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Proposal for FINADAPT consortium of Ympäristöklusteri
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ADAPTATION OF THE ENERGY INFRASTRUCTURE TO CLIMATE CHANGE

Tiivistelmä

Ilmastonmuutoksen tiedetään aiheuttavan merkittäviä vaikutuksia energiajärjestelmille. Ilmastonmuutos vaikuttaa paitsi uusiutuvien energianlähteiden saatavuuteen, myös sähkönsiirto- ja jakelujärjestelmiin. Ilmastonmuutoksen vaikutuksia sähköverkkoihin ja niihin varautumista ei ole vielä juurikaan tutkittu, vaikka luotettava sähkönsiirto- ja jakelujärjestelmä on yhteiskunnalle välttämätön. (Jo havaittuja haitallisia vaikutuksia on uutisoitu mm. Helsingin Sanomissa 18.1.2004.”Tykkyä poistetaan sähkölinjoilta Kainuussa ja Pohjois-Karjalassa. Pakkassumu on kuin liimaa, joka kerää lunta johtimiin.”)

Tutkimuksessa tehdään kirjallisuuskatsaus ilmastonmuutoksen vaikutuksista energiasektoriin Suomessa. Työssä huomioidaan uusimmat kotimaiset ja kansainväliset tutkimukset, mm. ILMAVA-projekti ja ympäristöklusterin projekti ”Poikkeukselliset luonnonilmiöt ja rakennettu ympäristö muuttuvassa ilmastossa”. Lisäksi käynnissä olevasta pohjoismaisesta projektista ”Nordic Project on Climate and Energy” saadaan uutta tietoa tämän tutkimuksen käyttöön. Työssä haastatellaan myös sähköyhtiöitä heidän näkemyksistään ilmastonmuutoksista heidän toiminnalleen aiheutuvista riskeistä ja mahdollisesta varautumisesta niihin.

Lisäksi Tekesiltä tullaan hakemaan lisärahoitusta tutkimukseen, jossa ilmastoskenaariodataa käyttäen määritetään tulevia ilmastonmuutoksia ja riskejä sähköverkoille. Tutkimuksessa kehitettävää säädatan skaalaamismenetelmää käytetään sekä sähköverkkoihin kohdistuvien rasitusten arviointiin että arvioimaan vaikutuksia tuulivoiman tuotannolle. Lisäksi Tekes-rahoitteisessa projektissa arvioidaan ilmastonmuutoksen aiheuttamia muutoksia sähköyhtiöiden taloudelle muuttuvien kulutusprofiilien ja lisääntyvien korjaustarpeiden myötä, sekä kehitetään sopeutumisstrategioita tutkimukseen osallistuville yhtiöille.

Background

Climate change is expected to have significant impacts on the energy infrastructure in the coming decades. First studies on the impacts of climate change on renewable energy resources in Nordic and Finnish conditions exist already (e.g. ILMAVA, on-going Nordic project on Climate and Energy). The impacts on transmission networks as well as risks and potential costs to the operators have not been studied, despite the fact that a reliable electricity transmission and distribution network is crucial to society. Already at present, significant problems caused by changed climatic conditions have been reported (e.g. Helsingin Sanomat 18.1.2004). A failure to consider timely adaptation measures may

result in significant additional costs and increased outage risks. In Finland, there are large renovation needs of networks in the next decades, and knowledge of adaptation needs and measures is needed for proper design of renovation measures.

Increasing storms cause more ruptures in large areas, leaving tens of thousands of rural households without electricity. Increasing average temperatures change the electricity transmission needs especially in rural areas where centralised heating is not available, thus affecting the network capacity needs. The increasing wintertime moisture accelerates the detoriation of the network components, causing additional repair and maintenance needs. Proper preparation to these changing conditions is essential both from the electricity operators' and from the users' (i.e. whole society) point of view.

For Finland and the whole Nordic area, renewable energy resources contribute a very significant part to the total energy use. It is known that climate change has significant impacts on the availability of these resources. Also this is important to take into account in the preparation of the energy sector to the changing climatic circumstances.

Objective of the work

In this study, a literature review will be conducted of the available Finnish and international studies on the impacts of climate change to the energy sector. Relevant studies include Finnish projects ILMAVA and on-going "Natural hazards to infrastructure in a changing climate" project in ympäristöklusteri (L. Makkonen et al). In addition, available international studies will be reviewed. The on-going Nordic project on Climate and Energy will provide up-to-date information on impacts and necessary directions of adaptation measures of the energy system in Nordic conditions. Based on the literature review, critical questions regarding impacts, necessary adaptation measures and adaptation possibilities of the energy system and infrastructure in Finland will be identified.

This study aims to produce information on the impacts of climate change and adaptation measures for the energy infrastructure, concentrating on the transmission and distribution network issues, where no studies are available yet. Additional funds for in-depth research will be applied from Tekes in Spring 2004. In the work, the IPCC climate scenarios A2 and B2, as available from Finadapt consortium or from the Nordic Climate and Energy project, will be utilised.

First studies on the impacts of climate change on renewable energy resources in Nordic and Finnish conditions exist already (e.g. ILMAVA, on-going Nordic project on Climate and Energy). In this work, a review of recent studies on energy sector adaptation to climate change will be conducted, considering renewable energy production, changing energy demand, technological progress, etc., and the new knowledge acquired in this project. Based on the review, further research priorities for the energy sector will be identified and recommendations for further work will be given.

From the electricity network companies' point of view, the need for identifying the future occurrence and effects of storms will be one of the key issues. The additional research applied from Tekes will contribute to this issue. The distribution of wind in lower heights is needed for studying the impacts on the networks. A down-scaling method is planned to be be developed in the Tekes-funded part of the work. In addition, the changing business environment due to climate change will be quantified and response strategies will be identified. (Increasing number of outages caused by storms will bind more and more resources from the company and the changing temperature will decrease the need of heating and in that way decrease the annual revenue.)

Organisation and participating institutions

The project is carried out as collaboration of VTT Processes and the Finnish Meteorological Institute FMI (Ilmatieteen laitos).

Stakeholders from the major electricity producing companies will be contacted and interviewed on their views of the risks posed by climate change to their operation and on the research needs regarding the risks and adapation measures.

The work will be carried out in coordination with the on-going Nordic Project on Climate and Energy and in coordination with the Work Package 8 of Finadapt consortium, Risks to transport and communication systems / S. Saarelainen.

Timetable and Deliverables

The project will be carried out during 8/2004 – 12/2005.

The project will produce a final report, i.e. a stand-alone chapter in the final report of the Finadapt consortium. In addition, other reporting needs of the consortium and ympäristöklusteri will be met.

The project will produce an outline of further research priorities, which will also support the applied further in-depth research from Tekes (application in spring 2004). The in-depth study on the risks and adaptation strategies of electricity companies, if financed by Tekes, will be able to contribute new information to the Finadapt final reporting. At the moment, no studies are available yet on the impacts of climate change and adaptation measures for the energy infrastructure, especially on the transmission and distribution network issues. Thus this would be a valuable contribution to the overall aims of the ympäristöklusteri and to adaptation research in Finland.

Funding

Funding requirements for the review study within the Finadapt consortium of ympäristöklusteri for the years 2004-05 will be as follows:

Work (VTT)		3,1 person-months
Salary, VTT cost		30 880 Eur
Costs by funding source:		
Klusteri	(Salary+social costs)*1,2 overhead	19 280 Eur
	Meetings and materials	200 Eur
VTT contribution		11 600 Eur
Total		31 080 Eur

<u>Total funding by sources:</u>

Ympäristöklusteri	19 480 Eur
VTT	11 600 Eur
Total	31 080 Eur

References

ILMAVA-project: Tammelin B., Forsius J., Jylhä K., Järvinen P., Koskela J., Tuomenvirta H., Turunen M., Vehviläinen B. & Venäläinen A. 2002. Ilmastonmuutoksen vaikutuksia energiantuotantoon ja lämmitysenergian tarpeeseen. Climtech/Ilmava-projektin loppuraportti. Raportteja 2002:2, Ilmatieteen laitos.

Nordic Project on Climate and Energy. Impacts of climate change on renewable energy sources and their role in the Nordic energy system. Nordic Energy Research 2003-2006.