

New and Ongoing Wind Power Research in Sweden 2013



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Introduction

This report is a follow up to the compilation *New and Ongoing Wind Power Research in Sweden 2011-12*, which was published in January 2013 and can be found on the Network for Wind Utilization's homepage. In the present report we have compiled the new and ongoing wind power research from 2013. These reports can also be found in Swedish.

The goal of these reports is to provide a yearly survey of what has happened within Swedish wind power research. These compilations contain both newly completed research and unpublished ongoing research. The research in these compilations covers wind power's effect on society and the environment as well as wind power's technical development.

This report refers to academic articles, dissertations and theses from 2013. The information comes from different databases and from direct contacts with educational institutions and researchers in Sweden. We have attempted to be as comprehensive as possible and will gladly accept additional contributions. A new report will be published each year.

The use of wind as a renewable energy source is a topic of lively media debate where different perspectives on its environmental impact, its approval process and how it relates to climate change and energy politics are presented. It is sometimes difficult to discern which opinions are based on facts. Seemingly, there is a need for independent, scientific and factual information regarding wind power which is grounded in research.

Uppsala University Campus Gotland is the hub responsible for educational and competency related questions in the National Network for Wind Power Utilization and is financed by the Swedish Energy Agency. This report has been compiled as part of this assignment.

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www.geo.uu.se, www.natverketforvindbruk.se, www.cvi.se

Ongoing Research 2013

Landskapsanalys för vindkraft

The project will develop the landscape analysis method so it also includes experience values.
Project Leader: Tom Mels, Uppsala Universitet. Rapportering 2014.

Storskalig vindkraft i skogsmiljö

New wind power parks are being planned and built in forested terrains that earlier had not been considered worth exploitation. Researchers at Dalarna University working on a project within the Network for Wind Utilization are attempting to determine what conflicts this new expansion can cause. The study will examine and analyse how landowners, permanent and summer residents, interest groups and municipalities react to wind power in this new environment. The goal of the study is to give an idea of how difficult conflicts can be avoided or handled.

Project Leader: Mattias Gradén, Högskolan Dalarna, Uppsala University. Project period: 2013-01-30 to 2014-06-30.

<https://www.natverketforvindbruk.se/sv/Aktiviteter/Aktiviteter1/Aktiva-projekt/Storskalig-vindkraft-i-skogsmiljo/>

Noise propagation/distribution properties of VAWTs

Researcher: Erik Möllerström, Uppsala University and Halmstad University.

Researching business models for service and maintenance in China

This project is a continuation and expansion of the research conducted in the paper *The Clash of Business Models*.

Project leader: Mike Danilovic, Halmstad University.

Lokal nytta av vindkraft

This project will examine what makes a wind power project more and less successful by examining other wind power projects in and outside Sweden. This review will consider how local interests can affect planning and what measures can be taken to create local benefit and acceptance as well as minimize possible damages. The starting point for this project is the earlier work found in *Policy om vindkraftens lokala nytta från kommunerna i Jämtland* from 2010.

Project Leader: Bosse Bodén, Mittuniversitetet Campus Östersund. Project period: 2013-07-01 to 2014-06-30.

<https://www.miun.se/sv/press/pressmeddelanden/Forskningsaktuellt/Lokal-nytta-av-vindkraft-lyfts-fram-i-nytt-policyunderlag-/>

Ljud från vindkraftverk vid olika väderförhållanden

The goal of this project is to optimize the siting of wind power with respect to both the wind potential and the acoustic environment through the use of improved sound propagation models.

Project leader: Conny Larsson, Uppsala University. Project period: 2013-09-01 to 2014-12-31.

Research Project for Wind Power in Cold Climates

The Swedish Energy Agency (Energimyndigheten) has granted approximately 31 million SEK from 2013 until 2016 to the 10 following projects to gather new knowledge and to develop new technical solutions for wind power established in cold climates. The project's [website](#) (in Swedish).

Vibrationer och laster i vindkraftverk vid islast

Projektet avser forskning inom isbildning, strömningsmekanik, strukturdynamik och lastövervakning för att bidra till utvecklingen av tekniska lösningar för kostnadseffektiv konstruktion, drift och underhåll av vindkraft i kalla klimat. Genom nationell och internationell samverkan skall forskargruppen ta fram metoder för simulering av ispåväxt, strömning kring rotorblad med is, linjär och icke linjär dynamik samt lastövervakning.

Project Leader: Jan Olov Aidanpää, Luleå tekniska universitet. Project period: 2013-09-01 to 2016-12-31.

Isdetektering för smarta avisning av vindkraftverk

Projektet ska ta fram en ny teknik, baserad på akustiska vågor och laser (AWL), för detektering av isbildning på rotorblad. Tekniken bygger på att kombinera två olika metoder för isdetektering, för att därigenom möjliggöra en mer effektiv avisning. En genomförargrupp bestående av personer från Chalmers Tekniska Högskola, Stiftelsen Chalmers Industriteknik samt WindVector AB kommer dels att utveckla teoretiska modeller, metoder och algoritmer, samt att bygga en demonstrator för ett AWL-baserat sensorsystem.

Project Leader: Viktor Berbyuk, Chalmers tekniska högskola. Project period: 2013-09-01 to 2016-12-31.

Avbildande mätmetod för bestämning av luftens innehåll av flytande vattenpartiklar

Projektet avser att ta fram en direkt metod för bestämning av luftens innehåll av flytande vatten, LWC, och droppstorleken, MVD. Dessa parametrar är kritiska för de meteorologiska förhållanden som styr nedisningsprocessen, och verktyg för att direkt bestämma dem saknas idag. Genom att kunna mäta parametrarna kan både beräkningar av nedisning och nya verktyg för ismätning tas fram. Metoden ska utnyttja bildbehandlingsteknik och avancerade sensorer, och kommer att inom projektets ram testas i en klimatkammare. Målet är att instrumentet ska fungera i verkliga förhållanden samt vara möjligt att kommersialisera. Utförare är Mittuniversitetet och Combitech, som bland annat tillverkar mätinstrument för vindkraft. Projektet bedöms bidra till mer tillförlitliga mätmetoder än de som idag är tillgängliga.

Project Leader: Patrik Jonsson, Mittuniversitet. Project period: 2013-09-01 to 2016-12-31.

Modellering av nedisning och produktionsförluster

Vädermodeller som används av Sveriges meteorologiska och hydrologiska institut, WeatherTech Scandinavian AB och Uppsala Universitet kommer att förfinas med inriktning mot parameterisering av molnfysik och turbulens. Syftet är optimering av modellernas förmåga att beräkna nedisning och produktionsförlust hos vindkraftverk som arbetar under nedisningsförhållanden. Projektet förväntas bidra till säkrare bedömningar av ishändelser samt produktionsförluster.

Project Leader: Hans Bergström, Uppsala universitet. Project period: 2013-09-01 to 2016-12-31.

Aktiv avisning av vindturbinblad med avancerade ytbeläggningar

Projektet avser att utveckla en ny avisningsteknik för vindturbinblad. Tekniken bygger på uppvärmning av ett tunt ytskikt genom absorption av mikrovågor. Det mikrovågsabsorberande skiktet täcks av en ytbeläggning med goda egenskaper för passiv avisning. Avisningssystemet uppges kunna ge en betydligt lägre energiförbrukning än konventionella avisningssystem. I projektet ingår även tester och dokumentation kring att säkerhetskrav gällande exempelvis strålningsnivå i markhöjd uppfylls.

Project Leader: Kenth Johansson, SP AB. Project period: 2013-09-01 to 2015-08-31.

Vindturbiner i kallt klimat: Strömningsmekanik, isbildning och terrängeffekter

Projektet syftar till ökad kunskap om hur nedisning påverkar buller från vindkraftverk, liksom hur ljudspridning påverkas av snö- eller isbildning på marken, terrängens beskaffenhet och temperaturvariationer. Projektet kommer också att undersöka om akustiska mätningar kan användas för att detektera graden av nedisning. Resultatet av dessa undersökningar ska användas för att utveckla fritt tillgängliga simuleringsverktyg och modeller som implementeras i verktyg med öppen källkod.

Project Leader: Johan Revstedt, Lunds universitet. Project period: 2013-09-01 to 2016-12-31.

Ljudpåverkan vid nedisning av vindkraftverk - Långtidsmätningar av ljud för verifiering

Projektet avser långtidsmätning av ljudemission och -immission från vindkraftverk, genom uppmätning av ljud från vindkraftverk med eller utan avisningssystem i fyra olika vindkraftsparker. Det övergripande syftet är verifiera hur nedisning av rotorblad påverkar ljudemissionen, d.v.s. den ljudpåverkan som upplevs vid närbelägna fastigheter. Tillförlitliga värden på ljudemissionsökning är viktiga både för projektörer, driftsansvariga samt konstruktörer av avisningssystem.

Project Leader: Paul Appelqvist, ÅF-infrastructure AB. Project period: 2013-09-01 to 2015-06-01.

Reparation och utveckling av avisningssystem till vindkraftsblad

Projektet avser en förstudie av skador och möjliga metodiker för att reparera skador på kolfiberbaserade avisningssystem i vindkraftsblad. Förstudien syftar till att ta fram en kravspecifikation och ett förslag på möjlig reparationsmetodik att utveckla och verifiera i ett eventuellt framtida doktorandprojekt.

Project Leader: Lars Liljenfeldt, Swerea SICOMP AB. Project period: 2013-09-02 to 2014-03-02.

ICETHROWER - Kartläggning och verktyg för riskanalys

Projektet syftar till att ta fram beräkningsmodeller som kan användas av vindkraftsintressenter i Sverige för att analysera risker med att vistas i eller i närheten av en vindpark under vintertid då isnedfall och iskast kan förekomma. Projektet består dels av insamling av empiriska data från tre vindparker i Sverige och dels av framtagning av en fysikalisk och en statistisk modell för beräkning av risker.

Project Leader: Bengt Göransson, Pöyry SwedPower AB. Project period: 2013-10-01 to 2014-09-30.

Utvärdering av isdetektor för vindkraft

Projektet avser att i en teknisk förstudie utvärdera en verifierad metod för att detektera is på flygplansvingar för implementering på vindkraftverk. Den tekniska förstudien ska utgöra underlag inför ett beslut om fullskaligt test.

Project Leader: Magnus Landberg, Saab Ventures AB. Project period: 2013-09-01 to 2013-12-31.

The Swedish Research Program Vindval

Vindval is a research program focusing on wind power's effects on humans, nature and the environment. The program is a partnership between the Swedish Energy and Environmental Protection agencies. To date the program has produced 30 individual research projects, four works of synthesis and 16 films. The results from these projects can be used as a basis for environmental impact assessments as well as in the planning and permitting processes for wind power development.

A new program period

The Swedish parliament has decided an additional 10 million kronor per year from 2013 until 2016 will be allocated to study, among other items, wind power's environmental impacts. Parliament wrote that large scale establishment of wind power is a relatively new phenomenon in Sweden and that there are questions which need follow up when it comes to wind power's effects on nature, the environment and people.

Read more about Vindval (in Swedish):

<http://www.naturvardsverket.se/Miljoarbete-i-samhallet/Miljoarbete-i-Sverige/Forskning/Vindval/>

Vindval reports published in 2013

Betydelsen av kungsörnars hemområden, biotopval och rörelser för vindkraftsetablering

Hipkiss, Tim; Ecke, Frauke; Dettki, Holger; Moss, Edward; Sandgren, Carolin; Hörnfeldt, Birger (SLU). Rapport 6589. 2013.

<http://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6589-8.pdf>

Kraftproduktion och miljöopinion: Kritiken av vindkraftens miljöpåverkan och den som riktats mot övriga kraftslag

Anshelm, Jonas (Linköpings universitet). Rapport 6571. 2013.

<http://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6571-3.pdf>

Videos in Swedish for this report can be found at the following links:

<http://vimeo.com/69143392>

<http://vimeo.com/69143390>

Fågelundersökning vid Storruns vindkraftanläggning Jämtland

Falkdalen, Ulla (Rydningen); Falkdalen Lindahl, Lars (Falkdalen Naturforskning), Nygård, Torgeir (Norsk institutt for naturforskning). Rapport 6574. 2013.

<http://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6574-4.pdf>

Renar och vindkraft: Studie från anläggningen av två vindkraftparker i Malå sameby

Skarin, Anna (SLU); Nellemann, Christian (Norut Alta); Sandström, Per (SLU); Lars Rönnegård (Högskolan Dalarna); Henrik Lundqvist (Länsstyrelsen Jönköpings län). Rapport 6564. 2013.

<http://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6564-5.pdf>

Vindkraft i öppet landskap, skog, fjäll och hav

Waldo, Åsa; Johansson, Maria; (Lunds Universitet); Ek, Kristina (Luleå Tekniska Universitet); Persson, Lars (Umeå Universitet). Rapport 6540. 2013.

<http://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6540-9.pdf>

[Additional Vindval reports can be found here.](#)

The Swedish Research Program Vindforsk III and IV

Vindforsk IV will run four years with budget of 60 million SEK and a planned project start in 2014. The new program is half funded by the Swedish Energy Agency (Energimyndigheten) and half funded by energy companies and other businesses related to wind energy. The program's goals are:

- To design, build and operate wind farms
- To adapt the farms and the energy system for a situation with an increasing amount of wind power.

The focus of the program will remain primarily technical and research will be split to the following areas:

- The wind resource, design and establishment
- Operations and maintenance
- Wind power in the electrical grid

For more information about Vindforsk IV (in Swedish only):

http://www.elforsk.se/Global/Vindforsk/VFIV/Styrdokument/Programbeskrivning_VindforskIV_ver131015.pdf

Vindforsk III was a program for basic and applied wind energy research. The program was half funded by Swedish Energy Agency (Energimyndigheten) and was half funded by energy companies and other industries related to wind energy. The program ran from 2009 until 2012 and had a total budget of approximately 80 million SEK.

The program's focus was primarily technical.

The program aims were to strengthen wind energy potential by:

- Producing generalizable results concerning wind power characteristics and opportunities
- Research activities will take place at the international forefront for a number of technologies
- Preserve and strengthen the skills of existing research groups at universities and technical schools
- Strengthen the recruitment base for the Swedish wind power industry
- Highlight wind power research and disseminate the results

The program was also divided into the following research areas:

- The wind resource, establishment and design
- Operation and maintenance
- Wind power in the electrical grid
- External environment monitoring and standardization

[Additional Vindforsk reports can be found here.](#)

Vindforsk reports published in 2013

Prefabricated foundations with cell reinforcement for landbased wind turbines

Nilsson, Martin. 2013.

http://elforsk.se/Rapporter/?download=report&rid=13_06

Long-term correction of wind measurements: State-of-the-art, guidelines and future work

Liléo, Sónia; Berge, Erik; Undheim, Ove; Klinkert, Rickard; Bredesen, Rolv E., Kjeller Vindteknikk. 2013.

http://www.elforsk.se/Global/Vindforsk/Rapporter%20VFIII/13_18_report_V377_longtermcorrections.pdf

Acoustic Emission Stethoscope - Measurements with Acoustic Emission on Wind Turbines

Kryniski, Krystof. 2013.

http://elforsk.se/Rapporter/?download=report&rid=13_16

The utilization of synthetic inertia from wind farms and its impact on existing speed governors and system performance

Seyedi, Mohammad; Bollen, Math. 2013.

http://elforsk.se/Rapporter/?download=report&rid=13_02

The effect of voltage control response characteristics of wind plants on damping of inter-area power oscillations

Ullah, Nayeem R.; Bollen, Math. 2013.

http://elforsk.se/Rapporter/?download=report&rid=13_01

Towards the development of a set of grid code requirements for wind farms: Transient reactive power requirements

Kim, Seon Gu; Bollen, Math. 2013.

http://elforsk.se/Rapporter/?download=report&rid=13_03

On some aspects of power system stability and grid code requirements relevant for large scale wind power integration

Kim, Seon Gu; Bollen, Math. 2013.

http://elforsk.se/Rapporter/?download=report&rid=13_04

Förstudie Energilager anslutet till vindkraft

Söder, Lennart; Hamon, Camille. 2013.

http://www.elforsk.se/Rapporter/?rid=13_43

SEK TK 88 Annual Report 2012 - Swedish participation in standardisation work in wind energy 2012

Göransson, Bengt. 2013.

http://www.elforsk.se/Rapporter/?download=report&rid=13_08

Wind power in cold climates – Ice mapping methods

Bergström, Hans; Olsson, Esbjörn; Söderberg, Stefan; Thorsson, Petra; Undén, Per. 2013
http://www.elforsk.se/Rapporter/?download=report&rid=13_10

Power balance regulation at large amounts of wind power – Frequency control and international experience

Söder, Lennart; Hamon, Camille. 2013.
http://www.elforsk.se/Rapporter/?download=report&rid=13_43

Optimization of Large Wind Farms, The Nordic Consortium, Activity report 2009-2012

Ivanell, S.; Carlén, I.; Nilsson, K.; Sarmast, S.; Odemark, Y.; Andersen, S. J.; Teneler, G.; Eriksson, O.; Breton, S. P.; Åkervik, E.; Gravidahl, A. R.; Fransson, J.; Mikkelsen, R.; Sørensen, J. N.; Henningson, D.. 2013
http://www.elforsk.se/Rapporter/?download=report&rid=13_12

Power quality analysis of a 110 MW wind farm in a 130 kV switchyard

Näslund, My; Lindberg, Elisabeth; Larsson, Anette; Axelsson, Urban. 2013.
http://www.elforsk.se/Rapporter/?download=report&rid=13_13

Sensitivity study of important parameters for icing modelling and measurements

Schelandar, Peter; Hansson, Johan. 2013.
http://www.elforsk.se/Rapporter/?download=report&rid=13_14

Instant Wind - Model reduction for fast CFD computations

Vogstad, Klaus; Bhutoria, Vaibhav; Lund, John Amund; Ivanell, Stefan; Uzunoglu, Bahri. 2012.
http://www.elforsk.se/Rapporter/?download=report&rid=12_72

Förstudie Energilager anslutet till vindkraft

Borg, Pia. 2012.
http://www.elforsk.se/Rapporter/?download=report&rid=12_44

Generic models for Wind Power Plants

Lindgren, Lars; Svensson, Jörgen; Gertmar, Lars. 2012.
http://elforsk.se/Rapporter/?download=report&rid=12_47

Oil cleanliness in Wind Power Gearboxes

Ukonsaari, Jan; Møller, Hans. 2012.
http://elforsk.se/Rapporter/?download=report&rid=12_52

Investigation of converter failure in wind turbines

Fischer, Katharina; Stalin, Thomas; Ramberg, Hans; Thiringer, Torbjörn; Wenske, Jan; Karlsson, Robert. 2012.
http://www.elforsk.se/Global/Vindforsk/Rapporter%20VFIII/12_58_report_ConFail.pdf

Technical Research Centers

Swedish Wind Power Technology Centre (SWPTC)

The center was formed to meet the needs of the rapidly expanding global wind power industry and to raise wind power expertise in Sweden. The wind power research center will focus on developing knowledge of the construction of wind turbines and of optimizing maintenance and production costs. Its goal is to be able to build both partial and complete wind power systems in Sweden. The objective of the center is also to supply the Swedish industry with in-depth expertise within the wind power field. By integrating education, research and innovation, it hopes to contribute new knowledge and a transposition of today's industries.

Read more here: <http://www.chalmers.se/ee/swptc-en/>

Uppsala University/Royal Institute of Technology (KTH) - (STandUP for Wind)

Extensive research is being conducted at these institutions and they have sought to bring together their various fields of wind power research to collaborate on new projects and to seek funding.

Uppsala University:

In July 2013 Gotland University merged with Uppsala University. As a result of this merger Uppsala University now conducts wind power research on several campuses. Links to the campuses' webpages and research can be found below.

Wind Power Campus Gotland:

<http://www.geo.uu.se/research/wind-energy-campus-gotland/>

Wind Power Uppsala:

<http://www2.teknat.uu.se/forskning/uu/beskrivning.php?vetenskapsid=0&hforskomr=5&id=10&lang=en>

Department of Engineering Science Uppsala:

<http://www.el.angstrom.uu.se/forskningsprojekt/vind.html>

Royal Institute of Technology (KTH):

The Royal Institute of Technology has the following research groups performing research related to wind power:

[Building Service and Energy Systems](#)

[Environmental Management and Assessment](#)

[Electric Power Systems](#)

[Mechanics](#)

Published Research Articles and Reports 2013

Interdisciplinary and Social Science Research

The Clash of Business Models in Emerging Economies: The Case of Wind Energy Industry in Africa

Campbell, Derek; Danilovic, Mike; Halila, Fawzi; Hoveskog, Maya (Halmstad University). 2013.

<http://www.diva-portal.org/smash/record.jsf?searchId=2&pid=diva2:664511>

Keywords: business model innovation, emerging economies, EMNEs, DMNEs

Siting conflicts between wind power and military aviation—Problems and potential solutions

Fredrik, Lindgren; Malmlöf, Tomas; Lindvall, Fredrik (Swedish Defense Force); Johansson, Bengt (Lund University & Swedish Defense Force). 2013.

<http://dx.doi.org/10.1016/j.landusepol.2013.02.006>

Location of Swedish wind power - Random or not?: A quantitative analysis of differences in installed wind power capacity across Swedish municipalities

Ek, Kristina (Lulea University of Technology); Persson, Lars (Umeå University); Johansson, Maria; Waldo, Åsa (Lund University). 2013.

<http://www.diva-portal.org/smash/record.jsf?searchId=2&pid=diva2:619369>,

Keywords: Wind power, installed capacity, local differences

Energy storage for wind integration: Hydropower and other contributions

Amelin, Mikael (KTH), Et al. 2013.

<http://www.diva-portal.org/smash/record.jsf?searchId=2&pid=diva2:587458>,

Keywords: balancing of wind power, energy storage, renewable integration, Wind power

The Swedish Maintenance and Services Market in Wind Power Industry Lessons Learned and Opportunities for Chinese Service Providers

Liu, Lihua; Danilovic, Mike; Hoveskog, Maya; Halila, Fawzi (Halmstad University). 2013.

<http://urn.kb.se/resolve?urn=urn:nbn:se:hh:diva-23997>

How experiences of the Offshore Wind Industry can aid development of the Wave Energy sector: lessons learnt from EIA studies

Sundberg, Jan (Uppsala University), Et al. 2013.

<http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-190225>

Market structures to enable efficient wind and solar power integration

Söder, Lennart (KTH). 2013.

<http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-114321>

Keywords: electricity markets, solar energy, solar integration, Wind energy, wind integration

Impact of Energy Storage Devices on Energy Price in Decentralized Wind-Diesel Utilities

Moiseeva, Ekaterina; Hesamzadeh, Mohammad (KTH). 2013.

<http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-134297>

Consultation practices and assessment of wind power impacts on indigenous Saami lands

Sasvari, Anett (Uppsala University). 2013.

<http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-190681>

Distributed Balancing of Wind Power Forecast Deviations by Intraday Trading and Internal Ex-ante Self-Balancing - A Modelling Approach

Scharff, Richard; Amelin, Mikael (KTH). 2013.

<http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-133916>

Keywords: Wind power integration, electricity market, forecast errors, re-scheduling

Fiskundersökningar vid Lillgrund vindkraftpark

Bergström, Lena; Sundqvist, Frida (SLU); Lagenfelt, Ingvar; Andersson, Ingemar (Havs och Vattenmyndigheten); Andersson, Mathias H. (Stockholm universitet); Sigay, Peter (Totalförsvarets forskningsinstitut).

<https://www.havochvatten.se/download/18.276e7ae81443563a750472f/1395159312245/rapport-2013-18-Lillgrund-140127.pdf>

Approaching wind power forecast deviations with internal ex-ante self-balancing

Scharff, Richard; Amelin, Mikael; Söder, Lennart (KTH). 2013.

<http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-124351>

Keywords: Balancing, Electricity market, Nordic power system, Re-scheduling, Stochastic generation, Wind power integration

Nuclear Energy and Renewables: System Effects in Low-carbon Electricity Systems: Method comments to a NEA report

Söder, Lennart (KTH). 2012.

<http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-108290>

Keywords: nuclear power, wind power, solar power, integration, system costs

Experience and challenges with short-term balancing in European systems with large share of wind power

Söder, Lennart (KTH), Et al. 2013.

<http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-129789>

Keywords: Balancing of wind power, frequency control, integration, power system, power transmission, wind power

Wind Power Balancing

Söder, Lennart (KTH); Holttinen, Hannele (VTT Technical Research Centre). 2013.

<http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-124557>

Keywords: wind power, physical balancing, electricity markets, reserves

Short-term Hydropower Planning With Uncertain Wind Power Production

Vardanyan, Yelena (KTH). 2013.

<http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-134309>

Sista ordet: alternativa energikällor kräver mer än sol och vind

Jonsson, Erik (Uppsala University). 2013.

<http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-190734>

Sound propagation from wind turbines under various weather conditions

Larsson, Conny (Uppsala University); Öhlund, Olof. 2013.

<http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-210666>**Ljudutbredning – Påverkan av väder och vind**

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