


Samenvattingen smart grid projecten NWO, TNO en EBU



voor  (TKI S2SG) bijeenkomst 25 maart 2014

met deze projecten en TKI S2SG en IPIN projecten

4 februari 2014

Hoewel dit rapport met de grootst mogelijke zorg is samengesteld,
kunnen betrokken partijen geen enkele aansprakelijkheid aanvaarden voor eventuele fouten.

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De samenvattingen van de TKI S2SG projecten en IPIN proeftuinen staan per programma in een aparte catalogus.

0. Inleiding

Deze catalogus omvat de openbare samenvatting van een aantal projecten op het gebied van smart grids en smart energy systems. Het betreft projecten onder programma's van

- Economic Board Utrecht,
- NWO en
- TNO.

De catalogus is bedoeld als inspiratie voor een bijeenkomst op initiatief van het TKI Switch2SmartGrids (TKI S2SG) op 25 maart 2014.

Tijdens deze bijeenkomst komen deze projecten en de projecten onder het TKI S2SG en de proeftuinen onder het IPIN (Innovatieprogramma Intelligente Netten) samen.

Nu is er al een grote rijkdom aan projecten. Bovengenoemde projecten maken daar deel van uit, maar er zijn veel meer projecten in uitvoering.

Doel van deze bijeenkomst, zonder de niet deelnemende projecten tekort te willen doen, is verbindingen te zoeken en gezamenlijk een netwerk op te bouwen. En op zoek te gaan naar nieuwe kansen met elkaar, synergie tussen de projecten en mogelijkheden om project(en) te koppelen en/of te versterken in hun bijdrage aan de doelstellingen van het TKI S2SG.

1. EBU - Smart grid: rendement voor iedereen

Het project "Smart grid": rendement voor iedereen" heeft als doel het ontwikkelen, testen en realiseren van dienstverleningsconcepten in de smart grid-wijken Lombok in Utrecht en Nieuwland in Amersfoort (bestaande bouw).

Beide pilots hebben sterke lokale trekkracht: de ondernemer achter LomboXnet & ZonXnet in Utrecht werft de deelnemers vanuit een droom: " het aanbieden van internet met de snelheid van het licht, mogelijk gemaakt door de zon" (100 gebruikers).

In Amersfoort is het collectief Amersvolt opgetuigd; het collectief discussieert onderling over voor hun interessante diensten met het oplossen van maatschappelijke uitdagingen als uitgangspunt en ontwikkelt deze bij voldoende interesse (100 gebruikers).

Het project werkt aan de volgende dienstverleningsconcepten: E-car4all (elektrische deelauto's op zonnestroom uit de wijk, die worden opgeladen als de zon schijnt), Insight4all (inzicht in eigen verbruik en opwek), Advice4all (advies op maat per huishouden), Flex4all (optimale timing door automatische sturing), Profit4all (financiële prikkels met variabele tarieven), Solar4all (voorspelling zonnestroom met PV Box), Storage4all (opslag zonnestroom per huishouden), Together4all (collectief als dienst).

Titel	Smart grid: rendement voor iedereen
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Partners	CapGemini, DNV GL, Ecofys, Economic Board Utrecht, Eemflow Energy, Hogeschool Utrecht, Icasus, LomboXnet, Rijksuniversiteit Groningen, Stedin, Universiteit Utrecht & Utrecht Sustainability Institute
Looptijd	T/m q1 2015
Regeling	Voormalig Pieken in de Delta

2. NWO SES - Domestic Intelligent DC Grid (DID Grid)

This project enables the implementation of ICT technology in a domestic grid and uses a voltage that can be directly coupled to the dc bus of the latest generation of electric and plug-in hybrid vehicles.

The envisaged domestic and commercial grids of the future, essential for widespread penetration of distributed renewable energy sources and adoption of e-mobility, rely on effective and intelligent information and communication systems. In this project we opt for using a two wire system that carries both power and information. The proposed system is based on a 500V DC grid, typical voltage of the dc/ac converter of the motor drive of battery and hybrid vehicles thus suited to directly accommodate e-mobility. The DC grid connects renewable energy sources, the 50Hz ac grid, vehicles with battery systems, energy storage elements and new smart appliances.

The removal of the lossy ac-dc and dc-ac conversion stages present in conventional ac system, will result in a system simplification and an increase in the overall energy efficiency.

The dc system topology is expected to result in a reduced capacitance of the grid thus allowing for a higher data transfer rates than that of conventional ac power line communication. The key benefit is direct accommodation of electric and hybrid vehicles and the exploitation of the grid stabilising potential of e-mobility. The main research and technology challenges are to achieve reliable high speed communication over the high voltage DC line, to provide solutions for safety and electromagnetic compatibility issues of the high voltage dc bus in a building environment. Furthermore, designing an efficient energy management between the sources, storage and loads for having a fully bidirectional power flow capability is another challenge. The concept will be demonstrated on a 20 kW system prototype.

Progress

Studies of DC grid architectures with different control methodologies have been done. Based on the comparison of the currently available grid architectures, standards and the envisioned DID grid, the DID concept development is being developed. The technical specifications being considered for the DID concept development are transient and steady state power cycle matching, and impedances characteristics of DID grid passive components for power line communication application.

Moreover, the technologies being considered are plug and play, and broad band power line communication in the ranges of 2 to 30 MHz for power flow control and energy management.

Title	Domestic Intelligent DC Grid (DID Grid)
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Researchers	Mr. T.G. Hailu
Partners	Betronic Solutions bv, Exendis bv
Duration	October 2012 – October 2016
User committee	Betronic Solutions bv, Direct Current bv, TNO

3. NWO SES - Computational Capacity Planning in Electricity Networks (COCAPLEN)

The project develops novel ICT tools for scenario simulation and decision-making in NCP. It develops network models and simulation platforms for realistic network and usage outcomes from parameter and scenario choices, and develops advanced and dedicated multi-objective optimization techniques in the field of EAs using those platforms.

The project focuses on computational optimisation in Network Capacity Planning (NCP) and develops novel ICT tools (Information and Communication Technology) for scenario simulation and decision-making in NCP. It develops network models and simulation platforms for realistic network and usage outcomes from parameter and scenario choices, and it develops advanced and dedicated multi-objective optimization techniques in the field of evolutionary algorithms, especially estimation-of-distribution algorithms (EDAs), using those platforms in order to deal with the high complexity. The project will deliver the foundations for future software systems that will enable regulators, network operators, consultants, and applied energy researchers to make informed decisions on electricity networks. Especially, network operators will be enabled to incorporate the high uncertainty and complexity of the electricity sector in its planning processes. This ability reduces large investment risks, which eases the integration of renewable energy production technologies and sustains a reliable electricity supply. The project contributes to decentralized durable energy supply in future networks, with reliability of supply and cost-effectiveness.

Progress

On the electrical engineering side, literature overviews and requirements analyses have been performed that outline key aspects to be considered in network capacity planning (NCP), based on current manual network expansion planning processes and strategies. These findings have been published in two electrical engineering conferences (UPEC 2012 and IEEE Young Researchers Symposium in Electrical Power Engineering 2012). These results also serve as a foundation for discussions between TU/e and CWI leading to designing computer-science models that can be used for optimization in network planning. An important topic regarding the dynamics of multi-objective evolutionary algorithms, the main optimization paradigm in COCAPLEN, has been studied.

Results have been presented at a computer science conference (PPSN 2012).

More recently, in cooperation, models have been developed to describe electric elements of a conventional medium-voltage (MV) distribution network and its working constraints (e.g. power flow capacity and voltage requirement). First results for automated planning via optimization are currently being obtained and appear promising.

Title	Computational Capacity Planning in Electricity Networks (COCAPLEN)
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Partner	DNV GL
Duration	August 2011 - November 2015

4. NWO SES - Increasing the robustness of smart grids through distributed energy generation (RobuSmart)

Increasing the robustness of smart grids through distributed energy generation: a complex network approach (RobuSmart)

This project focuses on performance and reliability of the Smart Grid: increasing figures should still be the potential of improving both safety, reliability and usability of the power delivery system.

Today's grid was designed to move power from centralized supply sources to fixed, predictable loads; The current grid is designed Today's grid to deal with these loads: the loading capacity of components such as transformers, cables, etc. is currently determined on the basis of an assumed constant loading pattern. Current models for measuring the health of a network are based on known patterns.

In the future grid, the Smart Grid, very large numbers of distributed (renewable) energy sources will be connected to the existing grid. These physically distributed generation installations (e.g., gas turbines, micro turbines, fuel cells, solar panels, wind turbines) will be connected to existing infrastructure.

This proposal addresses the impact of largescale integration of distributed wind/solar/micro-grid generation on the robustness of Smart Grids and containment of cascades of failures through intentional disconnection / rerouting of portions of the power grid (those augmented by distributed sources). Selfmanagement techniques, that dynamically connect and disconnect parts of the grid to maintain robustness, will be deployed to this purpose.

Progress

In the first year the project has focussed on quantifying the robustness of power grids. Where traditional approaches have considered either the topological aspect or the power flow (loading level) aspect of the power grid, the RobuSmart project has developed a new metric that quantifies both aspects in one metric.

This new metric can be used to assess the robustness of the power grid, giving better results than traditional approaches, but it also forms the basis for the self-management of robustness in the Smart Grid that will be further explored in the remainder of the project. Several publications give more detail on the robustness metric and proposed selfmanagement aspects of the project.

Title	Increasing the robustness of smart grids through distributed energy generation (RobuSmart)
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Researchers	Y. Koç MSc , Dr E. Pournaras, Dr M.E. Warnier
Duration	September 2011 - March 2015

5. NWO SES – Energy Smart Offices (EnSO)

EnSO considers the occupant of the building at the center of such Internet of things. His natural actions in the energy smart office will be recognized and supported in such a way so to reduce overall building energy consumption.

Substantial energy savings in office buildings could be achieved by building-wide collaborative switching and regulating installations and appliances according to actual needs. The EnSO project will develop a scalable energyaware framework that incorporates dynamic occupant activity recognition and building context knowledge to adapt office installations and appliances for saving energy. The EnSO approach builds on cooperative, goal-oriented Ambient intelligence, Artificial Intelligence planning and state of the art wireless sensor network techniques. The consortium is composed by the Distributed Systems group of the University of Groningen and the Pervasive systems group of the Technical University of Eindhoven. IBM Benelux and Philips Research are the technological partners of this NWO Smart Energy Systems project.

Progress

Energy Smart Offices (EnSO) is exactly half way through and has already achieved interesting results in the areas of 1) scalable service-oriented architecture comprising sensors, actuators and external services, 2) smart grid interconnectivity, and 3) user occupant recognition with simple sensors. Two living lab installations have been setup: one in four rooms of the University of Groningen with simple sensors, Plugwise energy monitoring plugs and external web services, and one in an office room and a meeting room of TU/e including lighting and HVAC actuation. The results have been published in 4 journals (including IEEE TSG and Elsevier Energy and Buildings) and several conference proceedings.

EnSO benefits from synergic work with the EU project GreenerBuildings, from the interaction between academia and the industrial partners Philips and IBM; and a number of important initiatives have spun off from the project, namely, in 2012 two members of the Groningen team have won the Green Mind Award (100.000 euros) to make the Bernoulliborg building more sustainable; one IBM PhD fellowship was awarded to a team member to work on Smart Grid interconnectivity; several activities of the project have been covered by the press. More about the project can be found at <http://www.ensoffices.nl>.

Title	Energy Smart Offices (EnSO)
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Researchers	I. Georgievski, M. Milenkovic MSc
Partners	Philips Research, IBM Benelux
Duration	May 2011 - September 2015

6. NWO MVI - Strijd om aanvaardbare smart-grid-standaarden

Smart meter van de toekomst minder privacygevoelig

Slimme huisenergienetwerken zorgen voor efficiënter gebruik van energie en minder uitstoot van CO₂. Maar deze 'smart grids' vereisen 'smart meters'. TU Delft werkt binnen de pilot 'Strijd om aanvaardbare smart-grid-standaarden' aan een oplossing voor een van de belangrijkste ethische bezwaren: de privacygevoeligheid.

Privacygevoeligheid smart meters

"Welke informatie wordt er verzameld? Wat valt er uit af te leiden? Wie krijgt die informatie en wat mogen ze ermee doen? We doen onderzoek naar een smart meter die rekening houdt met dit soort maatschappelijke overwegingen", zegt projectleider Jeroen van den Hoven, professor in de filosofie aan de TU Delft. "De privacygevoeligheid is immers een van de belangrijkste bezwaren."

Samenwerking met (valorisatie)partners

Maar ook betrouwbaarheid en nauwkeurigheid zijn belangrijke waarden. Van den Hoven: "De meter moet wel gekalibreerd zijn en een keurmerk krijgen. Consumenten betalen per slot van rekening voor het geregistreerde gebruik. Zaak is om al die relevante waarden tegen elkaar af te wegen. Dat doen wij samen met (valorisatie)partners als de overheid, elektriciteitsbedrijven, KEMA en de Consumentenbond."

Recht doen aan principiële bezwaren

Ook het domoticasysteem wordt binnen de pilot onderzocht. En ook dit huismanagementsysteem moet de privacygevoeligheid reguleren, betrouwbaar en nauwkeurig zijn. Van den Hoven: "We hopen met dit pilotonderzoek een interessante referentie-architectuur of een voorbeeld van een standaard te leveren, die bovendien recht doet aan de morele of principiële bezwaren van burgers bij de implementatie ervan."

Maatschappelijk Verantwoord Innoveren

De pilot is onderdeel van het brede NWO-programma Maatschappelijk Verantwoord Innoveren. De in dit programma gefinancierde projecten richten zich op onderzoek naar ethische en maatschappelijke gevolgen van technologische innovaties vanaf de ontwerpfase. De projecten hebben een looptijd van één of twee jaar. Het onderzoek van de TU Delft is eind 2013 afgerond.

Titel	Strijd om aanvaardbare smart-grid-standaarden
Projectleider	Prof. Jeroen van den Hoven (TU Delft)
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7. TNO – Sociale innovatie - Advanced

Project objective

Leveraging on the empirical data and lessons learnt in real Active Demand (AD) experiences, the overall objective of the 24 months project is to develop actionable frameworks enabling residential, commercial and industrial consumers to participate in AD, thus facilitating mass uptake of AD in Europe.

The actionable frameworks will consist of validated recommendations for the efficient consumer oriented design of AD programmes covering amongst others the following variables:

- AD programme type (and services to be offered to market participants)
- Consumer groups and segments within the groups
- Geographic prerequisites

This will be achieved through comparing the different AD solutions applied in Europe (including amongst others the comparison of recruitment strategies, functionalities and applied technologies, consumer retention strategies, incentives type and volume, activation measures as well as character of the involvement of relevant stakeholders) and enhancing them by the investigation of socio-economic and behavioural factors with direct involvement of real consumers. On this basis and applying KPIs, key success factors of AD and recommendations for the future design of AD programs will be derived taking data protection and security aspects carefully into account. To properly communicate the AD concept and benefits, communication umbrellas will be developed.

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Looptijd	2013-2015
Regeling	FP7
Aanverwant project	SUGGEST, info via Annelies.Huygen@TNO.nl

8. TNO – Standaardisatie m.b.t elektrisch vervoer - Green eMotion

Green eMotion aims at enabling mass deployment of electromobility in Europe. To achieve this, major players from industry, the energy sector, municipalities as well as universities and research institutions have joined forces to develop and demonstrate a commonly accepted and user-friendly framework consisting of interoperable and scalable technical solutions in connection with a sustainable business platform. The Smart Grids development, innovative ICT solutions, different types of electric vehicles (EV) as well as urban mobility concepts will be taken into account for the implementation of this framework.

Green eMotion will connect ten ongoing regional and national electromobility initiatives leveraging on the results and comparing the different technology approaches to ensure the best solutions prevail for the EU single market.

A virtual marketplace will be created to enable the different actors to interact and to allow for new high-value transportation services as well as EV-user convenience in billing (EU Clearing House).

Furthermore, the project will contribute to the improvement and development of new and existing standards for electromobility interfaces. The elaborated technological solutions will be demonstrated in all participating demonstration regions to prove the interoperability of the framework. By proving efficient and user-friendly solutions which are also profitable for businesses, the Green eMotion framework plans to accomplish EU wide acceptance of all stakeholders.

Titel	Green eMotion
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Partners	43 partners: http://www.greenemotion-project.eu/partners/index.php
Looptijd	2011-2014
Regeling	FP7
Aanverwant project	Cotevos (FP7, http://cotevos.eu/the-project/)

9. TNO – Muliti commodity matching - Heatmatcher

In dit project wordt de HeatMatcher, een innovatieve regeling voor duurzame energiesystemen, ontwikkeld en beproefd. Deze regelt op maximale benutting van duurzame warmte.

Hiervoor zal het systeem, als een huismeester met een vooruitziende blik, worden uitgerust met de mogelijkheid van voorspelling van het volgende.

- De warmtevraag op basis van klimaat en historisch bewonersgedrag. Het gaat hierbij niet alleen om de hoeveelheid warmte in 24 uur, maar ook het tijdstip waarop de warmte beschikbaar is
- De hoeveelheid warmte die duurzaam kan worden geproduceerd op basis van de weersvoorspelling.
- De beschikbaarheid van duurzame warmte uit de buffers (langetermijnopslag in de bodem en kortetermijnopslag in een buffervat).
- De verwachte kostprijs van duurzame en fossiele energie.

De HeatMatcher is bedoeld om optimaal gebruik te maken van duurzame energie, afkomstig van bijvoorbeeld de zon, warmtepompen of energieopslag in de bodem, zowel voor de levering van warmte als van koeling.

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Looptijd	2011-2014
Regeling	EFRO
Aanverwante projecten	E-HUB (FP7, http://www.e-hub.org/) en HEGRID (KIC EIT ICT Labs), info via George Huitema, George.Huitema@TNO.nl