Seminar 'The Future of our Energy Supply'

Date and time: Friday, 18-10-2013, 12.00-18.00

Room: Waaier 3

Program

12.00 - 13.00	Lunch
13.00 - 13.05	Opening
13.05 - 13.50	Prof.dr.ir. Han Slootweg (TU Eindhoven, Enexis) "Smart Grids supporting the energy value chain - theory and experiments"
13.50 - 14.35	Dr. Stefan Küppers (Chief Technical Officer of Westnetz GmbH) "Future Distribution Grids"
14.35 - 14.50	Break
14.50 - 15.35	ir. Peter van der Sluis (Alliander) "From smart grids to networked energy, a vision on the future power market"
15.35 - 16.15	Coffee-break
16.30 - 18.00	PhD-defense Stefan Nykamp "Integrating Renewables in Distribution Grids; Storage, regulation and the interaction of different stakeholders in future grids"

Abstracts and Biographies

Prof.dr.ir. Han Slootweg (TU Eindhoven, Enexis)

http://www.tue.nl/en/employee/ep/e/d/ep-uid/20098174/

Title: “Smart Grids supporting the energy value chain - theory and experiments”

Abstract: Due to the adverse impacts of the consumption of fossil fuels on our environment, the quest for a more sustainable energy supply is increasingly intensifying worldwide. Many renewable energy sources, such as wind, solar and tidal power generate electricity. Therefore, the development towards a sustainable energy supply leads to increasing electrification. Generators and consumers of electricity are connected by electricity networks. Traditionally, electricity networks transport electrical power from controllable bulk power generators running on fossil fuels or uranium to consumers. However, the combination of decentralization of generation, caused by the smaller scale of renewable generators, and decreasing controllability, caused by the fact that the availability of renewable energy sources is determined by the weather and can hardly or not be affected, requires new functions of electricity networks, in particular of distribution grids. The decreasing degree of controllability of electricity production and the high, but rare peaks caused by embedded generation require involving consumption in balancing supply and demand. To this end, electricity networks must develop towards "Smart Grids". In the presentation, first the background of the development towards Smart Grids will be studied in more detail. Then, the challenges that result from this development are pointed out. Finally, some pilot projects will be introduced.

BIOGRAPHY: J.G. (Han) Slootweg received a MSc degree in Electrical Power Engineering in 1998 (cum laude) and a PhD degree in 2003, both from Delft University of Technology, the Netherlands. He also holds a MSc degree in Business Administration. Currently he is an operational manager at Enexis. Till recently, he served as the manager of the Innovation department of Enexis B.V. (formerly Essent Netwerk B.V.), one of the largest Distribution Network Operators of The Netherlands, where his spearheads are energy transition (including distributed generation and smart grids), asset condition assessment and increasing workforce productivity through new technology.

Before that, he was responsible for network planning and for the design of maintenance and renewal policies for Enexis' regional transmission networks. He has written two editions of the company's Quality and Capacity Plan required to meet regulatory obligations. He was also involved in the development, implementation and certification of Enexis' proprietary Risk Based Asset Management process, enabling Enexis to be the first grid operator outside the UK to acquire a PAS 55 certificate.

Han is also a part-time professor in Smart Grids at the Electrical Energy Systems group of the Faculty of Electrical Engineering at Eindhoven University of Technology. He has authored and co-authored more than 75 papers, covering a broad range of aspects of the electricity supply. In 2007 Han won the Hidde Nijland prize for "significant contributions to electrical power engineering research". In 2013, he also won the Dutch Power Award for "significant contributions to the Dutch energy sector and establishing new coalitions between its members".

Dr. Stefan Küppers (Chief Technical Officer of Westnetz GmbH)

http://www.westnetz.de/web/cms/de/1703708/westnetz/unternehmen/management/dr-stefan-kueppers/

Title: "Future Distribution Grids"

Abstract: Resulting from the European energy policy the energy system faces big challenges. Especially in Germany, the amount of centralized generation plants decreases and small decentralized regeneration units form the future generation system. Whereas big generation plants are connected to the Transmission System the majority of new generation units are connected to the Distribution Grid. This not only leads to changes of the distribution grid but also requires an adaption of the operators´ functionality.

The presentation gives an impression of the challenges a distribution grid operator faces and shows todays Smart Grid Operation Technics of Westnetz GmbH and RWE as an example of a possible way into the future.

BIOGRAPHY: Born in Grevenbroich, Germany, a city that is known as the "Capital of Energy," Stefan Küppers trained as a power plant electronics technician from 1978 to 1981. He studied electrical engineering at RWTH Aachen University, graduating as a "*Diplom-Ingenieur*" or university-trained engineer in 1990 and obtaining his doctorate in 1996.

From 1996 to 2004, Küppers worked in various roles and projects at RWE Energie AG, RWE Net AG and RWE Rhein-Ruhr Netzservice GmbH, as specialist engineer for operations engineering and as a manager in protection, telecontrol and telecommunications technology. He was in charge as head of the "Neuss Regional Centre" from 2004 to 2007, then as head of "Operations 110-380 kV" from 2007 to 2008. End of 2008 he changed to RWE AG as head of "Performance Improvement Grids" and head of "Change Management". From 2010-2011 he's held the role of head of business unit "Specialist Service Electricity" at RWE Rhein-Ruhr Netzservice.

From 2011-2012 Küppers also took on the role of managing director of RWE Metering GmbH, Essen, and became technical managing director of RWE Rhein-Ruhr Netzservice GmbH, Siegen. Since 2013 he is board member of Westnetz GmbH, the leading Distribution System Operator in Germany. As Chief Technical Officer he is responsible for planning, new build, operation and maintenance of electricity and gas grids.

ir. Peter van der Sluis (Alliander)

Title: “From smart grids to networked energy, a vision on the future power market”

Abstract: In the past 100+ years economy of scale was the primary driver to keeping cost down and improving quality of service. The rapid growth of small scale generation shows this fundamental principle is becoming obsolete. The future will have to deal with millions of grid users that can change form supplier to customer in an instant. The presentation will discuss some of the challenges to the existing energy system and sketch a possible new energy landscape.

BIOGRAPHY: Graduated in 1996 at the Delft University of Engineering, Electrical Engineering.

Started at KEMA on reliability calculation for dutch distribution grids.

Switched in 1997 to Nuon, division Infrastructure. Here I started with the integration of large numbers of windturbines and CHP’s into the existing distribution grid. In 2002 I changed to Assetmanagement and was involved in the development and deployment of asset management tools for the dutch and german grid companies. After finising a MBA in 2006 got involved in regulatory affairs before becoming program manager for Electric Transport in 2008 at the department of strategy.

Since 2011 I have been working on the different aspects of local energy systems. This includes the technical, the ICT, market and customer behavior side.

For more details see www.linkedin.com (search for Sluijs & Alliander)

Stefan Nykamp (Westnetz)

Title (PhD thesis): “Integrating Renewables in Distribution Grids; Storage, regulation and the interaction of different stakeholders in future grids”

Abstract (PhD thesis): In recent years, the transition of the power supply chain towards a sustainable system based on “green” electricity generation out of renewable energy sources (RES-E) has become a main challenge for grid operators and further stakeholders in the power system. This transition is politically and socially supported to reduce the carbon footprint and/or enable the phasing out of nuclear power.

Hereby, the operation of consumption and generation appliances in grids and market systems has become more complex since multiple stakeholders are involved. Furthermore, the different functions of the supply chain (e.g. production, transmission, distribution and selling of energy) follow different optimization objectives. Hence, the current market design is not appropriately reflected by an integrated view on the supply chain. A disaggregated perspective is required considering that different steering approaches for appliances by different stakeholders could be realized in the future (e.g. based on (global) prices or (local) signals). Moreover, more fluctuating power generation profiles need to be considered since the feed-in of photovoltaic (PV) and wind generators depends on given weather conditions.

The operation of RES-E generators and the steering of flexible consumption appliances may lead to higher peaks in distribution grids. In most instances, the current solution for coping with these challenges is investing in additional, conventional grid assets (such as transformers, cables, lines). However, this ‘copperplate’ scenario will not be sufficient anymore in future power systems with a further increase of the share of RES-E on the total generation since next to regional aspects (transport of power over distances) also temporal aspects (transport of power over time) will be important. Therefore, consumption, generation and storage of electricity need to be coordinated. Next to this match on a global scale (e.g. for complete countries or the European continent) to ensure system stability, also the local aspects need to be considered to avoid unreasonable high costs in distribution grids. Hence, also these grids need to be operated more dynamically using the flexibilities provided by new generation, consumption and storage appliances. Especially the decentralized storage assets placed in distribution grids may provide an important and substantial contribution to deal with RES-E fluctuations. A higher market penetration of these assets in distribution grids is expected in the future, illustrating the urgency for developing concepts for an efficient integration of storage assets in the grids.

To enable the evaluation of new concepts for the integration of RES-E, first the feed-in characteristics of photovoltaic, wind and biomass generators located in a distribution grid area are studied in this thesis. The analysis considers numerous measured feed-in data and shows how the RES-E feed-in profiles correlate. Further important generation characteristics are presented such as indicators for the frequency and for the level of peaks and the dependence of these peaks on the numbers of generators.

The achieved insights from the feed-in profiles can be used for the planning and dimensioning of distribution grid assets. Furthermore, the results are useful for the evaluation of congestion management to throttle RES-E in certain time periods of the year or for the dimensioning of storage assets in distribution grids. The latter aspect is analyzed in detail such that suitable storage characteristics for an introduction in the electricity system are determined. Hereby, the perspective of the distribution system operator (DSO) is chosen with the objective of reducing feed-in peaks of photovoltaic and wind generators to avoid or delay the investments in conventional reinforcements. Furthermore, the influence of a larger number of generators on the storage requirements is investigated which is shown to be important for the size of the storage asset. An economic approach is presented to derive break-even points for storage assets as a substitute to conventional reinforcements. For this, operational as well as capital expenditures are considered. For a case study from a real world low voltage grid with reinforcement needs, these break-even points are determined and the main influencing parameters are evaluated. Based on these technical and economic elaborations, the DSOs are able to narrow down the choice of storage technologies for situations with the need for grid reinforcements.

A further important question in this context concerns the role DSOs may play with the operation of decentralized storage assets since several stakeholders may be interested in using the flexibility provided by these assets. This unclear responsibility also applies to the steering of adjustable consumption devices (Demand Side Management), such as electric heat pumps, electric cars or new white good appliances. For decentralized storage assets as well as heat pump appliances, optimal operation modes based on the optimization objectives for a DSO and a trader are derived. Hereby, the objectives for using the assets and exploiting the gained flexibility of the operation differ. The trader is an arbitrageur trying to exploit central price spreads whereas the DSO aims to solve local grid problems. The end users may benefit in both scenarios in terms of lower prices for the electricity consumption. However, it is shown based on real world data that choosing a ‘copperplate’ scenario is not only technically insufficient for a global balance of the consumption and generation. It may even be harmful for the society from an economic point of view when not taking local grid restrictions into account. This perspective is relevant since the investments for the reinforcements can significantly exceed the benefits on the trading side if no restrictions are given for the energy profiles resulting from the trading activities. Hence, a cooperation of the stakeholders in future markets and grids with an increased flexibility in the consumption and storage of energy is recommended from a welfare point of view.

A further important aspect for the energy transition with respect to the perspective of the DSO is the regulation of grids. In this thesis, it is investigated whether or not innovative investments such as installing storage assets, introducing new voltage regulation appliances or implementing Demand Side Management from a grid operators’ perspective are incentivized by the grid regulation method. For this, main aspects of the German revenue cap regulation are considered. It is shown that investments in grids are hampered in general and that conventional grid reinforcements are preferred rather than innovative solutions. Therefore, the regulation of grids needs to be adjusted to incentivize innovations and enable a successful and efficient energy transition.

BIOGRAPHY: Stefan Nykamp was born in Nordhorn, Germany on August 6, 1983.

In 2004 he started a cooperative study at the University of Cooperative Education, Lingen and RWE Westfalen-Weser-Ems AG, Osnabrück, Germany. In 2007, he obtained his bachelor degree in Economic Engineering (B. Eng.). From 2008 to 2010 he studied Energy Economics extra-occupational at the University of Münster and RWTH Aachen, Germany and completed the studies with a joint master's degree of both universities (M. Sc.) and a certificate of excellence. Since 2010, he is doing his Ph.D. studies extra-occupational at the University of Twente, The Netherlands. His Ph.D. research culminates with this dissertation.

He started his professional career in 2007 with RWE Westfalen-Weser-Ems AG in Nordhorn as a project engineer, with technical and economical responsibilities for projects in the power and natural gas distribution grid. In 2010 he became team leader in the planning department of RWE Deutschland AG, Nordhorn and - after a restructuring - he currently works with Westnetz GmbH in Bad Bentheim. Furthermore, he is involved as project leader and team member in several projects in the headquarters, e.g. in research and development activities and benchmark projects