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mountEE: Energy efficient and sustainable building
in European municipalities in mountain regions
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D 4.5: MONITORING AND EVALUATION REPORT FOR MOUNTEE PILOTS

Name of pilot project:
Kiruna new town hall

Region / local area where the pilot is situated
Norrbotten County, Sweden

Monitoring and evaluation report submitted by:
Nenet Norrbotten Energy Agency

Type of building:	Kind of public use: Town hall, administration and service building. Total effective area: 9700m2 in total. Number of levels above earth: 3. Source of energy for heating: District heating from waste and biomass. Type of heating system: Central heating system, district heating from waste and biomass. Type of water heating system: District heating from waste and biomass. Type of ventilation system: demand-driven, highly energy-efficient fans, metering of temperature, CO2 and PIR (passive infrared sensor)
Owner of the building:	Name of owner: City of Kiruna, building authority: LKAB mining company Date of construction: 2015-2016 Total cost: max 250 Mio SEK Financing resources: City of Kiruna, Mining company LKAB

1) Short description of the pilot project

The new Kiruna Town Hall is a lighthouse project within the comprehensive city transformation due to extended mining areas. In the coming 20-25 years, the mining will affect approximately 2 500 apartments as well as approximately 200 000 square meters of commercial, office, school and health care premises.

Kiruna Municipality is moving the existing city hall and surrounding buildings, because of the effect of the excavations on the city's underground. A total of 2,500 flats and 200,000 m2 of commercial, office, school and healthcare buildings will have to be moved by 2035. The city hall is the first large building to be affected by the excavations. Thus, the new city hall becomes the starting signal for the new city center in Kiruna. According to plans, it is to be inaugurated in 2016.

Based on MountEE criteria for pilot projects, the call for bids for the Town Hall included as targets and criteria in terms of sustainability

- Recycling of parts of the old City Hall
- Target level: at least -50% reduced energy demand compared to building code
- Low CO2 emissions calculated for the whole lifecycle
- Matching criteria for Swedish Green Building Council's Miljöbyggnad
- Use of environmental-friendly building materials according to Sunda Hus criteria

The City of Kiruna aims at becoming a sustainable city taking care of all dimensions of sustainability. Due to the harsh mountain climate, energy efficient buildings are an important

part in that. The Town Hall will be a meeting point for citizens as well as the place for decision making, and it shall – like the former Town Hall – become a national recognized example for Northern sustainable building architecture.

So far, there are few examples for highly energy efficient public buildings in the County of Norrbotten. The Town Hall will contribute substantially to a better understanding of technical questions, it will also be a highly visible example made to raise awareness.

After an architect competition, in which the MountEE criteria were part of the call for bids, the winning proposal "Kristallen" was selected. First, it did not meet energy criteria in their full extent, and a re-design has been demanded, which has been successful.

The new city hall consists of two building volumes. The inner building is shaped like a crystal inspired by the great deposits of iron ore in the area's underground. The outer building floats like a ring around the crystal, protecting it against the rough weather conditions of the region.

"It has been important for us to get the best out of the rough weather and wind conditions and allow as much daylight into the building as possible", says Peer Teglgaard Jeppesen, Director and Partner at Henning Larsen Architects. "Kiruna's new city hall is a democratic building, open to everybody. Inside the building, the democratic process is supported by the interplay between offices at the periphery and public functions at the heart of the building."

The round shape of the new city hall creates a better microclimate both inside and outside. The shape allows 17 % more daylight to pour into the volume. The city hall has already been named The Crystal. It is inspired by the city's special character, culture and history. Kiruna's existing city hall is a unique piece of architecture from 1958, which was designed by Artur von Schmalensee. The new city hall refers to the old one in several ways. The bell tower from the listed city hall will be re-used in the square, just as materials and building parts will be re-used to the extent possible.

"The Crystal is a city hall that we can be proud of, and we are delighted to present this particular proposal as winner today. In the assessment, we have sought help from several experts and various reports. We have also had many comments from the public, and naturally, we have considered these in the jury work, too", says Lisbeth Nilsson, Chairman of the Jury.

Total area: 9702 m2
Energy demand: 56 kWh/m2 (building code 132 kWh/m2)

Choose of materials according to Sunda Hus and based on LCA. It includes low-emission products, certificated wood, priority for recycled material and use of renewable and sustainable material.

Building envelope: at least meeting Miljöbygnad Silver criteria, good insulation, compact form.

Building materials have a high thermal capacity to save heat.

Energy efficient windows which secure use of daylight to a high extent to reduce electricity demand for lighting while allowing to use passive solar energy wintertimes. Solar shadowing to avoid electric cooling.

Ventilation is demand-driven, highly energy-efficient fans, metering of temperature, CO2 and PIR (passive infrared sensor).

Electric lighting: highly energy efficient, incl. motion detector, daylight-driven.

Time schedule: for many years it is clear that major parts of central Kiruna have to be moved due to the enlargement of the mining area. In 2012 the final decision was taken that the Kiruna´s new town hall should be the first building to be raised symbolizing the "New Kiruna". An architect competition was carried out 2012/2013 including the MountEE criteria for pilot projects, the winning concept "Kristallen" was chosen by an expert jury some months later. As all projects did not fully meet the MountEE pilot, project criteria the winning consortium was assigned to improve the concept. An updated version which fulfills all MountEE crietria was presented in March 2014. The building phase will start fall 2014 and the new town hall should be completed in spring 2016.

2) Quality of location and facilities (new buildings only)

The project to build a new Town Hall in Kiruna is part of a comprehensive city transformation due to extended mining. The process of deciding where the new Kiruna will be built and developing urban land-use planning is ongoing. A sustainable transportation concept is under development. This makes that no information is available so far on how the Town Hall will be connected in terms of public transport etc.

3) Process and planning quality

a) Decision making and determination of goals
In 2004, the governmentally owned mining company LKAB sent a letter to Kiruna municipality asking for changes in the land-use plan due to the effects the expansion of their mining activity would have on the ground underneath the city. Since then, the City of Kiruna is together with LKAB working on making the city transformation happen. The Town Hall is one of the first buildings which will be replaced. Responsibility for this project is split between the City and LKAB depending on which phase is happing. The City of Kiruna was responsible for the architecture competition, while LKAB is responsible for the construction. After this, the building will be owned by the City.

Nenet, Norrbotten Energy Agency, is owned by all municipalities in Norrbotten County, thus also by the City of Kiruna. Based on consultancy of Nenet's MountEE project staff, environmental and energy criteria were developed as an important part of the competition. Different variants in respect to energy efficiency, ecological use of material had been already

discusses in the MountEE regional committee, results have been used for designing the competition.

The competition of architects to find right proposal has been finished taking into account MountEE criteria. While the first proposal did not meet energy criteria to full extent, a re-design has been demanded in collaboration with MountEE project which succeeded in changing the proposal.

b) Objectives for energetic measures
- Recycling of parts of the old City Hall
- Target level: at least -50% reduced energy demand compared to standard
- Low CO2 emissions calculated for the whole lifecycle
- Matching criteria for Swedish Green Building Council's Miljöbyggnad, which include even criteria for indoor environment, materials and chemicals
- Use of environmental-friendly building materials according to Sunda Hus criteria

c) Standardized calculation of economic efficiency
The architecture competition demanded that lifecycle costs have to be accounted, but defined no specific method.

d) Product management - use of low emission products
- Matching criteria for Swedish Green Building Council's Miljöbyggnad, which include even criteria for indoor environment, materials and chemicals.
- Use of environmental-friendly building materials according to Sunda Hus criteria.

Leading questions were:
Ecological optimization of materials during planning and tendering followed and will follow the Swedish Green Building Council regulation, and all materials are checked against a national database on ecological building materials. Results are documented in detail.

e) Planning support for energetic optimization
The competition defined clear goals and even methodology according to Swedish Green Building Council. It was a part of the consultancy work within MountEE project to ensure a proper realization of plans to reach the defined energy targets.

f) Information for users
Involvement of stakeholders and Kiruna´s population was highly prioritized through the entire planning process for both Kiruna´s new city center and the new town hall as a pilot project of high impact.
Plans how to train and inform the future users (municipal staff etc.) are under preparation.

4) Energy and Utilities

a) Specific heating demand
At least:
- 50% reduced energy demand compared to building code
- Heating power requirement: < 40W/m2 heated area

b) Specific cooling demand
Central cooling system using recovered heating energy.

c) Specific lighting demand
Energy efficient windows which secure use of daylight to a high extent to reduce electricity demand for lighting while allowing to use passive solar energy wintertime. Solar shadowing to avoid electric cooling.
Electric lighting: highly energy efficient, incl. motion detector, daylight-driven.

d) Primary energy demand
At least -50% reduced energy demand compared to building code, concrete following the updated winning project from the architect´s competition: 56 kWh/m2 (building code for north Sweden is 132 kWh/m2).
Defined values for energy are:
- at least -50% reduced energy demand compared to building code
- Heating power requirement: < 40W/m2 heated area
- Solar heat load <43 W/ m2 floor area
- Renewable energies: >50% bioenergy and less than >25% fossil or nuclear energy

e) Renewable energy
District heating will be the basic energy solution, which is produced by waste and biomass. Electricity is about 45% renewable, emission factor 0,023 tCO2/MWh.
A feasibility study for using the facade for solar energy is under way (1500 solar hours/year, 2886 m2 facade, 130 kWh/m2). Chances are good as the price for solar facade is lower than for conventional facade solution which is planned up so far.
Geothermal Heat pump is another option which will be taken into account.

5) Health and Comfort

- Use of low-emission products according to Sunda hus criteria
- The ventilation system is demand-driven, highly energy-efficient fans, metering of temperature, CO2 and PIR (passive infrared sensor)
- Solar shading
- Use of daylight as much as possible
- Sound emissions will be low due to new technology and high standards

6) Building materials and constructions

Energy demand: 56 kWh/m2 (building code 132 kWh/m2).

Choose of materials according to Sunda Hus and based on LCA. It includes low-emission products, certificated wood, priority for recycled material and use of renewable and sustainable material.

Building envelope: at least meeting Miljöbygnad Silver criteria, good insulation and compact form. Building materials have a high thermal capacity to save heat.

Energy efficient windows which secure use of daylight to a high extent to reduce electricity demand for lighting while allowing to use passive solar energy wintertime. Solar shadowing to avoid electric cooling.

Electric lighting: highly energy efficient, incl. motion detector, daylight-driven.

7) Test of special methods (renovation only, if applicable)

N.A.

8) Service Package

Nenet cooperated with both the city of Kiruna and experts from Tyréns consulting trying to use elements of the service package from the beginning of the planning process, concrete during the architect competition. Start of the construction phase yet to come.

The following parts of the Service Package were used in practice:
- Realization: support of craftsmen, material control, product declaration
- Control of success
- Service and maintenance

9) Deviations from implementation plan

The architect competition was a useful concept. However, none of the proposal did meet all (energy and environment) criteria in the first round. Therefor more work had to be done to adapt the winning proposal "Kristallen" in order to meet the MountEE criteria.

10) Lessons learned and proposed improvements

1) The cooperation with Kiruna municipality was fruitful but sometimes very time-intense. A lot of different target groups – politicians, decision makers within the municipal administration, LKAB mining company, stakeholders, architects etc. hade to be contacted, involved and

convinced. Adapting the winning concept from the architect competition in order to fulfil MountEE criteria was an additional challenge.

2) A lot of communication and information activities were carried out from the very beginning of the planning work. The project was seen as a lighthouse project for Kiruna municipality and as a part of the planning for the New, Sustainable Kiruna.
The target is to influence all new (public) buildings which are going to be built within the next decade in order to shape the "New Kiruna".

3) Use of LCA calculation for building materials and heating system was of high importance, even as a part of the dialogue between Kiruna municipality and LKAB mining company.

11) Next step and follow up

Ongoing support for pilot project during construction period 2015/2016:
1) Sharing information with City of Kiruna and LKAB building teams, e.g. from WP2 Best Practice examples;
2) Facilitating continuously exchange of information with MountEE Regional Cooperation Committee;
3) Capacity building for municipal staff, building company and project leaders following concrete demands from the pilot;
4) Coaching and consultancy on concrete questions and problems in the actual building project;
5) Offering contact and network for discussion questions and experience exchange with international experts;
6) Evaluation of actual project and compiling lessons learnt;
7) Documenting construction process in terms of sustainable building and publishing of results.

Evaluation process:
According to the joint evaluation guidelines and using interviews with the involved parties in the Kiruna Town Hall project as well as the continuous discussion of the project by the RCC.

9) Contact project owner

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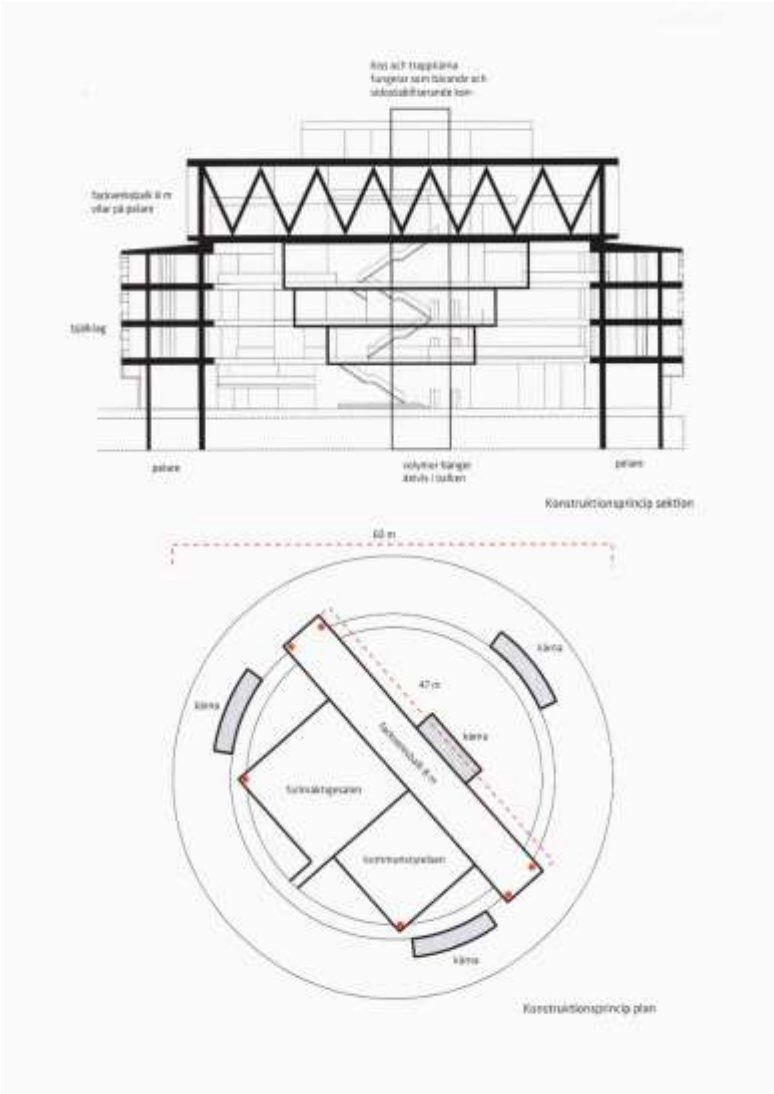
www.kiruna.se/stadsomvandling/City-in-transformation/New-Kiruna/
www.henninglarsen.com/news/archive/2013/09/new-city-hall-in-kiruna.aspx

10) Add Logo and 2-3 pictures or diagrams if appropriate!

KIRUNA KOMMUN

Kiruna municipality


Konstruktionsprincip sektion
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