between developers and the municipality of Bærum. The municipality must cover costs of social infrastructure and municipal services, like schools, children’s day care and recreation and cultural facilities. The regional transport authorities (Akershus Fylkeskommune) in collaboration with the landowners must also arrange for a public transport service on rail. If everything goes as planned, Fornebu will be fully developed by the year 2015.

Statsbygg provides the framework necessary to realise Fornebu as a remarkable case of sustainability in practice and a beautiful place to live, work and visit.

**FUTURE DEVELOPMENT**

**STATSBYGG PROVIDES THE FRAMEWORK NECESSARY TO REALISE FORNEBU AS AN INTERESTING CASE OF SUSTAINABILITY IN PRACTICE AND A BEAUTIFUL PLACE TO LIVE, WORK AND VISIT.**

Fumebu is already the home to more than 264 species of birds.

The architects’ vision for a new city outside Oslo.

**MONTAGE: F JELLANGER WIDERØE AS/ARKITEKTBYRÅ HELIN & SIITONEN**

**KETIL KNUTSEN**

**INTRODUCTION**
Local and national authorities have made it clear that Fomnebu’s redevelopment shall correspond with a long-term perspective and high environmental ideals. Statsbygg and the city of Oslo have produced a document, called The General Environmental Programme for Fomnebu (GEP), to ensure that all planning and implementation efforts aim towards the establishment of a sustainable community at Fomnebu.

The programme lays down the following overall objective for development at Fomnebu:

Development at Fomnebu shall emphasise sustainable use of resources and the protection and development of biological diversity. Developers shall employ best practices to create environmentally efficient solutions.

Planning, development and implementation at Fomnebu shall take a conscientious approach to the environment. Environmental considerations shall bear as much weight as functional, technical, aesthetic and economic considerations.

The programme covers five areas:
1. Transportation
2. Energy supply and consumption
3. Building materials, waste and mass management
4. Natural and cultural conservation
5. Pollution and noise

The following chapters will present a set of secondary objectives and measures for each of these areas.

Strategies and areas of responsibility
Local planning authorities included the GEP in its latest master plan for Fomnebu to ensure that environmental objectives and measures are incorporated at an early phase of the project. Specific environmental plans for infrastructure, soil handling and remediation have also been established.

Through the sale contracts, the landowners have informed new owners about the environmental programme, and the new owners’ responsibility for the implementation of the programme. All developers are obliged to integrate the environmental programme in their planning and construction in the Fomnebu area, including building plans, architectural design competitions, calls for tenders and contracts. This means that they must develop their own environmental plans, including a set of objectives and measures that contribute to the achievement of an environmentally sustainable Fomnebu.
Case study: Environmental performance of infrastructure

The GEP is a relative novelty in Norway and there is little experience in how to implement such programmes. Statsbygg, which is responsible for the construction of roads and technical infrastructure at Fornebu, has broken new ground with its Infrastructure project at Fornebu.

In order to follow up performance and planning systematically, Statsbygg has developed an integrated environmental and quality management system. This system includes a set of objectives, plans, routines and processes to secure that environmental aspects are taken into account – from preparing the tender documents until the project is completed. A full-time environmental manager is responsible for the implementation process.

Suppliers

The tender process plays an important role in the environmental programme for Infrastructure Fornebu. Contracting parties must present a sufficient solution to the environmental challenges pointed out in the environmental programme, and describe their own environmental skills. This presentation is taken into account during the assessment of the offers.

Within four weeks after entering into a contract the contracting party should have delivered an environmental plan in accordance with Statsbygg’s system. The contracting party has to explain how environmental aspects are considered in its own production and how the contracting party will implement the programme, including the main environmental objectives and Statsbygg’s environmental requirements.

Skills

The contracting party must appoint one person in its project team to control environmental performance. A CV of this person’s skills is part of the tender documents, and will be evaluated as part of the assessment process.

Several nature reserves have been established at Fornebu to preserve bird, plant and animal life.
The contracting party, and its entire project staff, is obliged to attend Statsbygg’s three-hour environmental course. The course focuses on the main environmental objectives in the GEP and how these are to be followed up during the actual project. It also points out the main challenges, the vulnerability of the area and tries to make people understand the importance of being environmentally conscious.

**Reporting**

Contractors have to deliver an environmental account every month based on indicators chosen by Infrastructure Fornebu. The main indicators for this project are as follows:

- Loss/waste on site of construction
- Sorted waste as share of the total amount of waste
- Recycled and reused materials as share of total amount of materials
- Materials/products subject to environmental assessment as a share of the total amount of materials/products
- Environmental accidents
- Total number of transports to and from Fornebu, and number of transports with empty load one way as share of the total

*Telenor’s new headquarters: a prime example of environment-focus in both construction and use.*

*PHOTO: KNUT RAMSTAD. TELENOR AS*
TRANSPORTATION
THE ESTABLISHMENT OF AN EFFICIENT TRANSPORT SYSTEM FOR FORNEBU HAS BEEN A KEY FACTOR IN THE AREA’S SUSTAINABLE DEVELOPMENT, AND IT REPRESENTS A TWO-FOLD CHALLENGE ...
The establishment of an efficient transport system for Fornebu has been a key factor in the area’s sustainable development, and it represents a two-fold challenge. On the one hand, its successful utilization as a centrally located development area is crucial, both in avoiding urban sprawl (and the resulting increase in transport needs) and in providing a basis for a satisfactory public transport service. The State assumes that Fornebu shall have efficient public transport services, and successive governments have called for a – in Norwegian terms – relatively high building density. On the other hand, the traffic generated by a development of this magnitude necessitates major investments in infrastructure and new roads. The Norwegian Public Roads Administration has therefore required that the major road (European Road E 18) into Oslo be widened before full development is permitted.

Both the question of what type of public transport service Fornebu should adopt and the widening of E 18 have been the subject of continual clarification and debate for many years. The latest recommendation is to enhance the public transport services with light rail from the junction at Lysaker.

**Linked network of footpaths and cycle paths**
A comprehensive and attractive network of footpaths and cycle paths that aims to create easy access to all areas of the

**Low impact transport solutions**
The General Environmental Programme for Fornebu (GEP) describes the public transportation strategy: enable the reduction of total transport needs; prioritise the establishment of internal pedestrian and cycle transportation solutions; prioritise the establishment of commuter transportation solutions using public transport; minimise the impact of traffic on residential areas.

The strategy’s implementation requires comprehensive measures:
- Linked network of footpaths and cycle paths, with site-wide accessibility.
- Provision of on-site amenities, services and activities.
- Road re-routing and enhanced public transport services.
- Centralised and limited parking facilities.

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**Linked network of footpaths and cycle paths**
A comprehensive and attractive network of footpaths and cycle paths that aims to create easy access to all areas of the
site is under construction at Fornebu. It will mean that car transport will neither be necessary nor swifter. The paths are routed through green corridors and in separate lanes alongside the main roads, resulting in pleasant views of the landscape.

**Urban environment, esthetics and safety prioritised**

The area planning for Fornebu includes a differentiated road system sheltering residential areas from through traffic, and school routes that avoid road crossing. The existing main road to Fornebu has been diverted away from the coast and the new road - a boulevard with avenue planting and wide green borders - is located in the buffer zone between residential and commercial areas. Together with the adjoining buildings, this is meant to provide a recognisable and pleasing urban space; a navigational axis for the new Fornebu area.

Quality and harmonious design have been emphasised in the development of the road system, with a special design being developed for stop points, stone constructions and street lighting. The road will carry a large volume of traffic - up to 3,600 vehicles during peak hours. Its initial four lanes also allow for the later addition of a mass-transit lane.

**Limited parking facilities**

To limit motor traffic, the number of parking spaces at Fornebu has been restricted. The area planning limits parking capacity to one space per 60 m² of office space. When Telenor constructed its headquarters the requirement was amended to one space per 80 m² - in effect just one parking space for every four workspaces. As Telenor moved in before any agreement on public transport for Fornebu was made, the company itself secured agreements with local bus companies regarding an expansion of public transport services. Its employees' transport needs were determined prior to occupation, and new bus routes and departures were added to the existing Oslo public transport services, where necessary. According to the first survey conducted among Telenor's employees (in May 2002), 37% drive to work, 52% use public transport, while the remaining 11% prefer to walk, cycle or use other means of transportation.
NORWAY HAS TRADITIONALLY BASED ITS SUPPLY OF ENERGY ON ELECTRICITY. MEASURES TO INTRODUCE MORE FLEXIBILITY INTO THE ENERGY SUPPLY AND DECREASE DEPENDENCE ON DIRECT ELECTRICITY FOR HEATING ARE NOW BEING PRIORITISED.
Situated close to Oslo, Fornebu experiences cold winters and relatively warm summers. The average temperature drops below 0°C four months of the year, but recent winters have only produced light snowfalls. The landscape is flat due to Fornebu’s earlier use as airport and, despite some re-modelling during the development of the area, it will therefore remain vulnerable to wind.

Because of the climate and topography, buildings require heating seven or eight months of the year, and during the summer some office buildings will require cooling. Therefore a large amount of the total energy used at Fornebu will be for heating and cooling of the buildings. Norway has traditionally based its supply of energy on electricity. Measures to introduce more flexibility into the energy supply and decrease dependence on direct electricity for heating are now being prioritised.

Renewable energy from heat pumps and district heating

To challenge today’s energy technology a contest for energy solutions at Fornebu was arranged. Based on the winner’s solution a combination of heat pumps that exploits the energy in seawater to create heat and district heating was chosen. The heat is distributed in a flexible, water-borne system. The system will also supply the district cooling system.
In order to reduce the dependence on direct electricity for heating, developers are now being required to connect their buildings to the district heating system.

**Lighting solution cuts electricity use by 40 per cent**

When constructing the new main road, a demand-controlled lighting system is installed that will reduce electricity use by 40 per cent compared to a traditional system. The reduction is due to dimmed lighting during the nights and low traffic hours, reduced energy losses and energy efficient technology. The system’s other advantages are controllability, increased lamp life and reduced light pollution for the neighbourhood.

**Telenor combines IT and energy innovation**

The first new resident at Fornebu, Norwegian telecommunications giant Telenor, has focused on environmentally friendly solutions in the development of its new headquarters. Telenor has implemented The General Environmental Program’s objectives for energy supply and usage throughout the planning and construction phases.

Prior to construction, Telenor set itself an ambitious energy-use goal: More than 50 per cent of energy used shall be derived from local renewable energy sources through the use of seawater. To fulfil this, Telenor is using heat pumps to supply 85 per cent of the energy necessary for heating and cooling the new headquarters. This method results in a dramatic reduction in the use of electricity.

Telenor has also implemented a range of other energy efficiency measures like controlled ventilation, heating and lighting systems, energy follow-up systems and control of energy use during construction.
PROTECTING THE WETLANDS AT FORNEBU WILL BE A CHALLENGE WITH THE INFLUX OF 10 TO 20,000 NEW RESIDENTS.

THE IMPACT ANALYSIS FOR FORNEBU ALSO INCLUDED A COMPREHENSIVE SURVEY OF CULTURAL MONUMENTS.
Fornebu is a low-lying peninsula at the head of the Oslo Fjord. Its bedrock consists of highly folded layers of calcareous shale from the Kambro Silur period. Combined with the mild and stable climate, this has given rise to a varied and rich flora and fauna. Until the airport was built in the late 1930s, Fornebu was a fertile agricultural area and home to prosperous merchants and ship-owners. Construction of the airport was a geographic turning point for the area. Large swaths of natural and cultural landscape were cleared, stone shelves were blasted away and natural depressions were filled. Parts of the shoreline were less affected and have been sheltered from human activity by air traffic. These wetlands are important biotopes and provide nesting sites for a variety of bird species. Periodic field studies of the areas have registered some 264 different species. Today these inlets are the only remaining wetlands of significance in the Oslo Fjord interior. They were protected as nature reserves by Royal proclamation in 1992.

Buffer zones
Protecting Fornebu’s migrant bird population will be a challenge with the influx of 10 to 20,000 new residents. An impact analysis by the Norwegian Institute for Nature Research recommended a green border at least 50 metres wide to shield nature reserves from human activity. Protective measures against free-running cats and dogs were also recommended.

Conscientious and practical co-operation for conservation
The General Environmental Programme for Fornebu (GEP) describes the strategy for natural and cultural conservation and protection at Fornebu: prioritise Fornebu’s biological diversity; protect nature reserves; provide accessibility to the public; restructure the landscape that enhances the area’s natural beauty; preserve local cultural landmarks.

The strategy’s implementation requires comprehensive measures:

- Establishing buffer zones between the bird sanctuaries and the housing area.
- Creating public parks with easy accessibility for residents and visitors, and green corridors that ensure biological diversity.
- Protecting cultural treasures or incorporating them into new development.

SUMMARY

ENVIRONMENTAL GOALS

- Protect existing sites of natural or cultural value
- Create landscaping with focus on aesthetics and functionality
- Promote outdoor activities for Fornebu residents and the region
- Designate shorelines for public recreation or nature preserves only
- Protect and develop biological diversity in Fornebu’s green areas

Fornebu's wetlands are rich biotopes and important resting sites for migrant birds.
Recreational areas along the shoreline
Fornebu has seven kilometers of shoreline of which 2.5 kilometers form parts of the nature reserves. The remainder is earmarked for recreational areas with public access. Parts of the shoreline are intact biotopes, whilst landfill sites, roads and runways have spoilt others.

Large green sites tie shore areas together
The municipal master plan for Fornebu identifies large areas – circa 1 square kilometer – as green sites. These are to consist of linked sites and green corridors to tie shore areas together and ensure the diversification of species. One of the first initiatives is the development of new land formations. Some areas have been excavated and others have been built up with residual soil and crushed rock. Since the buffer zones adjoining nature reserves will have indigenous vegetation, some plants have been cultivated from locally collected seeds.

Public access to parks
Commercial developers at Fornebu have signed construction agreements with Bærum municipality that oblige them to open their park areas to the public. Telenor has promised to open its headquarters’ parking area to the public outside of office hours.

Outdoor spaces in building projects
The landowners and Bærum municipality have drawn up joint esthetic guidelines for Fornebu, which have been approved by the municipality’s executive committee. They cover design of buildings, outdoor spaces, external furnishings, signage and advertising. They are intended to guide the planning of buildings and other constructions on Fornebu.

Cultural monuments and new buildings
The impact analysis for Fornebu included a comprehensive survey of cultural monuments. Monuments worthy of preservation were noted in the municipal master plan and are slated for protection. Fornebu gård is the most important cultural monument at Fornebu. The prominent mansion, which dates back to the late 1700s, was extensively rebuilt and enlarged in 1917 and today represents a prime example of the private residencies of its time. The building will be protected as a cultural monument and parts of its magnificent grounds will be restored and integrated with Fornebu’s public park areas.

The airport itself is also an important cultural monument. A small terminal building from the airport’s pioneer days of 1939 has been protected as a cultural monument along with the first hangar from the 1940s. When the newer southern terminal was built in the 1960s, it was considered one of the most modern in Europe. The terminal building itself is now being converted into a national IT centre. Few traces of the airport will remain visible aside from the central departure lounge with its characteristic murals.
THE TRANSFORMATION OF THE FORMER FORNEBU AIRPORT AND SURROUNDING AREA INTO A GREEN, RESIDENTIAL AND COMMERCIAL DEVELOPMENT INVOLVES HUGE QUANTITIES OF MASSES, MATERIALS AND SOIL.
Initiate the use of ecologically sound building materials and construction procedures
Achieve minimal waste and optimal reuse of existing buildings
Achieve maximum recycling of demolition materials and masses to reduce transport needs

Efficient, balanced and local material management
The General Environmental Program for Fornebu (GEP) describes the material management strategy for Fornebu: use of ecologically sound building materials and construction techniques; minimal waste and optimal recycling of materials; local management and recycling of materials to reduce transport needs.

The strategy’s implementation requires comprehensive measures:
- Establishing a local plant for recycling of soil and asphalt aggregates.
- Requiring all technical infrastructure contractors to maximise the use of recycled masses and demolition materials from the former airport.
- Promoting re-buying agreements between the recycling plant and developers.
- Developing and testing new uses of recycled materials.
- Promoting the use of ecologically sound building materials and construction procedures.

The transformation of the former Fornebu airport and surrounding area into a green, residential and commercial development involves huge quantities of masses, materials and soil. For both economic and environmental reasons, the reuse of buildings and materials has been an important issue during the planning process, and all demolition will be undertaken with a view to maximising recycling and controlling waste management. As an overall goal it was suggested that no masses should be transported out of the area and that new high-grade end-use should be given priority over land-filling.

The development of the new Fornebu, also implies the large-scale introduction of new materials. The environmental challenge here is to promote healthy and non-toxic materials, with good ecological performances, to ensure efficient use of resources and to minimise transport needs. For the future development of resident and commercial areas, the municipality of Bærum has established special guidelines for environmentally sound design and construction, including guidance on the use of materials.

Airport terminal becomes IT and Knowledge Centre
The former airport terminal is to provide the nucleus of the new Information and Knowledge Centre being built at Fornebu. The airport hangars, which have already been used extensive for cultural events, are also being considered for reuse.
The re-development of the airport site is so far a prime example of recycling of existing infrastructure and materials. Materials from demolished structures are sorted on site and all health- and environmentally damaging substances removed for recycling. Statsbygg’s infrastructure project requires all developers of new structures to maximise use of environmentally sound materials and technical solutions. In order to monitor standards for environmentally friendly materials, all contractors have to document the 10 most used materials (besides rock).

**Reduced construction traffic by 80,000 truckloads**

The total mass management strategy for Fornebu - involving mass balancing by reuse of asphalt and concrete and local production of soil and heavy construction materials - is illustrated in the figure below. Extensive R&D work has been carried out on soil production and recycling of asphalt and concrete to develop new end-uses based on existing raw materials. Statsbygg has established a local recycling plant to produce the masses.

The plant is expected to supply all soil for common green areas, and 90 per cent of masses used for site infrastructure. Its ‘non-profit’ operation demands that local site developers joining the scheme sign re-buying agreements and follow a system for reporting of mass excess and requirements to Statsbygg. This enables Statsbygg to keep a mass-management account for Fornebu, to optimise end-uses and to plan the production at the recycling plant.

If the principal owners succeed with the mass management strategy it can reduce traffic by 80,000 truckloads during the construction period. The profit for each project lies in reduced transport costs and savings gained from purchase of local recycled products rather than externally produced virgin materials.

**Waste becomes superior road material**

As part of efforts to maximise recycling potential for the waste at Fornebu, Statsbygg initiated an R&D project in 1999 to investigate the use of recycled asphalt and concrete as unbound road masses. A test road built on one of the old runways provided the basis for frequent field investigations carried out by the road authorities, and extensive laboratory investigations of the masses. The results showed that the recycled asphalt and concrete perform better than natural aggregates in road building, and a new heavily trafficked road into Fornebu, Ny Snarøyvei, was built with 30 cm of crushed asphalt in the sub-base. The project has made it possible to open up for extensive use of recycled masses in road construction at Fornebu. It has also given the road authorities valuable support in their ongoing revision of the national road.
THE FORNEBU AREA IS POLLUTED FROM SEVERAL DECADES’ USE AS AN AIRPORT. CONSIDERABLE EMPHASIS IS PLACED ON CONTROLLING AND DOCUMENTING THAT CONTAMINATED AGGREGATES ARE PROPERLY DEALT WITH.
The Fornebu area is pollulted from several decades' use as an airport. The pollution was surveyed during 1993–98 and 35 sites where soil needed removing and treating before re-development were identified. The main remediation of the 35 contaminated sites started year 2000, and will be carried out during a four year period. The identified sites (including ten landfills) are mainly contaminated with oil, tar (PAH), heavy metals and de-icing chemicals. Approximately 200,000 cubic meters of soil have to be excavated during the remediation project.

Fornebu will become a residential and commercial area with large green spaces and nature reserves. The fact that many people will live and work in these areas means that the clean-up of all ground contamination has been strictly regulated.

The current landowners have obtained a general area license from the Norwegian Pollution Control Authority (SFT) to take responsibility for implementing the remediation work in accordance with SFT's requirements.

**Pollution control and site-specific remediation**

The General Environmental Programme for Fornebu (GEP) describes the remediation strategy of all existing ground pollution; prevention of future ground, air and water pollution; minimising of noise pollution; maintaining climate gas emissions at below national averages.

The strategy's implementation requires comprehensive measures:

- Site-specific risk assessment for remediation and reuse of soil
- Local treatment of all contaminated soil
- Public transport and car-free transport solutions to reduce emissions and noise
- A sustainable energy supply to avoid use of fossil fuels

**Environmental Goals**

- Prevent future ground, air and water pollution
- Achieve remediation of all existing ground pollution
- Maintain climate gas emissions at below national averages

**Site-specific risk assessment for reuse of soil**

Statsbygg has developed a site-specific risk assessment model, assessing the risk for health and environmental damage for each contaminated site, in light of natural local conditions, the type of contamination and future use of the area. On the basis of historical research, site investigations and risk assessment the action required at each site will be de-
The overall target for the clean-up is the removal of sources of contamination that represent an environmental threat or conflict with the future use of the area.

An important environmental target for the development at Fornebu is to treat most of the contamination locally, in order to reduce transport. Local measures – excavation and treatment at a local treatment plant, sealing of contaminated sites, remedial measures in situ without prior excavation – are therefore prioritised. A local treatment plant (biological treatment by composting) for contaminated soil has been established at Fornebu. The plant successfully treated around 14,500 tonnes of soil in 2001. Treated soil is reused in Fornebu, landscaping at according to the mass management strategy.

**Reuse of tar contaminated aggregates and soil**

One of the challenges at Fornebu was to deal with the 200,000 square meters of asphalt and sub-base contaminated with tar (PAH). The contamination is found under the oldest runways and is very unevenly distributed. Remediation consists of removing the overlaying asphalt which is uncontaminated and can be reused at the local recycling plant. The remaining 10-15 cm thickness of tar-contaminated asphalt and underlying sub-base is then scraped away and transported to the stabilisation plant at Fornebu.
Excavated PAH-contaminated soil is stabilised with bitumen and reused as foundation in new roads at Fornebu. A total of 20,000 tons of PAH-contaminated soil will be stabilised and reused.

**Dedicated database aids remediation**

Considerable emphasis is placed on controlling and documenting that contaminated masses are properly dealt with, without any dispersion of contaminants during excavation, sorting or treatment. For this purpose, specific instructions have been drawn up for the excavation and control of contaminants at each site. There is also a contingency plan for unforeseen situations and emergencies.

A monitoring programme, effective during the remediation period and two years after, will ensure that any leaching from the land areas and changes in the water quality in the sea and sediments can be controlled.

Statsbygg will collect all data on environmental investigations and implemented measures in a dedicated GIS (Geographical Information System) database. The GIS system will provide maps of contamination sites and treated soil deposits to support the documentation and presentation of the remediation works at Fornebu.

**Fombeu remediation R&D initiatives**

One of the objectives of the remediation project at Fornebu is to use the most cost-effective technology from an environmental economic viewpoint. The project shall also contribute to developing new knowledge about the treatment of contaminated soil and groundwater. Environmental impact assessments of various initiatives are documented, in terms of ‘most environmental value for money’. The model used compares the environmental impact of material consumption and work processes throughout the life-cycle of the remediation measure with the environmental benefits achieved through implementation of the project. At two sites comparative assessment was used to highlight the effectiveness and environmental impacts of different remediation technologies.

Development work on monitoring of leakage and toxicity of PAH-contaminated sub-base to study the possibilities for reuse at Fornebu began in 2000.

Another R&D project at Fornebu, studies the impact of benzotriazol on the terrestrial ecosystem. This de-icing chemical is studied in soil and groundwater, with respect to toxicity and possible ways to break down or immobilise the chemical.
Water

Like most parts of the inner Oslo Fjord, contaminated sediments dominate the seabeds around Fornebu. However, there’s little evidence that these contaminants are affecting the quality of the seawater. Remediation measures will therefore not be necessary unless the seabed is disturbed, by dredging or by other activities that cause whirling of the sediments.

The ground water at Fornebu is not suited for drinking due to its high salt content. Apart from remediation of aggregates and soil, no measures will be undertaken to improve the ground water quality.

Air pollution

The open, relatively flat landscape at Fornebu offers good outdoor ventilation and air quality, with road traffic as the main source of pollution. Dust from demolition, excavation and crushing of masses will be a challenge during the construction period. If necessary, developers have to undertake measures to prevent the spreading of dust. To limit ventilation barriers or pools of air pollution after Fornebu is fully developed, special attention is being paid to the effects of the landscaping and building structures.

Attention is also being paid to the emission of greenhouse gases from Fornebu. The environmental goal is to keep the emissions per capita from Fornebu lower than the average in Norway. District heating, prioritising the use of public transport and limitations on parking facilities are all measures that will help fulfil this goal.
Statsbygg acts on behalf of the Norwegian government as manager and advisor in construction and property affairs. Statsbygg offers governmental organisations premises suited to their needs, either in new or existing buildings.

Statsbygg is an administrative body, responsible to the Ministry of Labour and Government Administration, and operates in accordance with standard business principles. However, achievements in accordance with Government objectives takes precedence over Statsbygg's own business interests.

**Property Management**
Statsbygg manages around 2.2 million square meters of floor space, in Norway and abroad. The property portfolio consists of office buildings, schools, accommodation and specialised buildings throughout the country, and embassies and residences outside Norway.

**Consultancy and construction**
Statsbygg is responsible for organising, planning and completing building projects within set frameworks for budgets, time limits and quality. The buildings must meet quality requirements pertaining to architecture, functionality and environmental concerns. In total, Statsbygg's annual building budget is approximately NOK 2.3 billion.

Statsbygg offers consultancy and assistance in civil engineering and technical matters to ministries and other governmental organisations. Statsbygg also cooperates with the public administration, and advises on assessing property needs, planning and acquiring property.

**Development**
A new task for Statsbygg in the future will be to develop Government premises vacated for alternative public or commercialized utilization. The objective is to create attractive areas, emphasising local interests, the efficient use of resources and sound environmental solutions.