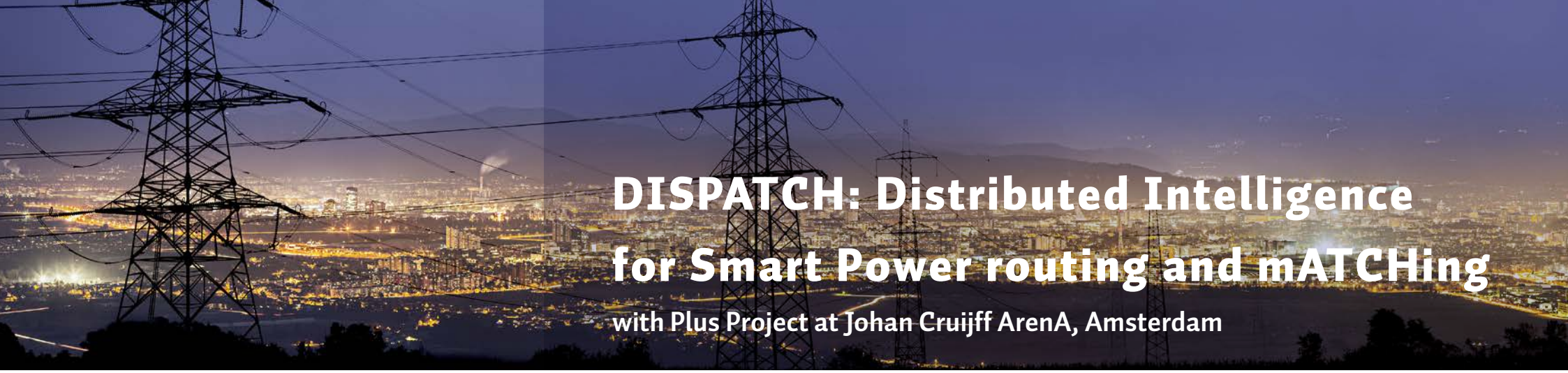

DISPATCH: Distributed Intelligence for Smart Power routing and mATCHing

with Plus Project at Johan Cruijff ArenA, Amsterdam

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Period

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Integrating control mechanism for supply & demand and for power flows

Currently, the electricity grid is operated by two separate control mechanisms. Firstly, demand and supply are balanced by electricity markets. Secondly, (regulated) grid operators (TSO and DSOs) control the grid by keeping the system within secure bounds (voltage, current, frequency) on a much finer time scale (milliseconds to minutes) while taking care of the physical location of injections and withdrawals from the grid. The massive integration of renewable energy sources and new demand technologies challenges the power system because of more uncertainty on all time scales. This makes it increasingly difficult to control the power flows in real-time, and especially to balance supply and demand to guarantee stability and reliability at all times and all places, without involvement of the market and deploying its flexibility.

DISPATCH has developed a framework based on the interaction between both control mechanisms to overcome the uncertainty challenges.

Framework for energy markets

The framework combines the 15-minute schedules of the energy markets with the much shorter time schedules of grid operators. This multi-disciplinary approach includes electrical power engineering, advanced control theory and the use of novel ICT concepts plus appropriate legal and organisational instruments.

Read more

1 L. Diestelmeier, D. Kuiken (2016): *Sustaining Universal Service Conditions in Smart Electricity Systems*, *Network Industries Quarterly*

2 L. Nordstroom, N. Blaauwbroek, J. Slootweg, H. Nguyen (2017): *Interfacing solutions for power hardware-inthe-loop simulations of distribution feeders for testing monitoring and control applications IET Generation*, *Transmission & Distribution*

3 N. Blaauwbroek, H. Nguyen (2017): *Interfacing applications for uncertainty reduction in smart energys systems utilizing distributed intelligence*, *Renewable and Sustainable Energy Reviews*

4 D. Kuiken, L. Diestelmeier (2017): *Smart Electricity Systems: Access Conditions for Household Customers Under EU Law*, *European Competition and Regulatory Law Review*

The research programme Uncertainty Reduction in Smart Energy Systems (**URSES**) aims to make a quick transition to a reliable, affordable and sustainable energy system possible. It is a joint initiative of several departments of NWO, Shell, AMS and the TKI Urban Energy.

Insights & recommendations

[1] National policy makers should carefully analyse the national markets for communication services and conclude whether communication services will be available to all household consumers that are, or will become part of the SES. If no minimum guarantee for the provision of communication services suitable for SES communications exists, it is suggested that the minimum quality standards for internet services could be aligned with the minimum standards for SES communications. Alternatively, the smart meter communication infrastructure could be used to integrate SES communication services.
EU policy makers should address household consumers' access conditions for SES. They could consider adopting a safety net, setting minimum requirements for either the smart meter infrastructure, or perhaps data communication services. This would also service a broader policy objective enshrined in the Digital Agenda for Europe: ensuring (high quality) internet access throughout the EU.

[2] The need for advanced monitoring and control applications (MCAs) in future distribution networks calls for highly accurate and fully integrated simulation solutions for the purpose of performance assessment of these MCAs. Power hardware-in-the-loop (PHIL) simulations are considered a cost-effective approach to overcome these challenges. A PHIL-interface has been designed that allows for the integration of a physical low-voltage feeder within a larger real-time simulated distribution network. Using the combination of the physical network and the larger simulated network, MCAs can be tested for scalability as well as accuracy. A data acquisition and processing system has been presented that acquires all the true system states of both the physical feeder and the real-time simulated network, such that the MCAs can be verified in real-time. The functioning of the PHIL-interface is validated using practical results and illustrated using a test case for the performance assessment of a branch current state estimation algorithm.

[3] A conceptual framework for SES development has been developed to give an overview of Distributed Intelligence-based applications in different specific SES domains. The ultimate goal for modelling and simulation techniques for SES and DI is to create an affordable testing environment to validate and verify various DI-based applications. This accelerates the development of the SES and smoothens the transition to suitable energy systems by reducing a great part of the uncertainty.

[4] There are four different options for household customers to access communication systems for SES under current EU legislation. Ensuring a level playing field for household customers to participate in SES requires EU and national policy makers to guarantee comparable conditions for household customers to access SES communication services.

NWO Netherlands Organisation for Scientific Research

AMS AMSTERDAM INSTITUTE FOR ADVANCED METROPOLITAN SOLUTIONS

TKI URBAN ENERGY Topsector Energie