SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

2017 HIGHLIGHTS

Task 52 – Solar Heat and Energy Economics in Urban Environments

THE ISSUE

This Task focuses on the analysis of the future role of solar thermal in energy supply systems in urban environments. With fast changing economic boundaries in the energy economic markets and the growth of renewables in the electricity sector a review of the strategic role of solar thermal energy systems for low temperature heating and cooling demand is needed.

OUR WORK

Based on an energy economic analysis - reflecting future changes in the whole energy system - strategies and technical solutions as well as associated chains for energy system analysis will be developed. Further on technically and economically feasible examples of integration of solar thermal systems in urban energy systems will be identified, assessed and documented.

Energy Scenarios

The role of solar thermal in the energy system of urban environments will be identified with a horizon of 2050 and a 100% Renewable energy goal. The focus lies on a national or international level, but not necessarily 100% on a city or regional level solely.

Integrating Design Tools for Urban Energy Supply Systems

Existing tools for estimating the solar potential based on geographical information systems GIS are not yet linked to existing design tools for optimizing the structure of urban energy systems and do not consider the spatial and time resolution and variability of energy production and energy consumption induced by local renewable resources. Tools and techniques for the transition process of the energy system towards a renewable one will be addressed and case studies documented.

Demonstration and Operation

The implementation of solar thermal in existing or new urban districts as part of an integrated energy supply system will be demonstrated and analyzed. A focus will be on the integration of solar systems in district heating systems. Tools for operation will be analyzed and existing sites included to identify bottlenecks and best practices.

Participating Countries

Austria
Denmark
Germany
Portugal
Switzerland
Sweden

Task Period 2014 - 2017
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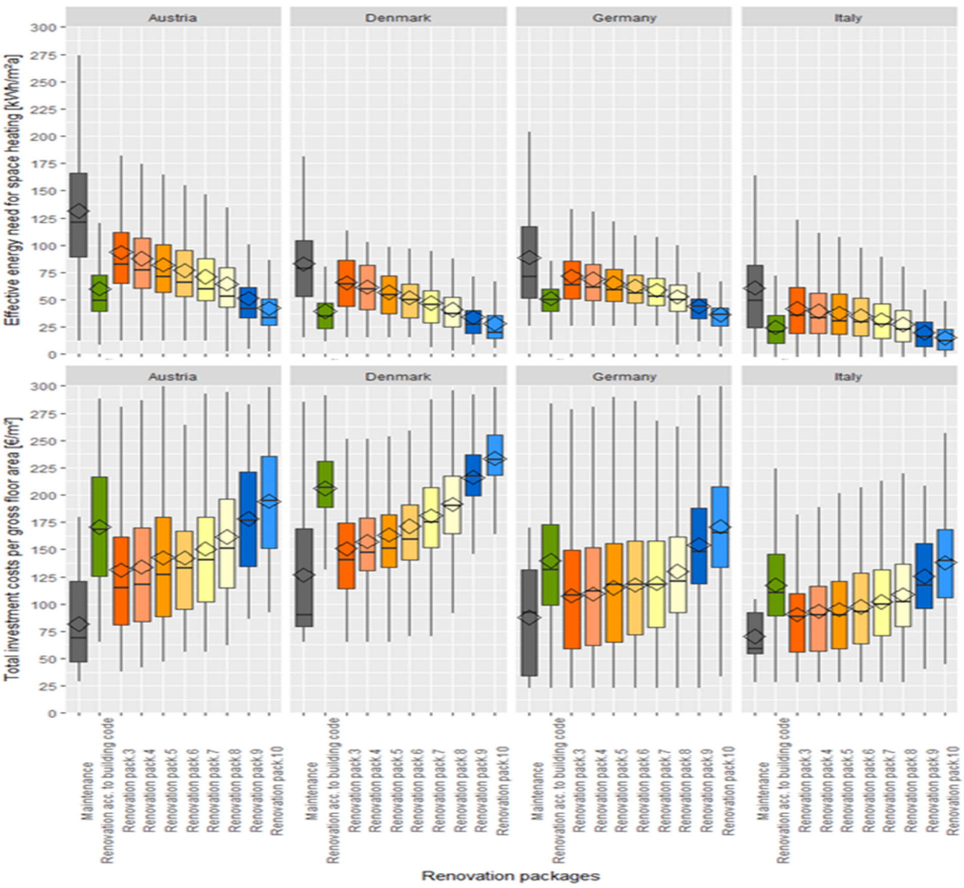
KEY RESULTS IN 2017

Cost Curves For Heat Savings In Buildings

The development of cost curves for heat savings in buildings by the application of measures on the building envelope showed remarkable saving potentials in existing buildings for the analysed countries Austria, Denmark, Germany and Italy. While the overall potentials for heat savings as well as the costs for these savings differ between the countries, the shape of the cost curves is similar. In the first part of the cost curves, reflecting the cheaper saving options, the increase of costs with increased level of savings is relatively low. In the second part of the cost curves, reflecting cumulated savings of more than 60 – 80% of the overall saving potential, the costs increase remarkably. This is due to the lower effect of the same insulation applied to an already insulated surface compared to a non-insulated surface.

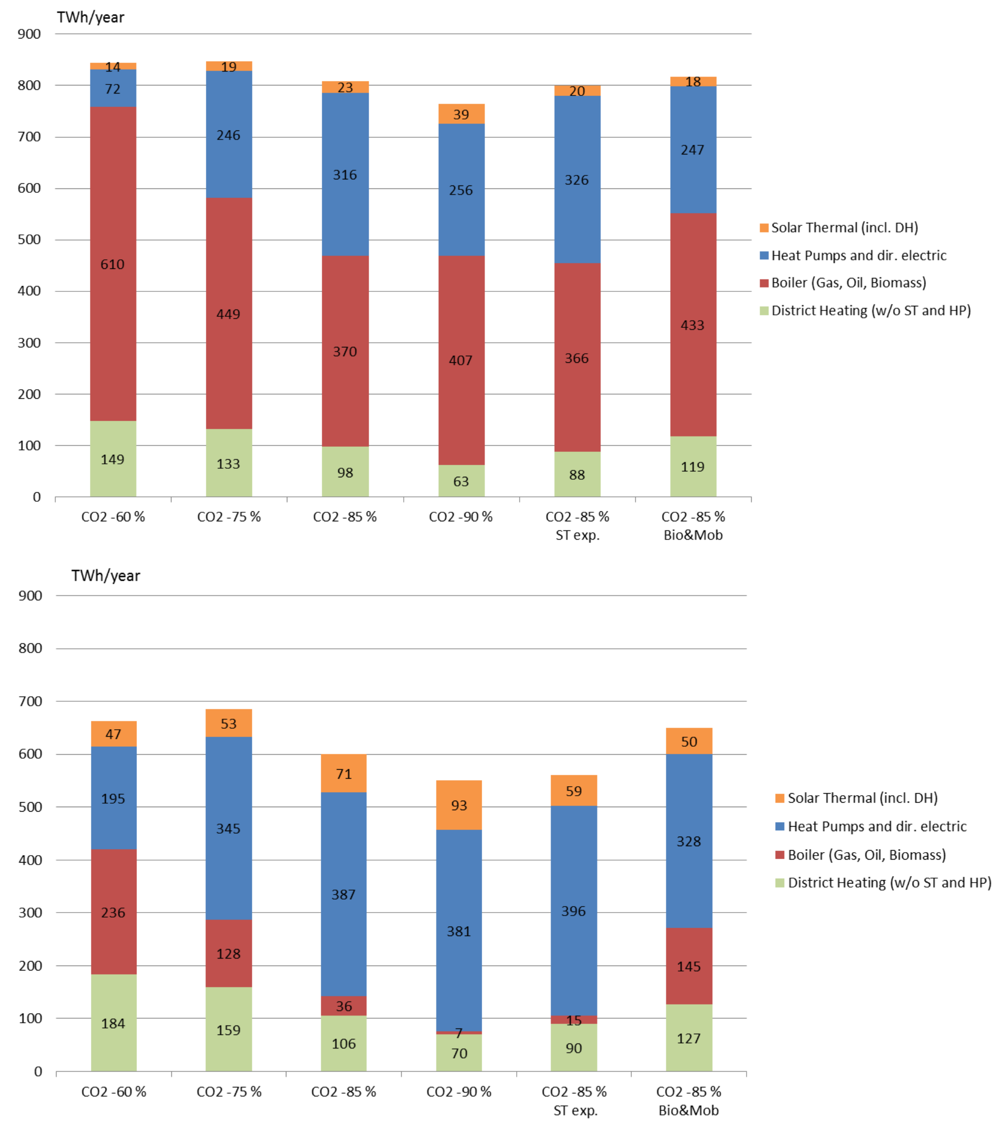


Box plots of effective energy needs and total investment costs for all building classes in the different countries when implementing the maintenance and renovation packages as defined for this analysis
Source M. Hummel, eeg TU Wien

The analysis showed the following highly influencing factors on the additional costs of heat savings in buildings: High shares of window area in the building envelope leads to remarkably higher investment costs for reaching similar amounts of savings. This is due to the fact that the investment costs in for windows per square meter of surface area are around three times higher than for the insulation of opaque surfaces. More external surface area increases the investment costs and therefore higher surface-to-volume ratios lead to higher renovation costs. Renovation measures on the building surface are more cost effective in places with higher space heating needs. This is because applying the same measure leads to lower savings in warmer places or in places where buildings already contain higher levels of insulation. The additional costs for heat savings are remarkably higher if a maintenance action is assumed as the reference action compared to assuming, for example, a standard renovation as the reference action.

Scenarios on Future Role of Solar Thermal

A detailed scenario analysis for Germany using the energy system analysis model ReMod-D gives for different ambition levels of CO_2-reduction the amount of heat produced by different technologies. The share of solar heat varies from 2 to 5% (2030) and 7 to 17% (2050). The higher the ambition level is, the higher the share of solar thermal might be in the scenarios. With rising cost for solar thermal, the share will be lower, as well with a higher availability of biomass. The use of solar thermal in district heating will be ~ 20% in 2050 and grow up to 40% of the heat produced by solar thermal. It can be seen, that solar thermal could ease the pressure on scarce renewable resources such as biomass but will be competing with other renewable sources such as biomass in a high-renewable energy system in saving CO_2.



Scenario of contribution of different technologies for low temperature heat production in 2030(upper graph) and 2050 (lower graph) for different scenarios. Source A. Palzer, Fraunhofer ISE