Profitability of Low Energy District Heating for Areas with Low Energy Buildings

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In order to achieve sustainable economical growth in the future society the whole energy concept should be reviewed and optimized. Buildings account for about 40% of the total energy consumption, where heating and cooling are the key figures.

An efficient energy supply systems together with energy conservation in the buildings is a promising concept to reach sustainability in the building sector.

District heating (DH) is based on the idea of utilizing locally available heat sources, that otherwise would be lost, such as waste incineration plants and heat from the industrial processes. Low energy DH gives new opportunities of utilizing renewable energy (solar, geothermal), better exploitation of the energy sources and smaller heat losses.

However, DH in relation to low energy buildings has several challenges. As heating requirement is predicted to be very low, the cost-effectiveness of DH systems is affected by high investment and operational costs, in comparison to the income from the delivered heat.

The general topic of the thesis is to develop a proposal of methods to make DH systems competitive for areas with low energy buildings, from the economical and environmental point of view.

Firstly, an idea generation workshop has been organized with people involved in the field from DTU, COWI A/S and Hillerød Kommune. The main areas, where analysis and improvements could be done, have been determined as followed – metering system, user behavior, energy demand in the buildings, number of connected consumers to the DH network, optimization of the DH network, energy regulations, economical considerations, energy supply and energy storage.

Building energy simulations for different types of low energy buildings have been performed in IDA ICE using a model (developed at DTU) that is capable to take into account realistic human behavior. Results show that a so called “low energy” buildings are not using so little energy, however still can be supplied with low temperature.

The output from the building energy simulations was used in DH network simulations, using TERMIS software. Various types of buildings, user profiles and network configurations were considered, investigating possibilities to achieve a cost-effective and environmentally friendly heating technology for a future sustainable society.