This thesis discusses how energy optimization focussed on daylight and solar gains may be qualified as an architectural design method, which does not just increase the energy efficiency of the built environment, but may potentially increase its overall qualities by offering new insights into the complex interrelationships between urban and building design, environmental performance, human needs and behaviour, technology and energy use.

The main hypothesis is that a hierarchy of scales related to energy optimization and environmental performance may be used to guide and support architectural design decisions in the earliest design stages. The hypothesis is examined through literature studies, empirical observations, interviews with practitioners, a series of simulation studies focussed on energy optimization, solar gains and daylight, and a final case study applying derived design principles in an architectural design competition.

The aims are:
1) To situate energy optimization and environmental performance as qualitative architectural design issues which should also be understood in quantitative terms, by discussing these in a wider cultural and social context of sustainability.
2) To investigate the impact of basic urban and building design decisions on energy use and environmental performance in Northern Europe, using the central city districts of Copenhagen as references.
3) To combine the insights gained into a theoretical framework, relating the various aspects of energy optimization focussed on daylight and solar gains into a coherent methodology.

The thesis demonstrates that not just one, but several functional and cultural hierarchies of scales can be found from practical and theoretical studies and combined into a coherent theoretical framework. It confirms that the most basic architectural design decisions – urban density and pattern, building form and material choice, window to wall ratio, colour and insulation properties of facades, have great impacts on energy use and environmental performance, which is described with more detail and greater precision than previous studies, by adding climate based daylight analysis to thermal and energy simulations.

Design issues related to urban density receives particular attention as the bottom level of a hierarchy of scales, in addition to addressing the trend of increased urbanization and urban densification which is seen internationally as well as in Denmark. It is found that an optimal range of urban densities can be defined balancing building energy efficiency with access to sun and daylight depending on regional climate. In Northern Europe this density can be described as plot ratios between 100 - 300%. But great environmental performance differences among building typologies within this range indicates that there is plenty of design opportunity to improve environmental performance of buildings by working with urban design, building form and orientation and the geometry and properties of the building skin.

It is argued that it is more important to see energy optimization as a creative opportunity to create better, diverse and stimulating environments using urban and building design as the key instruments, rather than focussing on narrow optimization of technical subsystems. The results demonstrate that daylight and solar access is more dependent on urban scale design decisions than energy use, and should therefore be considered primary design objectives in the very beginning of the design process in the context of Northern Europe.