

**Is it possible to lower resource use and at the same time increase the quality of the built environment?**

**Is there necessarily a conflict between low-energy design and usability?**

**Can architecture and planning actually contribute to lowering a local community's carbon footprint?**

**And can this be achieved while maintaining a high quality of life and a stimulating built environment?**

These questions form the background for the renovation of a 1950's school building at Linesøya.

Building owners Sukhi Karlsen and Thomas Flower-Ellis of the LIPA Eco Project invited students to contribute to its development: the conversion of a 1952 school building to a net zero energy building ([www.lipa.no](http://www.lipa.no)). The overall goal for this project is to raise awareness regarding resource efficiency measures in architecture and particularly in existing building mass, to apply sustainable energy sources and to provide a hands-on example with regards to energy efficiency, architectural design and craftsmanship for a low-carbon society. LIPA EcoProject will complete Scandinavia's first retro-fit of a single unit building to zero-energy standards. The chosen building is a 60 year-old schoolhouse, located on Linesøya, off the coast of central Norway. By retrofitting to passive house standards and combining this with energy generated on site, LIPA aims to provide a hands-on example with regard to energy efficiency, architectural design and craftsmanship for a low carbon society. The aim is to develop cost-effective methods which contribute to a reduced carbon footprint in the existing building stock. Linesøya Eco Project is an interdisciplinary project in which all of the participants are driven by a strong environmental engagement and a desire to raise awareness and increase competency regarding sustainable architecture in the building sector and society in general. In order to maximise the transfer of knowledge and learning experiences on a local, national and international level, marketing, demonstration and dissemination activities have been given high priority.

### **Renovation of the existing building to passive house standard and net zero energy**

The students were encouraged to work on integrated design solutions in which architecture and technology support and enhance each other. They needed to combine good indoor comfort with energy conservation, including energy supply and use of sustainable energy sources. To this purpose, the students are taught a range of tools that can be used to document energy performance, such as ECOTECT, energyplus and PHPP. In addition to energy use during operation, the students evaluated the embodied energy of the materials and components used in the building, the durability of the component design, the flexibility of the connections, and the generality of the floor plan and building geometry to facilitate a second service life.

### **A meaningful connection to local history, context and community**

Linesøya is an island of 17 km<sup>2</sup> with 37 km<sup>2</sup> of shoreline. There are six farms, about 30 main and 100 second homes. Currently a local ferry constitutes the only transport to and from the island, but a bridge is under

construction. Most of the around 60 permanent inhabitants have a distinct relation to the old school building, and have even used its classrooms as a child. The basement of the building is currently used as local gym while the building owners use some of the rooms on the ground floor as their residence. Therefore, a delicate balance needs to be designed between the public and private spaces in the building, along with a close connection to the landscape on the island, its traditional building style and vast vistas to the fjord. In addition, it is very important to create a distinct identity for the new environmental centre that is carefully related to the need for refurbishment and protection of the old structure.

### **Zoning of multiple functions according to usability, local climate and site**

The student projects needed to show a thorough understanding of the nature of the site and its connection to the surrounding environment, such as orientation, view, traffic, and green infrastructure. The functional programme includes housing facilities, kitchen, conference facilities, exhibition area, entrance and toilets; also accommodation can be included. The students explore flexibility and usability during the building's entire lifecycle, with different patterns of use according to season and type of visitors. Based on these assessments, a space-efficient design is created in accordance with the occupancy of different types of rooms and the corresponding need for heating, shading, ventilation and lighting.

### **Project outcome**

Each group of students submitted four A1 posters containing project and site plans along with schematic diagrams showing the environmental and architectural strategies used in their design. Student calculation reports show that most of the designs for the renovated building reach passive house standard and show the way to a net zero energy building. The students do report an increased awareness and knowledge about the vast challenges building professionals need to overcome to unite technical details and high user quality into good environmental performance. Close contact with the building owners and project team have provided the students with the unique opportunity of intensive interaction between clients' wishes, practical limitations in building design, and their own design practices as students. Especially building integrated sustainable energy as solar thermal collectors, BIPV and even micro wind turbines was successfully applied to the building design to optimize the synergy effects. The posters will be exhibited at the Norwegian university for Science and Technology NTNU for two weeks, after which they were moved to the Linesøya school building to present the ideas to the local population.

### **Important dates**

06. may 2011 opening of the exhibition, central building, 2<sup>nd</sup> floor, ntnu

16. may 2011 exhibition ends

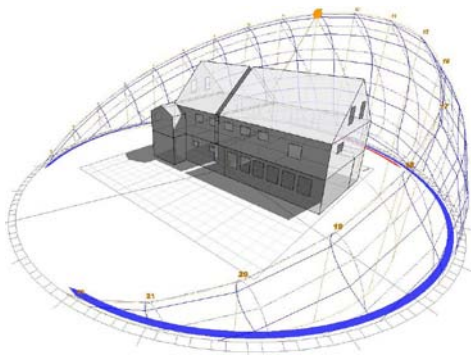


Figure Examples from six student groups