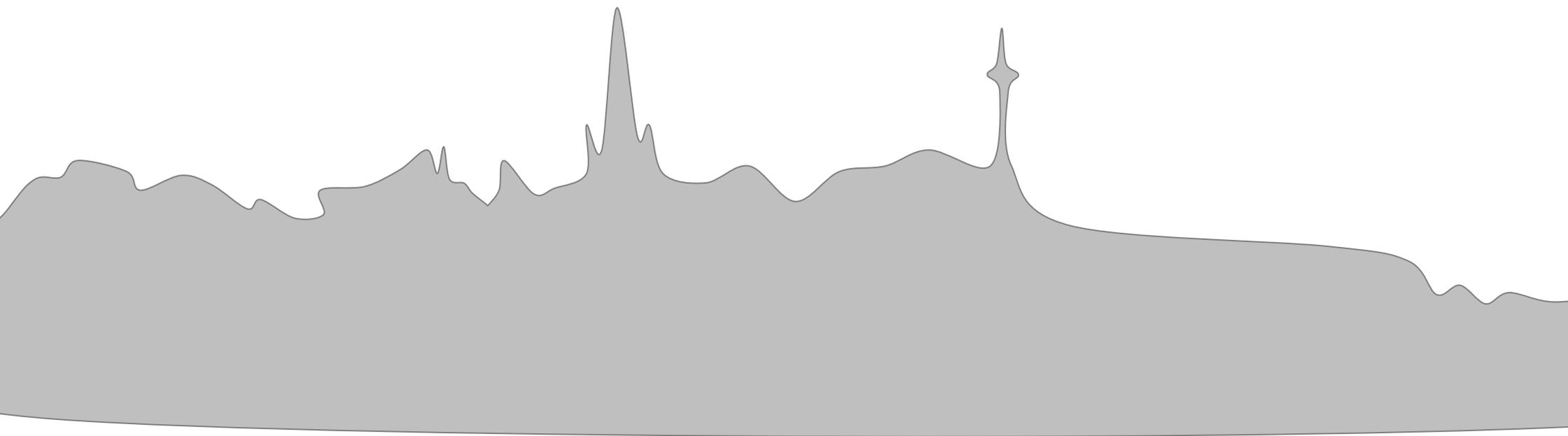


ECO-City Trondheim

- making part of the *CONCERTO* initiative



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ECO-City
Trondheim



ECO-city

Today about 2/3 of all energy consumption in households originates in heating and warm water supply. This illustrates the relevance and reduction potential in this field.

ECO-City is part of the CONCERTO initiative of the European Commission, focusing on the development and demonstration of good and efficient energy solutions on municipal level. The ECO-City project especially is dedicated to working with joint developments in Scandinavia and Spain.

The objective is to strengthen the technological and institutional basis for a community wide utilization of efficient and economic energy concepts. The second aim is to develop projects that demonstrate solutions and serve as knowledge basis and incentive for further development in selected communities in Spain, Denmark/Sweden and Norway. The three participating European ECO-Cities are: Tudela (Spain), Helsingborg/Helsingør (Sweden/Denmark) and Trondheim (Norway).

The overall approach is defined by the aim of using the reduction potential of the demand before designing the sources for supply. This allows an optimization of the supply solution and raises the level of efficiency as well as sustainability. The focus is on energy efficient technologies, integrating a maximum of renewable energy sources.

The ECO-City demonstration projects in Trondheim:

- Supply of environmentally friendly energy to St. Olavs Hospital (District heating and cooling through river water from Nidelev)
- Efficient energy solutions for municipal schools
- Seasonal storage of waste as fuel for the incineration plant that supplies the district heating system
- Ecological rehabilitation and renewable energy supply for an ecological city part
- Construction of new low energy dwellings at "passive house" standard
- Establishing individual metering and monitoring of electricity and heat consumption in block dwellings

In Trondheim the ECO-City project partners are:

COWI, Svartlamon Boligstiftelse, Trondheim Kommune, Heimdal Gruppen, TOBB, SINTEF, Trondheim Energi

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CONCERTO

The CONCERTO initiative is the European Commission's largest initiative that has a focus on energy related issues. It is a Europe wide initiative proactively addressing the challenges of creating a more sustainable future for Europe's energy needs.

With autumn 2010, there have been a total of 58 communities in 22 projects, each working to deliver the highest possible level of self-supply of energy. CONCERTO is part of the framework research program supervised by the DG (*Directorate General*) Energy and Transport of the European Commission.

CONCERTO supports local communities, as clearly defined geographical areas or zones, in developing and demonstrating concrete strategies and actions that are both sustainable and highly energy efficient. Interactions and relevant energy flows between centralised and decentralised energy supplies and demands can be identified, measured and assessed.

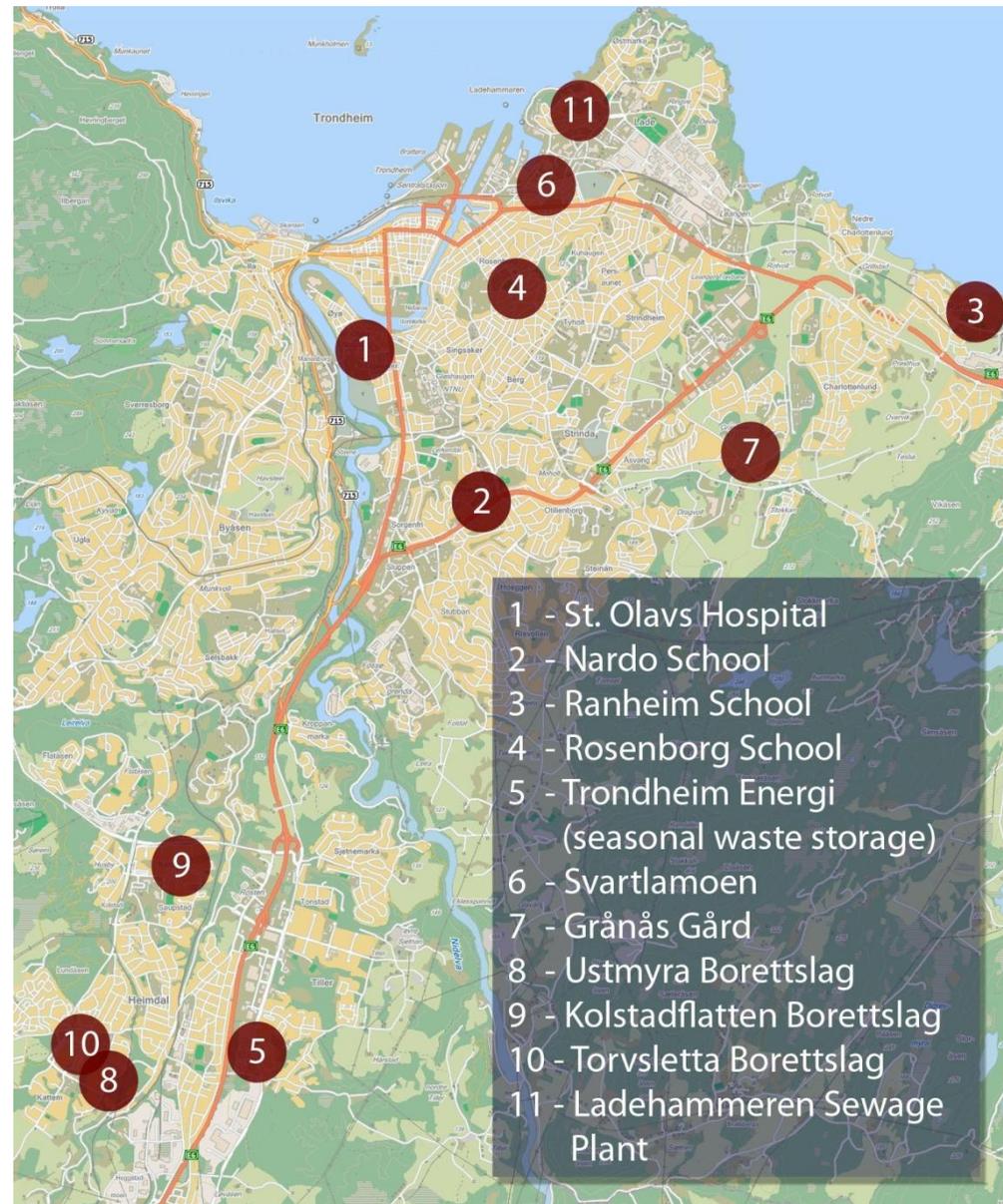
Throughout the 22 participating CONCERTO projects the focus is primarily on demonstrating the environmental, economic and social benefits of integrating renewable energy sources together with energy efficiency techniques through a sustainable energy-management system operated on a community level.

The CONCERTO initiative provides a platform for the exchange of ideas and experiences between the 58 CONCERTO demonstration communities, and other cities that are committed to introducing similar strategies. The projects provide immediate input and inspiration as well as a knowledge base guidance through available documentation and research reports.

The project sights in Trondheim

The ECO-City approach is defined by the aim of using the reduction potential of the demand before designing the sources for supply. This allows an optimization of the supply solution and raises the level of efficiency as well as sustainability. The focus lies on energy efficient feasible solutions, efficiency technology and the integration of a maximum of renewable energy sources.

Through cooperation and exchange with the other communities in the ECO-City project, a wider approach to possible solutions has been possible.





Municipal School projects

Trondheim has three municipal school projects demonstrating the potential of energy efficient solutions in buildings. All three of them are newly built, replacing old, energetically inefficient school buildings.

The energy consumption of new Nardo School and Kindergarten building ranges 40% below the average of school buildings in Norway. By replacing the old buildings at Nardo, Ranheim and Rosenborg School with low energy buildings the earlier energy demand has been cut in half.

Nardo School

In 2008 Nardo School and Kindergarten, 2 newly built massive wood buildings at low energy standard, were completed. The buildings altogether comprise a net heated area of ca. 6800m², whereas the heating demand is covered through the combination of a 132kW ground heat pump and a connection to the district heating grid.

By attaining an annual energy consumption of 78kWh/m², the new building is halving the earlier energy consumption.

This high level of energy efficiency makes it at this point one of the most energy efficient schools in Norway. In 2009 Nardo School has been awarded the “Energispareprisen 2009”.

Nardo School and Kindergarten

Area:	6800 m ²
Best goal:	118 kWh/m ² y
Project goal:	107 kWh/m ² y
Completed:	Summer 2008
Measured:	78 kWh/m ² y



Rosenborg School

Rosenborg School and sports arena have been completed in 2009. The school and the sports arena together, both buildings with concrete structure, comprise about 8700m² of net heated area.

By replacing the old buildings the earlier energy consumption has also been halved.



Rosenborg School

Area: 7150 m²
 Best goal: 118 kWh/m²y
 Project goal: 111 kWh/m²y
 Completed: Winter 2009
 Measured: n.a. kWh/m²y

Rosenborg Hall

Area: 2760 m²
 Best goal: 165 kWh/m²y
 Project goal: 180 kWh/m²y
 Completed: Winter 2009
 Measured: n.a. kWh/m²y



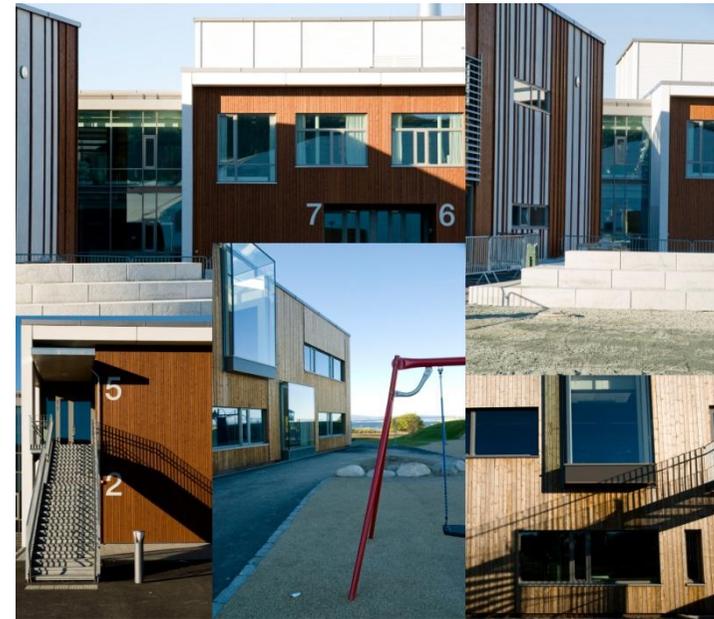
Ranheim School

The new school building and the new sports arena at Ranheim School have been handed over for use in July and August 2010. The energy consumption is expected to lie at a similar level as at Nardo School. In both cases the energy consumption attains a high standard of efficiency.

The school has a water based heating system that runs with a 150kW see water heat pump and the district heating system. The heat pump covers for the largest part of the energy demand for heating and cooling during all year whilst the district heating system works as backup and peak demand supply.

Ranheim School

Area:	6430 m ²
Best goal:	118 kWh/m ² y
Project goal:	105 kWh/m ² y
Completed:	Fall 2010
Measured:	n.a. kWh/m ² y

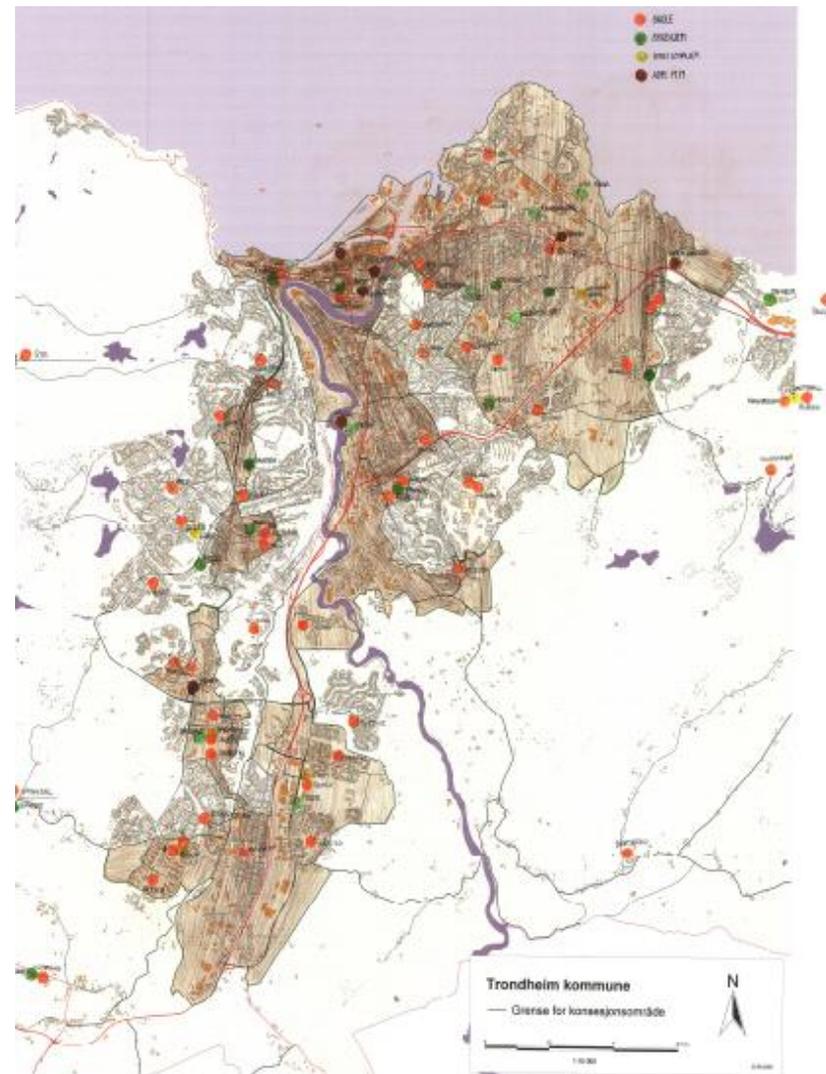


District heating and the ECO-City project

In 1982 the Trondheim City Council decided to build a district heating system based on municipal waste. Thereafter the first incineration plant with a processing capacity of 90.000 tons of waste per year started operation in 1985. The district heating grid has expanded over the years and in 2007 the old incineration plant has been extended, now contributing with another 170.000 tons of waste processing capacity per year. As for today 11 heating plants feed in the grid whereof waste makes up for 70 to 80 %. The remaining demand is covered by decentralised located heating plants fed by biomass, electricity, natural gas and oil. The concession area covers 30% of the heating demand in Trondheim.

On the right: Map of Trondheim with the grey area representing the largest part of the district heating concession area in Trondheim (not showing the extension in Byåsen/Heimdal and Ranheim after 2008).

*The locations of municipal buildings are indicated on the map:
Orange = schools; Green = nursing homes; yellow = sport facilities;
violet = administrative buildings*



St. Olavs Hospital

The energy solution at St. Olavs Hospital is a large scale demonstration whereas an environment friendly heating and cooling supply is utilized.

The hospital is supplied through two sources. The cold production is based on the direct heat exchange with cold river water. Additionally two 3MW absorption chillers are connected to the district heating and driven by excess heat from the waste incineration plants covering peak demand in the summer.

The district heating supplies heat for air ventilation, room heating and warm water supply. Simultaneously the absorption technology provides energy for the cooling of technical equipment and air-conditioning.

Seasonal storage of waste for incineration

The district heating system in Trondheim is supplied through 11 (decentralized) heating plants of Trondheim Energi Fjernvarme. The largest heating plant is the incineration plant in Heimdal supplying the system all year.

Waste for incineration occurs constantly over the year. Before incineration it is processed and burned. Warm summer months create a seasonal fluctuation and a significant reduction in heating demand. At the same time the district heating system remains in operation to cover the residual demand. Consequently the demand for waste for incineration is undergoing a just as strong seasonal fluctuation.

This characteristic gave the incentive to establish the seasonal waste storage. Excess waste now is stored when the heat demand is low to fuel the incineration plant when the heat demand has retained a higher level. This solution demonstrates an environment friendly and economically feasible approach in this demonstration project.

Ladehammeren Sewage Plant

As one of the decentralized renewable energy sources in the district heating system in Trondheim the 1 MW biogas boiler at Ladehammeren Sewage Plant feeds into the grid. Since 2009 the heating plant uses the residual gas from the sewage plant processes which before had not been utilized but only flared.



Energy consumption monitoring and rehabilitation

In the process of rehabilitation of different dwelling areas a smart metering system has been established. The concept of smart metering and monitoring in the ECO-City projects comprises both electricity and heat consumption. The primary focus is on reducing the energy consumption by raising awareness and responsibility through visualization.

Individual meters for electricity, water and the heating through district heating allow a share specific monitoring and billing. For the consumer this provides a continuous feedback on the actual consumption and herewith the basis for conscious behavior and an incentive for saving.

Ustmyra Borettslag

In Ustmyra block dwellings and row houses from the construction year 1978 have been rehabilitated in 2008, decreasing the annual energy consumption from 270kWh/m² to 150-160kWh/m². In addition intelligent metering for district heating and electricity consumption has been established for 188 units, which is expected to set down the energy

consumption for an additional 10%.

Kolstadflaten Borettslag

In Kolstadflaten Borettslag intelligent metering for electricity has been established for 481 units. The dwelling units have a water based heating system and are connected to the district heating system. In this case the metering for heating through the district heating still happens on common splitting.

Torvsletta Borettslag

At Torvsletta Borettslag 201 dwellings have been rehabilitated in 2010. The gross area covered is 16 930m².



Low energy building

The first phase constructions at Granås Gård will comprise 17 detached houses at passive house standard. With completion of the whole project 300 "ECO-dwelling" units will be built. The project focuses on demonstrating the compatibility of comfort and low energy buildings built at Norwegian passive house standard.

The project targets a holistic approach, comprising a range of measures that allow more sustainable consumer behavior. Crucial measures comprise building density and energy efficient design, good connectivity through public and individual transportation, the integration of car sharing pools and a centralizing waste sucking system.

Plan for Granås Gård

- 20 single family houses
- 80 row houses
- 200 dwellings



Trondheim Kommune - Miljøenheten
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