

ERASMUS energy FORUM 2017



28 & 29
June 2017

Erasmus Energy Forum 2017 report



The Erasmus Energy Forum is an annual forum hosted by [Erasmus Centre for Future Energy Business](#)

And founded by



It is a conference for discussion between business, science and policymakers. In 2017 the sixth edition focused on accelerating the energy transition and the path to zero carbon energy. Science Day was on Wednesday 28 June, and Business Day on Thursday 29 June. www.erasmusenergyforum.com

The Erasmus Energy Forum 2017 was a joint effort of



The 2017 edition was additionally powered by



This report is published by

© 2017 Rotterdam School of Management, Erasmus University.

Editors: Dorine Schreiner and Justine Wittern. All rights reserved.



Erasmus Energy Forum 2017 - Science Day – Wednesday 28 June 2017, Erasmus Paviljoen

Science Day at the Erasmus Energy Forum 2017 created a business focus for scientific papers, allowing industry and business to give their feedback on the validity of how academia makes its assumptions and formulates the problems associated with real-world energy challenges. Science Day is the Energy Informatics & Management conference (EIM 2017). Discussions and interactions were encouraged as science and business came together and learned from each other as complementary scholars at the event, organised by the Erasmus Centre for Future Energy Business (ECFEB) at Rotterdam School of Management, Erasmus University (RSM).

Programme moderators for Science Day were two of RSM's Assistant Professor of Business Information Management [Tobias Brandt](#), and [Yashar Ghiassi-Farrokhfal](#).

Discussions resulting from the academic papers included **the practicality of energy co-operatives** and the possibility of energy co-operatives developing in the future; **charging station location optimisation** and how **operators of** roadside charging stations for electric vehicles (EVs) can locate new chargers to improve their return on investment (ROI); plus **future electricity markets** – how they might change as the share of renewable energy increases in the energy mix.

The practicalities of assumptions and models were explained to participants from business and academia by the authors of the papers – one of the few opportunities for such close debate in either the academic or the business world.

“Definitely the reflections gave room for a vivid exchange between academics and business representatives on current research topics,” said moderator Tobias Brandt, Assistant Professor of Business Information Management, RSM.



“Networking sessions also achieved the aim of bringing together people from industry, and academia during the networking sessions and breaks. Further collaborations are expected as a result,” said moderator **Yashar Ghiassi-Farrokhfal**. *“Business scholars need the technical background of academia to better understand their problems, and the academic crowd needs real-world data and to work on the problems that businesses experience.”*

Science Day also resulted in opportunities for students at RSM, with the chances of a series of master thesis projects and internship jobs in the industry resulting directly from contacts made by RSM academics at the event.



Erasmus Energy Forum 2017 - Science Day -

The opening address *Bring Sustainable Energy a Step Closer* was presented by Steef van de Velde, Dean and professor of management and technology at RSM.



[Catherine Rosenberg, Professor of Electrical and Computer Engineering,](#) University of Waterloo and Tier 1 Canada Research Chair Future Internet made the [keynote presentation](#) about linking storage to renewable energy production and the importance of storage in the smart grid, covering the optimal configuration of solar, wind and storage.

PAPERS

Papers followed three themes:

- [1 Smart Electricity Markets](#)
- [2 Demand Side Management](#)
- [3 Innovative Applications](#)

1 Smart Electricity Markets

Abstracts for each of the papers are presented here and they were *reflected by Wolf Ketter, Professor Next Generation Information Systems, RSM*

Are Optimal Day-Ahead Markets Able to Face RES Uncertainty? Evaluating Perfect Stochastic Energy Planning Models by Germán Morales-España, and Benjamin F. Hobbs Delft University of Technology in the Netherlands.

Approximations made in day-ahead markets can result in suboptimal or even infeasible schedules for generating units and inaccurate predictions of actual costs and wind curtailment. Here we compare different optimal models of day-ahead markets based on unit commitment (UC) formulations, especially



Erasmus Energy Forum 2017 - Science Day -

energy- versus power-based UC; excluding or including start-up and shutdown trajectories; and deterministic versus “ideal” stochastic models to face wind uncertainty. The day-ahead hourly schedules are then evaluated against actual wind and load profiles using a (5-min) real-time dispatch model. We find that each simplification usually causes expected generation costs to increase by several percentage points, and results in significant understatement of expected wind curtailment and, in some cases, load interruptions.

The Sustainable Tipping Point for Electricity Markets by Derck Koolen, Wolfgang Ketter, Liangfei Qiu and Alok Gupta.

With the electrification of heating and transport, and the integration of renewable energy sources, electricity markets are currently in a state of uncertainty and flux. Where renewable resources indeed provide sustainability benefits and help to achieve political targets, their recent sharp increase has pronounced challenges for efficient market design and integration in the electricity system. We propose a multi-stage competitive equilibrium model with suppliers producing under heterogeneous operational constraints. This allows us to compare risk related market strategies of conventional and renewable producers, and study the respective change on strategic forward and spot trading along the increase of volatile resources. We find a convenience yield for having flexible products in the production portfolio once the share of renewable energy sources reaches a tipping level. We analyse the tipping point, defined by the market set up and design, in terms of market efficiency and producer profits. The latter allows us to validate an investment analysis of new flexible products, for example battery technology and demand response. From the analysis policy implications can be drawn for achieving in a sustainable manner the high penetration of renewable energy sources in electricity markets. [Watch the video about our energy market design research here](#)

Unified Energy Agents in Simulations, Testbeds and Real Systems by Nils Loose, Christian Derksen and Rainer Unland of DAWIS, ICB, University of Duisburg-Essen.

Abstract: The liberalization of the energy markets, together with the ongoing energy transition, require new solutions for a flexible and adaptable energy supply infrastructure. The smart grid, i.e. equipping existing energy grids with modern information and communication technology, is regarded as a key enabler to handle this challenge. With the concepts of Unified Energy Agents and the Energy Option Model, a generic approach for a cross-domain and vendor-neutral smart grid architecture based on multi-agent systems has been proposed. In this work, the development process of an Energy Agent is described, with a special focus on the testing and evaluation phase, and the current state of its implementation is outlined.



Erasmus Energy Forum 2017 - Science Day -

2 Demand Side Management

Abstracts for each of the papers are presented here and they were *reflected by Jaron Reddy, Sales Manager, Energy eXchange Enablers*

A cooperative aggregation model for pricing residential energy users with renewable energy sources by Mohammad Ansarin, Yashar Ghiassi-Farrokhfal, Wolfgang Ketter and John Collins.

Abstract: Improving technology and worsening climate change are reducing barriers and increasing demand for alternative and clean energy sources. Consequently, distributed renewable energy sources (D-RES) are quickly growing in capacity, bringing along higher intermittency. Integrating D-RES into current electricity grids remains a challenge. One solution is aggregating D-RES within a microgrid system. But how should such a microgrid be managed? In this article, we discuss how high D-RES penetration in a microgrid favours energy co-operatives over other forms of organisation. In particular, we analyse how a co-operative allows for costs reductions through aggregation of energy demand and load shifting. We investigate a case study with 2015 residential electricity demand data from Austin, Texas, verifying that aggregating households within a co-operative reduces costs. However, costs reductions are strongly dependent on the chosen electricity tariff design. Encouraging suitable aggregation forms for energy users requires better tariff structures which clearly reflect the associated costs for all stakeholders.

Towards a Benchmark for Demand-Side-Management Methods by Dennis Behrens, Thorsten Schoormann, Sebastian Bräuer and Ralf Knackstedt.



Abstract: A balanced energy demand is challenging but beneficial for both energy providers and consumers. Demand-Side-Management (DSM) contributes to this by shifting flexible loads. Since various methods exist in DSM, it has to be evaluated which method can be deemed suitable for a certain situation in order to achieve the utmost value for the stakeholders involved. However, current comparisons do not provide this kind of evaluation or benchmark. Hence, this article aims at developing and

implementing a benchmark framework that supports a proper selection and comprehensible comparison of DSM methods. Therefore, in a first iteration a framework for the residential context is adopted from an adjoining field. Afterwards, in a second iteration, the resulting framework is compared to general benchmarking approaches to derive a framework for other contexts.



Erasmus Energy Forum 2017 - Science Day -

Green Greenhouses: An Application of Energy Informatics by Richard Watson, Nadine Fares, Marie-Claude Boudreau, Marc van Iersel and Erico Mattos.

Abstract: Controlled-environment agriculture (CEA) is a highly productive method of food production, but electricity is about 30 per cent of the cost of operating a greenhouse. As the light level of LED lighting can be easily controlled, it offers the potential to reduce energy costs by matching a crop's photon needs precisely. A simulation of LED lighting for growing lettuces in the south-east of the USA using historical solar radiation data for the area shows that lighting costs can be potentially reduced by an order of magnitude.

3 Innovative Applications

Abstracts for each of the papers are presented here and they were **reflected by Marc Bras, Manager BMWi**

Intelligent Transportation Systems, Traffic Congestion, and Environmental Sustainability by Zhi Cheng, Min-Seok Pang and Paul Pavlou

Abstract: In recent decades, transportation policymakers have begun to utilize intelligent transportation systems (ITS) to manage traffic. However, whether and how ITS helps mitigate traffic congestion has limited understanding. To investigate this, we built a unique longitudinal dataset on traffic and the adoption of 511 systems, a federally-supported ITS program, in 99 U.S. urban areas in 2001-2014. Our difference-in-differences estimations show that the adoption of a 511 system reduces traffic congestion, saving a driver 50 minutes in driving time and \$30 per year on average. We also found that 511 systems help save 19 million gallons of gasoline consumption and reduce 152 million pounds of CO₂ emission per year. We further investigated in what mechanisms ITS alleviates congestion and fosters environmental sustainability and found that in the demand side, ITS assists drivers to schedule travel more efficiently, to mitigate travel time uncertainty, to choose better navigation routes, and to alter work-trip transportation modes. In the supply side, ITS assists local governments to manage traffic by guiding road expansions. Our study extends the IS literature on IT capabilities, public-sector IT value, and Green IT, and contributes to the transportation economics literature. We also inform transportation policymakers that ITS could be a more cost-effective alternative to tackle traffic congestion than expensive road construction.

Electric Vehicle Enabled Parking Lot: a New Stakeholder in a Changing Energy Landscape by Jurica Babic, Arthur Carvalho, Wolfgang Ketter and Vedran Podobnik.

Abstract: Nowadays, significant efforts are made in introducing new energy stakeholders within existing energy systems. For example, increasing inclusion of renewables lowers pollution at the production side



Erasmus Energy Forum 2017 - Science Day -

while electric vehicles (EVs) lower pollution at the consumption side. EVs are particularly interesting not only because they are efficient, clean, and can be used as storage devices, but also because they open new business opportunities. This paper presents an Information System artifact for studying the electric vehicle enabled parking lot (EVPL), a new stakeholder in a changing energy landscape, which naturally coexists with EVs. In short, the EVPL extends beyond traditional parking lots by adding the charging service to its service portfolio. Based on real-world data we show that, if properly configured, the EVPL brings substantial economic benefits for the EVPL operator. In particular, our computational model estimates that the optimal EVPL configuration (i.e., a number of EV parking spots and a charging service fee) for 30 per cent EV adoption rate leads to an increase of around 1.5 per cent in profits against the business-as-usual (i.e., parking-only) scenario.

The Power of Science Erasmus Energy Science Award



A winner was picked from papers submitted to the academic conference on Science Day. The judges were looking for research that best pairs practical relevance to future energy business, and presents new findings with scientific rigour.

A paper from Dr Marius Buchmann, Research Associate at Bremen Energy Research (BER), Jacobs University Bremen [won the Erasmus Energy Science Award](#). The judges commented that Dr Buchmann's paper is policy research that reflects growing awareness of blockchain technology within the energy sector; the opportunities it presents and the challenges it faces.

His paper, [Blockchain in the energy sector: Applications and institutional implications](#) investigates the hot topic of blockchain technology for the energy sector. Blockchain technology, a secure decentralised and digitalised ledger containing and maintaining a growing set of data (such as energy usage) is still in its infancy and needs to prove it can meet high expectations. Dr Buchmann's paper explores its potential applications – and the implications for not only the retail sector, but also the power network sector and the regulation of network operators.

For example, decentralized energy providers (such as households that can generate electricity from photovoltaic equipment) sell locally produced electricity to their neighbours via blockchain. Most devices connected to the electricity grid have access to the same blockchain. Buchmann concludes that generators



Erasmus Energy Forum 2017 - Science Day -

could sell directly to consumers to strengthen the integration of generation and retail business. Retail may not remain an independent part of the supply chain, he says, but instead become an automated and autonomous process conducted by generators and consumers themselves. He also identifies an opportunity for reducing the asymmetry of information between regulators and network operators.

POWER TAC – TRADING AGENT PARTICIPANTS AND WINNERS

Earlier this year, the ECFEB invited researchers from universities around the world to participate in the annual [Power Trading Agent Competition](#) (Power TAC). While many simulations are viewed as games, this competition provides researchers with important data for managing future energy markets. Teams compete as 'brokers' in an online simulation of a real-world energy market.

Power TAC is both a competition and a form of open, modular research: a test bed for the design of power markets and trading strategies. The co-creation of [Professor Wolf Ketter](#) and John Collins and Alok Gupta from the University of Minnesota, the competition is a form of competitive benchmarking, inviting top researchers from academia and industry to pit their agents against each other [in a race for the most successful strategies](#).

The winners are:

1. AgentUDE - University Duisburg-Essen, Germany
2. fimtax — University of Augsburg and Bayreuth
3. SPOT — University of Texas at El Paso



ERASMUS energy FORUM 2017



28 & 29
June 2017

Erasmus Energy Forum 2017 - Science Day -

STUDENT ENERGY CHALLENGE

Students from RSM's [MSc Business Information Management](#) programme honours class were challenged to devise applications and solutions to empower the energy transition focusing on urban mobility. The winners, Nanne van der Wal and Tjeerd Hoes presented an approach that built on personal experience in South Africa, where shared taxi vans following predetermined routes constitute an essential part of public transportation. They translated this into a business model for an IT-enabled shared mobility service that can be launched around the world. While keeping in touch with current developments in urban mobility, their proposal emphasises the role culture plays for sustainable mobility and how different countries and cultures can be inspired by each other to find novel solutions.





Science meets Business evening programme at Eneco World



The evening programme for Science Day took the audience away from campus to [Eneco World](#), Eneco's innovative head office in Rotterdam for a themed evening, 'Science meets business', which included two presentations, by Kees Jan Rameau, Member Board of Management, Eneco and Robert Phillips, Director, Marketplace Optimization Data Science at Uber who gave insights into the current developments and challenges their companies are facing.

Dinner was followed by a debate about the opportunities of collaboration to accelerate the energy transition with Wolf Ketter and Eric van Heck (both from RSM) and Kees Jan Rameau, Eneco and Robert Phillips, Uber. The participants discussed the current transition energy companies, but also the mobility sector, are facing. A particular powerful sentiment emerged towards the middle of the discussion in that both academics and business operatives that work towards sustainability need to look beyond their own 'echo chamber' and appreciate more the basic challenges a vast share of the global population face on a daily basis. While the energy transition will have beneficial effects for everybody in the long term, these are hard to appreciate if people face a daily challenge related to food, water, and access to energy.
