Digital Data Days -Flexibility Markets and Needs

Flexibility Core Team



Agenda Digital Data Days Flexibility Market and Needs

alot), Frank
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Agenda – Digital Data Days

- 1. Introduction TenneT
- 2. Future flexibility needs TenneT's perspective
- 3. The future of flexibility
 - Fraunhofer Institute
 - The Mobility House
 - Metalot
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- 4. Panel discussion
- 5. Closure



TenneT at a glance 2020





TenneT at a glance Facts and figures Netherlands and Germany







A grid operator's tasks Main tasks

Transmission services Ensure a robust and efficient high-voltage grid



Market facilitation Facilitate an efficient and stable electricity market









The changing environment... Drop in renewable electricity prices



Source: Our World in Data (2020)



... is an enabler for new innovations





Main aim of the webinar Connect with external market parties



Create awareness

External market parties can gain more insight and understanding TenneT's main challenges

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Develop solutions together

TenneT believes in the innovative capabilities of the market to find smart flexibility solutions. In case parties need support, TenneT intends to facilitate this



Challenge TenneT's main challenges

External parties may foresee other / additional challenges, it is important for TenneT to stay in dialogue with the market



TenneT will not unnecessary interfere in the energy market

Pilots will only be done if the market is not doing this



TenneT will not favor one market party above another

TenneT will make a thought-out decision before partnering with an external market party





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Future Flexibility Needs

Frank Wiersma



Rapid transition to system dominated by wind + solar example NL

2020





Rapid transition to system dominated by wind + solar example NL

2025





Rapid transition to system dominated by wind + solar example NL

2030







Flexibility applications



Wholesale market

An efficient wholesale market is key to matching supply and demand in first instance. This results in a lower flexibility demand in the other flexibility segments. The wholesale market includes: the forward, day-ahead, the intra-day and cross border trading.

Challenges

- How to unlock new technologies that can move the peak supply towards another moment of the day?
- How to unlock new solutions that can forecasting flex and contribute to validation activation?
- How to unlock new business cases in a combination of sectors (e.g. coupling industry, heat and mobility)?

Example initiatives

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 Integrated infrastructure exploration 2030-2050

System balancing

A stable electricity system is based on a continuous balance between generation and consumption (Frequency = 50 Hz). This segment is focusing on the future grid stability (50Hz) by unlocking the flexibility of small scale distributed assets.

Challenges

- How to unlock flex potential of new flexibility sources in the balancing market?
- ► How to enable easy data exchange between different market parties?
- How to validate the data received form assets?

Example initiatives

Crowd Balancing platform (Equigy)

Targets TenneT

 Unlock balancing power from new flexibility resources by 2030

🛓 Congestion

Congestion management and congestions alleviation aim to solve a short term transport problem (between day-ahead & real time) by making use of remedial actions.

Challenges

- How to unlock new congestion management solutions New congestion management solutions/products, incorporating VRE, DSR and storage flexibility via aggregators.
- How to unlock new potential for congestion management from other sectors: heat, industry, building and mobility?
- How to gather high quality data forecasting? And how can IT systems combine this data for congestion management purposes (more efficient)?

Example initiatives

Crowd Balancing platform (Equigy)



Flexibility actors and roles

Prosumers

Make the decisions to invest in assets that can potentially operate and be unlocked as flexibility resources

Market Parties (BRP, BSP, CSP)

Have to manage the output of increasing quantities of VRE in their portfolio and match these with fluctuating demand on the consumers portfolio

DSOs

Manage new peak loads in the distribution grid, driven by growing capacity of variable wind and solar generation and new electricity demand

TSO's

Manage balancing services to maintain a balanced electricity system and a stable frequency and perform congestion and alleviation management







Congestion management congestion alleviation



Congestion management System balancing congestion alleviation





Key takeaways

1. This is a quest for unlocking cost-effective new flexibility potential.

- Demand response potential and cost of unlocking flexibility
- Evolving cost levels of storage technologies
- Co-location at consumption and renewable generation hubs

2. Enable flexibility owners to valorise their flexibility resources across applications

- Wholesale market, TSO balancing and congestion management, DSO congestion management
- This complexity needs to be organised reliably and securely, while avoiding gaming risks.
- Practical experience and pilot projects are key to moving towards suitable frameworks and systems





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Project Group Business & Information Systems Engineering

The Future of Flexibility

Prof. Dr. Jens Strüker (Director @ Fraunhofer Institute Blockchain Lab)



Research Center Finance & Information Management

University of Bayreuth

Prof. Dr. Jens Strüker

Research Center Finance & Information Management

Project Group Business & Information Systems Engineering of the Fraunhofer FIT

Professor of Information Systems and Digital Energy Management

BlockchainLab Management

www.fim-rc.de

www.fit.fraunhofer.de/bise



29.06.2021

Research Center FIM and Project Group Business & Information Systems Engineering of the Fraunhofer FIT







🗾 Fraunhofer

FIT

Our triad of research, education, and application



inance an

nformatio

economic graduate programs 2008, 2011, 2014 & 2017

Various flexibility options contribute to the required balance in electricity systems



The ability of power system operation, power system assets, loads, energy storage assets and generators, to change or modify their routine operation for a limited duration, and responding to external service request signals, without inducing unplanned disruptions.



Degefa et al. (2021)



Flexibility increases liquidity in markets and can serve the market, serve the system, or serve the grid

However, there exist several obstacles that prevent the exploitation of demand-side flexibility



Grid charges regulation



The calculation of the capacity charge as well as individual grid charges according to §19 II S. 2 of the grid charges regulation (StromNEV) hamper the provision of grid- and system-friendly flexibility.

Static levies and taxes



As electricity prices for the energy-intensive industry consists to large part of levies and taxes, market price signals (reflecting flexibility needs) are distorted.

Conflict with efficiency

- EEG-umlagepflichtiger Stromwebrauch an der Abnahmestelle mehr als 1 <u>GWh</u> (siehe hierzu d., <u>Merkblatt für stromkostenintensive Unternehmen 2018</u>;
 <u>Purchchnittsstromorais-Varordnung</u> und dazugehöriges "Hinweisblatt"); Unternehmen, die nur knapp über dieser Schwelle liegen, sollten die Kosten, die im Zusammenhang mit der Antragstellung entstehen, z.B. für den Prüfungsvermerk des Wirtschaftsprüfers und die Gebührenverordnung, beachten!
- Stormkösteimiterisiat (Stromkösteiniterisiat) (Stromkösteiniterisiat) en Unternehmens (nach Anlage 4 zu § 64 EEG 2014): Unternehmens (nach Anlage 4 zu § 64 EEG 2014):
- Im Antragsjahr 2018 du Liste 1: Stromkostenintensität mindestens 14 %*
- Im Antragsjahr 2018 d Liste 2: Stromkostenintensität mindestens 20 %*
 Zertifizierung des Energie- oder Umweltmanagementsystems (Potenziale zur Verminderung
- Zertifizierung des Energie- oder Umweltmanagementsystems (Potenziale zur Verminde des Energieverbrauchs) nunmehr f
 ür alle Antragsteller verpflichtend.

Exemptions from the Renewable Energies Act Levy (EEG-Umlage) for energy-intensive industries set efficiency requirements, which are difficult to meet when providing flexibility.

Lack of end-to-end digitalization



Manual entries of third parties in central registers and often timeconsuming manual verifications cur-rently prevent efficient energy market design, which could be solved by end-to-end digitalization.

It is necessary to remove such barriers to use the existing flexibility potential

Major steps are required to shape our electricity system for the future





There is a need for an objective for a future electricity system that fosters and enables all flexibility options





The current market design needs to adapt to new developments in electricity markets and systems.



Electricity prices should mirror restrictions in grid capacities. As a result, regionally differentiated price signals (even nodal prices) may incentivize an optimal integration of both renewable energy sources and flexibility options.



CO₂ budgets must become a central control variable for the electricity system.

Information technologies and **information systems** must contribute to endto-end digitalization.

A future electricity market design must address the dimensions of security of supply, economic efficiency and sustainability (in weighted form)

Sources: Ashour Novirdoust et al., 2021; Strüker et al., 2021

an der Universität zu Köln



Ashour Novirdoust, Amir, et al. (2021). "Electricity Spot Market Design 2030-2050".

Degefa, M. Z., I. B. Sperstad, and H. Sæle (2021). "Comprehensive classifications and characterizations of power system flexibility resources". In: Electric Power Systems Research 194, p. 107022. ISSN: 0378-7796. DOI: 10.1016/j.epsr.2021.107 022.

Strüker J., Weibelzahl M., Körner M.-F., Kießling A., Franke-Sluijk A., Hermann, M. (2021). "Dekarbonisierung durch Digitalisierung - Thesen zur Transformation der Energiewirtschaft" Hg. v. Universität Bayreuth, Projektgruppe Wirtschaftsinformatik des Fraunhofer-Instituts für Angewandte Informationstechnik FIT und TenneT. Bayreuth. Online verfügbar unter <u>https://doi.org/10.15495/EPub_UBT_00005596</u> (ab 1.7.2021)



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ZERO, ZERO

Marcus Fendt, June 29th 2021





TMH will leverage and monetize EV flexibilities

The opportunity

Automotive industry

¹ Energy market for short term flexibility in 2025 Source: European Commission, Bernstein Report, Bloomberg NEF, The Mobility House

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Energy industry

The e-mobility industry pathway

E-Mobility charging market development - from charging to future value



TMH offers comprehensive solutions for an electrified future

TMH business areas





THE MOBILITY HOUSE **Charging Solutions Smart Charging Stationary Storage** Charging Solutions for B2C/B2B Smart charging technology Monetization of large-scale storage customers and reseller in Germany, ChargePilot for charging and solutions based on (spare parts/ Austria and Switzerland energy management 1st- and 2nd-use) EV batteries RENAULT \bigotimes 🕨 zalando BURNS Deutsche Post 👷 FAT•N 🏹 Post (\mathcal{A}) ST. LOUIS METRO **EVB**OX Hermes seie 🎹 \mathbb{O} fenecon **EVBOX** Infineon SIEMENS Allianz 🕕 Nider **SIEMENS** anpost 60,000+ >2.500 EV-batteries 500+ Smart Fleets

Installed/sold chargers & products

 ∞

ABI

(-)ebasto

30+ MW Site capacity installed or in construction

100+ MW

Capacity installed or in construction

Vehicle-Grid-Integration

EV Aggregation Platform for monetization of EV battery flexibility energy & grid markets





8+ V2G-Piloten 14+ energy products

Value generating energy & grid services enabled THE MOBILITY HOUSE AG © 2021

EV Batteries Pave The Way For A Fossil Free Future





Center (GDC).

— Flow of energy — Flow of information



RENAULT



2030 – 10 m EVs in the energy market reduce CO₂ und vehicle price 7 - 10 m ~500 GWh -39 Achievement of CO₂ goals MtCO₂/a * 65% Accelerated +650 mobility €/EV/a transformation 40% No additional 40 GWh subsidies 0,1 m 2020 2030 2020 2030 2020 2030

Share of renewableNumber ofenergies (elec.)EVs

Storage capacity

33

* 22 MtCO₂/a through change in drive train and 17 MtCO₂/a through VGI in 2030 Source: KBA, BDEW, Fraunhofer ISE



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Iron Fuel

Enabling safe and sustainable energy

Tennet Webinar: Flexibility Need and Market Trends

13-07-2021

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Challenge







Solution



metalot

Benefit

		Flammable	Acute Toxic	Health Hazard	Corrosive	Environmental	Pressured Gas
			Set .			¥	$\langle - \rangle$
		\mathbf{V}	\mathbf{V}			\mathbf{V}	
CLEAN							
	Methanol (CH ₃ OH)	X	X	X			
COMPACT	Hydrogen (H ₂)	x					x
CHEAP	Ammonia (NH ₃)		x		х	X	x
	Iron (Fe) and Fe ₂ 0 ₃	X					

13-07-2021

39

 \approx large H2 salt cavern

Benefit

Equivalent Energy Containment Volume



CHEAP

CLEAN







Renewable energy production





<15 €/MWh (2020)

43 €/MWh (NL, 2030)

Benefit



CLEAN



Yearly total value chain cost for a 10 MW boiler







Valorization



Circular iron fuel









Roadmap



2020	2022	2024	2028	>2030
Lighthouse MP	OPZuid MP	MF & City Plants	MF International	Commercialisation
Bavaria	Swinkels	Uniper	Uniper & Swinkels	Industry & Energy
0.1 MW	0.5 MW	5 MW	5+5 MW	10-2000 MW



Main message

- Metals like iron are safe, dense and renewable fuels that enable CO₂ free heat and power with security of supply.
- The challenges in the Netherlands are big, but the country is small. The energy transition takes place globally. We believe that international commodity trading can be part of the solution for large temporal and spatial fluctuations.
- Iron fuel will play a big role in the hybrid solution for high quality heat and therefore reduces grids constraints, peak loads and gas & electrical grid expansions.

Consortium partners



metalot



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Flexibility Marketing for Power & Gas

Benefit from price volatility throughout the day

Copyright: ESFORIN SE 2021

ES·FOR·IN SE at a glance – optimization platform for power and gas



- ES·FOR·IN SE Energy Services for Industry is an independent and innovative start-up with headquarters in Essen (Germany)
- Subsidiary IT company IT24⁷ GmbH with headquarters in Essen and Berlin
- Fully automated platform with focus on market price-oriented short-term optimization of flexibility for industrial customers in the electricity and gas sector
- One of the first and most innovative companies for algorithmic intraday trading of electricity and gas
- Fully automated and digital processes
- Independent service platform



We lead electricity markets into the future



– profitably for companies and the energy turnaround!



- Profits of up to 85,000€ per MW/a and trading direction
- Our unique and fully-automated algorithmic optimization platform no comparable system exists to ours with more than 50 individualized trading algorithms
- No dependency on volatile extreme price fishing, you rather profit from continuously trading activities within a millisecond range.
- Highly customizable and user-friendly.
- We are stabilizing the power grid in the context of the energy transition through balancing fluctuating supply of renewable energies. We buy electricity at high levels of availability and sell at to higher prices at insufficient supply.

We created our own unique system focusing on flexibility marketing at the wholesale market...

Transfer of

...that runs independently 24/7 fully automated without any human intervention! – including:

- the transfer of flexibility restrictions via web portal
- user-specific API
- trading at the EPEX Spot SE
- control of the flexibility by own developed control box, or schedule transfer via user-specific API
- as well as the final settlement.





In future, the need for **flexibility options will increase** with the number of decentralized generation plants due to feed-in characteristic of renewable energies and resulting forecast accuracy.

Electricity producers and consumers are encouraged to adapt to the feed-in of renewable energies and thus support negotiating the forecast errors by passing on electricity price signals.



Fully-automated & digital flexibility marketing enables energy transition

ES·FOR·IN offers innovative energy solutions and services for the flexibility marketing of electricity via a completely automated optimization and service platform.

Flexibility options are used to economically optimize the electrical energy demand of consumers.

 If exchange electricity prices are low, consumers purchase more energy. If prices are high, consumption will reduce.

In reverse, electricity producers will increase production if prices are high and reduce it in times of lower prices.

These reactions to price signals are always executed within all asset-specific constraints.



The **power value** depends on

- When will electricity be traded?
- When will delivery take place?







Our flexibility marketing at the intraday markets of the EPEX Spot SE enables companies the incomparable profitability - up to 85.000 €/MW per year! - contrasting the highly regulated control power. The more short-term flexibility is traded, the higher the revenue potential.

Continuus Trading – Price Volatility





Example for intraday trade



T O

Flexibility can be used profitably through intelligent trading strategies and technology

Intraday price development on the cont. Intraday trading for the delivery hour from 08:00 to 09:00 on 15.10.2020



Benefits of our flexibility marketing



- for companies and the energy turnaround!







We are convinced our flexibility marketing in the wholesale market is one of the solutions to enable a **smooth energy transition** and to deal with accompanying challenges.

Christian Hövelhaus & Christoph Gardlo



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