

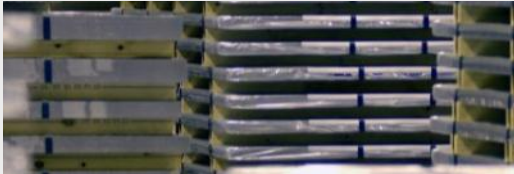


Near zero energy building with steel solutions – case study

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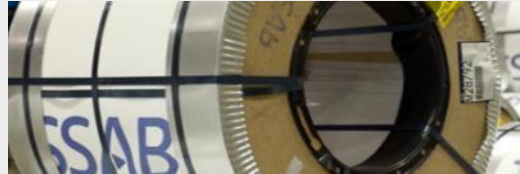
SSAB & Ruukki

SSAB Special Steels



Global steel and service partner in value-added Advanced High Strength Steels (AHSS) and Quenched & Tempered steels (Q&T)

SSAB Europe



Nordic-based steel producer of high-quality strip, heavy plate, and tubes

SSAB Americas



North America-based steel producer of high-quality heavy plate

Tibnor



Nordic full-service steel distribution partner

Ruukki Construction

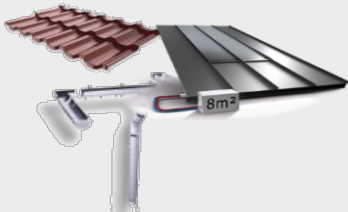


European provider of energy-efficient building and construction solutions

Our business units and comprehensive product portfolio

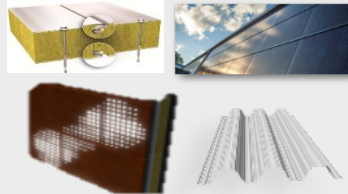
RESIDENTIAL ROOFING

Roofs, rainwater and
safety systems
Installation services



BUILDING COMPONENTS

Panels, profiles,
claddings, accessories,
design services



BUILDING SYSTEMS

Design, manufacture
and installation of
frames and envelopes



RUSSIA

Building systems
components and
roofing



Solutions to nearly zero energy buildings

Holistic approach for the design

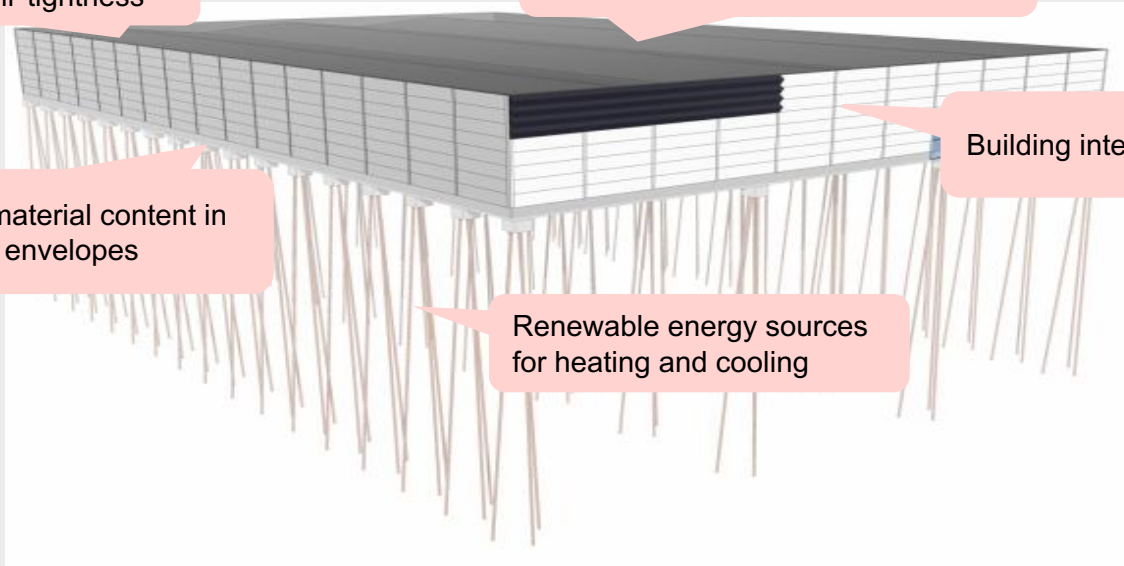
Optimized building envelope with excellent air-tightness

Energy efficient HVAC and lighting systems

Building integrated solar applications

High recycled material content in the frames and envelopes

Renewable energy sources for heating and cooling



Important issues: Design management & co-operation

Case: Cost efficient nearly zero energy building

Case – HAMK Sheet Metal Centre

Cost efficiency driving energy efficiency



Building use: Research centre for metal structures

Users: HAMK University of Applied Science,
Ruukki Construction

Owner: Hamk Oy

Architect: Ajan Arkkitehdit / **Structural design:** Tasoplan Oy

Energy efficiency concept: Ruukki Construction Oy

HVAC design: AX-prosessit Oy

Floor area: 1500 m²

Targets & features for the project

- Target of the project was to realize near zero energy building as a profitable investment for the owner – comparison made with “conventional building”
- Another target was to fulfil forthcoming nZEB regulations already in 2015
- Building owner and Ruukki committed to energy and life cycle efficiency already in the early project planning phase
- Special attention was paid on the control of energy efficiency and holistic approach from the design to the execution
- Building energy simulation was used from the very beginning of the project

Near zero energy solutions

Minimizing energy need

- Optimized thermal insulation and excellent air-tightness with Ruukki® energy panels and roof elements
- Ventilation heat recovery 80%
- Energy efficient LED-lighting
- Effective utilization of day-lighting + lighting control
- Integrated radiant heating and cooling

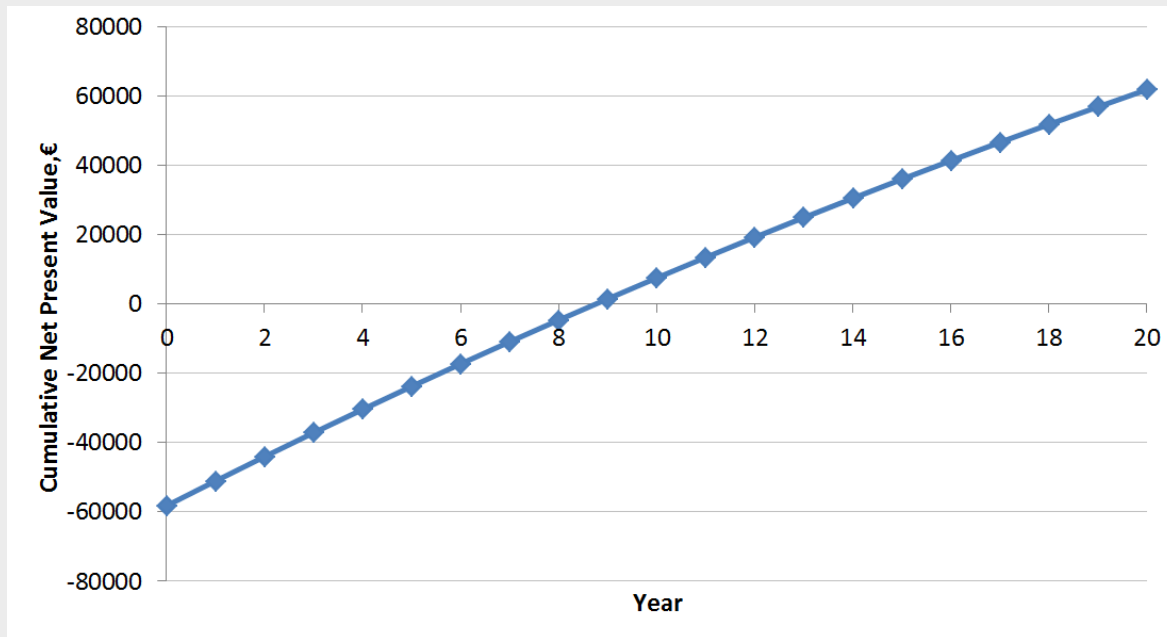
Utilisation of renewable energy

- Ground energy heat pump + Free ground cooling
 - Energy piles (60) + 2 heat wells
- Roof integrated solar heat collectors
- Facade integrated solar PV

Cost efficient near zero energy hall

Ruukki solution vs. conventional solution

Net present value of extra investment for nZEB with 6% interest rate , 4% increase in energy price.



Steel frame

Fast and light construction



Sandwich panel system for walls

Energy efficiency

Air-tight panel system cuts life-cycle costs and carbon dioxide emissions

- Ruukki energy panel is an airtight solution for commercial and industrial buildings, logistics centres and warehouses
- Solution is based on extensive expertise in airtightness with testing of tens of buildings, and long experience from design to installation
- Whole building air-tightness level $q_{50} < 1,0 \text{ m}^3/(\text{h},\text{m}^2)$ can be guaranteed
- $q_{50} = 0,76 \text{ m}^3/(\text{h},\text{m}^2)$ measured in this building



Day-lighting utilisation

Energy efficiency and good lighting comfort

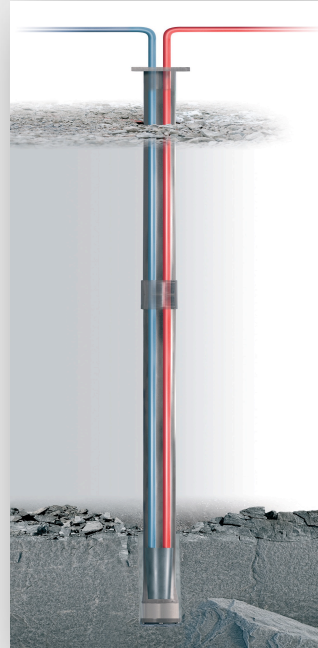


- Large day-lighting windows on S-W facades (prefab units)
- Window panes with opal polycarbonate sheets
- Diffuse day-lighting without glare & cut extra heat gains
- Good thermal properties, total U-value $\sim 0,84 \text{ W/m}^2\text{K}$
- Reduces artificial lighting need together with lighting control (55% in the spaces adjacent to large windows)

Energy piles

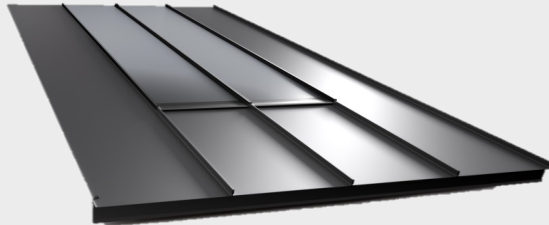
Renewable energy use, seasonal energy storage

- Steel piles enable utilization of demanding soil conditions for renewable energy collection
- Ground energy is utilized for heating through heat pumps in winter and as free cooling during summer
- Totally of 60 energy piles with length of 11m were used in HAMK OLK building
- In addition, two traditional heat wells of 200m were used



Integrated solar heat collectors

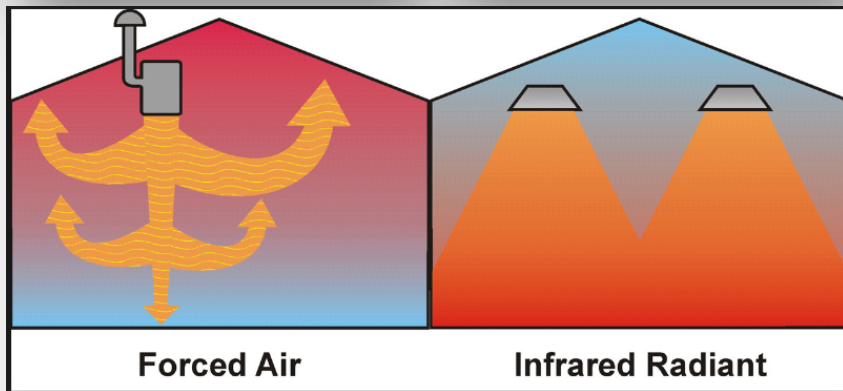
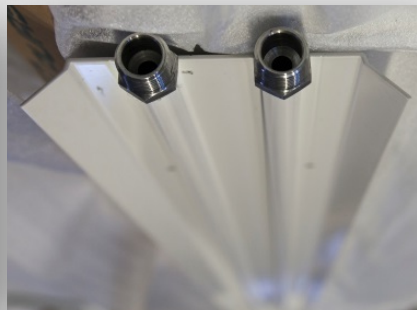
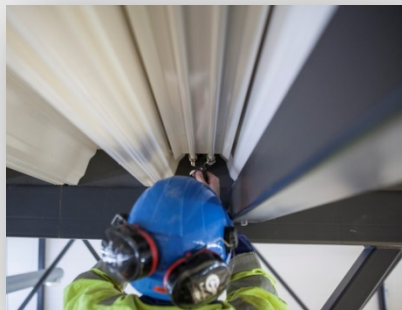
Renewable energy use, recharging the energy pile field



- Fully integrated solar heat collector to fit in steel roofing system
- 24m² Ruukki Classic[®] solar heat roof is used on the roof of the technical room
- Heat energy is directed to the soil through energy piles = "Thermal battery"
- Due to utilisation of low temperatures, the efficiency of the system is very high

Integrated radiant heating & cooling

Energy efficiency and good indoor comfort



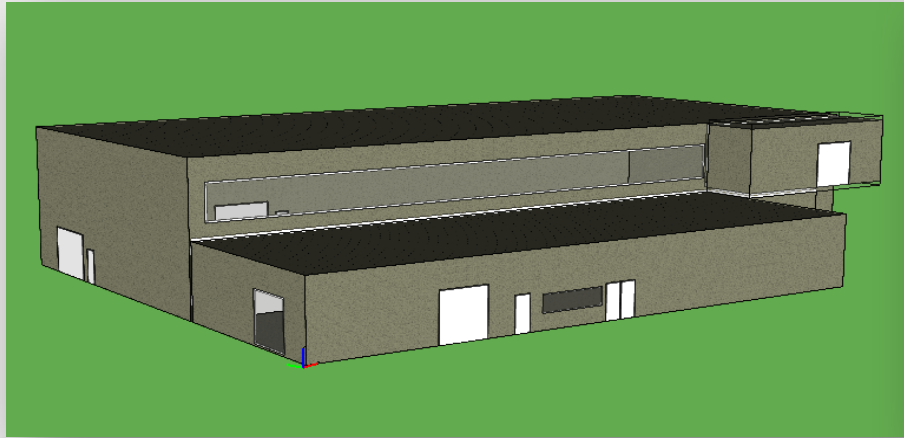
- New type of radiant heating and cooling units integrated into the roof element
- Enables low temperature system
 - better COP for heat pump
 - free ground cooling through heat wells
- Reduced air-flows in ventilation, because needed only for fresh air
- Reduced temperature gradient in hall and more comfortable indoor climate in occupied zone

=> Energy savings

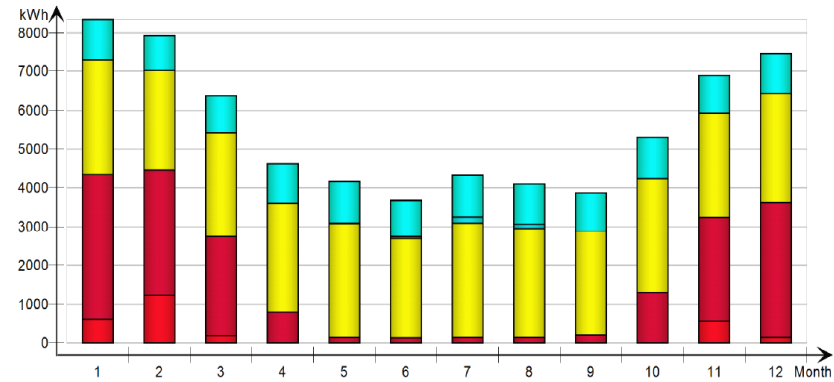
Total solution for nZEB

Optimisation and energy efficiency

determined with building simulation by IDA-ICE tool

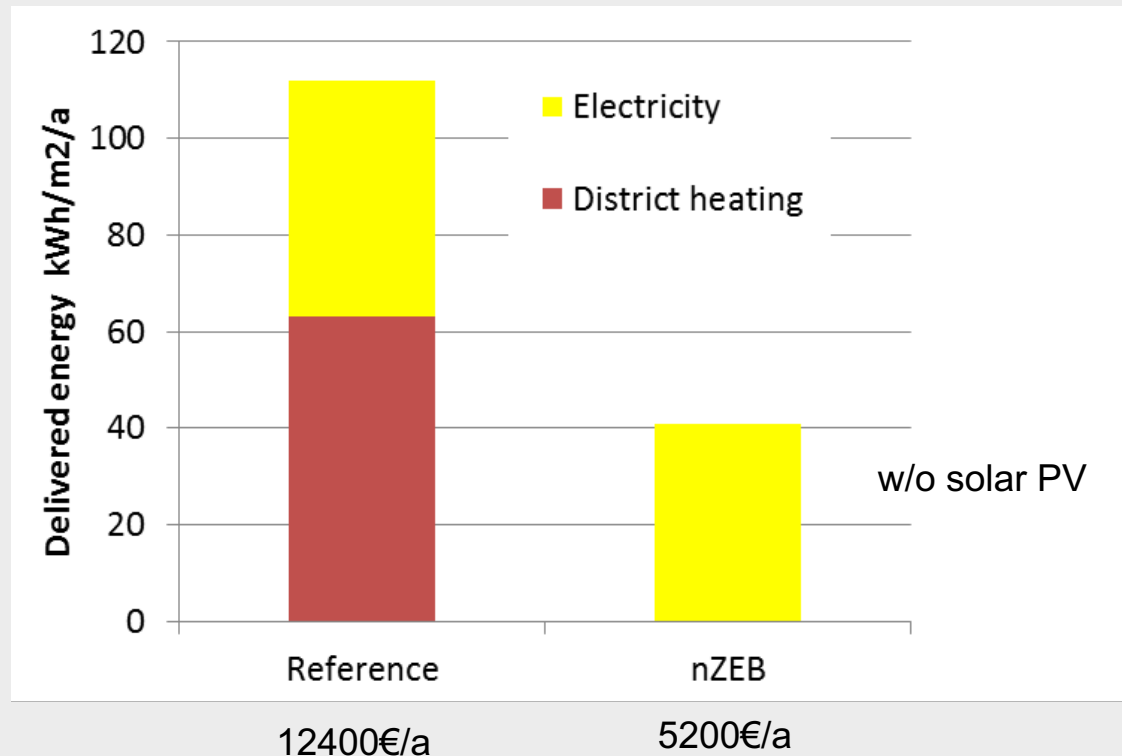


Monthly Delivered Energy



Full IDA-ICE model and modelling by Tallinn Technical University

Comparison of purchased energies



- Heating
- Cooling
- Lighting
- HVAC

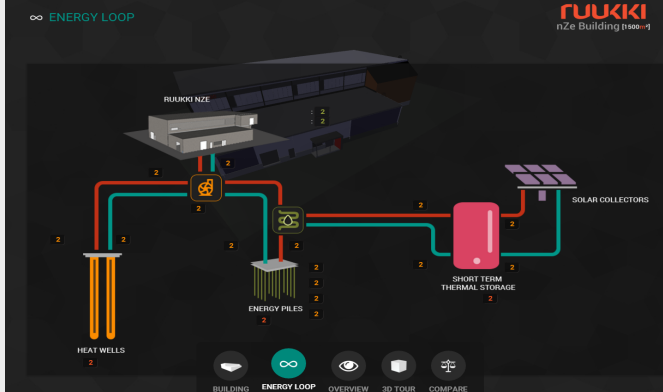
Building integrated solar PV-panels

- High performance Building Integrated PV-solution for building facades
- Full system with PV-panel modules, structural components and all electrical equipments
- Totally 61 m² are used in S-W facade in HAMK, yearly electricity production 6900 kWh
- Reduces primary energy use from 70 kWh/m² to 63 kWh/m²



Follow-up and sensing

- Building has been equipped with extensive measuring system for energy systems and indoor conditions



Lessons learned

- Need for skillful designers & builders (owner)
- Early engagement of all stakeholders
- Strong management of design & purchase process in order to achieve concept goals
- Better end result if all solution providers are chosen at the early phase and they could participate in design process
- Look after energy metering is executed as planned
- Plan and execute commissioning properly
- Be sure building automation system is modern and capable for fluent data output (IoT)



Conclusions

- nZEB hall needs both reduction in energy demand as well as renewable energy production
- Building has to be designed as a whole
- nZEB hall is possible to execute in Nordic conditions in a cost-efficient way





Ruukki's project delivery contained

- Steel frame, part design, installation
- Roof elements, element design, installation
- Energy panels incl. air tightness measurement, installation
 - Modular flashings
 - Ruukki expression prints
- Ruukki Add-on solar PV solution, dimensioning, installation
- Ruukki Classic Solar heat panels for seasonal heat-energy charging, dimensioning, installation
- One-off Cor-Ten claddings, part design, installation
- Ceiling integrated Radiant heat/cold distribution system, dimensioning, installation

Component deliveries contained:

- Energy piles seasonal heat storage, dimensioning
- Sandwich panels for interior walls

RUUKI

Building your tomorrow.