Auswärtiges Amt Bundesministerium für Wirtschaft und Energie

MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE

15 OFATE DFBEW

Flexible energy systems (markets & regulation)

Jean-Michel Glachant

Director of the Florence School of Regulation

At core of EU decarbonization strategy

- At the core of EU decarbonization strategy is **electrification** with **clean electricity**. This implies:
- 1- Decarbonizing the electricity EU consumes today 2,500 TWh
- +2 Direct electrification of road mobility 3,100 TWh , heating & cooling buildings & households 2,900 TWh, parts of industrial processes 1,000 TWh
- +3 Indirect electrification of maritime & aviation, other parts of industrial processes (via Green Hydrogen & Ammonia, etc.) 2,000 TWh. Competing with Biofuels? Synthetic fuels from gas + CCUS?
- = I will limit my talk to "**Flexibility of electricity systems**"

Overview of electricity flexibility

- First, **the supply of flexibility** on the consumer side, distinguishing 4 types of consumer flexibility (from demand response to system peaks, to integrating consumption in a transactive process)

- Then, **the uses of flexibility**, distinguishing 3 levels of flexibility use (¤ at transmission level, ¤ at distribution level, ¤ and ''*Behind-the-Meter*'')

Consumer Flex (1) Demand response to system peak pricing

- Not new, exists since decades that certain consumers gain by not consuming at peaks
- Tradition in France is ‘’*EJP*’’ = Demand response to seasonnal peaks. Mainly professionals do that. But even households: in 2021, 22 ‘Red Days’ at 374 Euro a MWh (retail rate)
- New business for ‘’*Aggregators*’’ = Demand response at all peaks, incl. daily peaks. Made EU legal by *Clean Energy Package*, but rules (*Aggregators vs Suppliers*) left national. Leading French: *Voltalis*. Leading German: *Next Kraftwerke* (10,000 clients & 9GW in 2020). Business of ‘’*Light Assets*’’ intermediary & trader

Consumer Flex (1) Demand response to system peak pricing

- Expansion of electricity consumption via electrification of industrial processes will expand the potential business of demand response; and I have seen industrials studying what could be the ‘’right flexibility potential’’ to give to their new investments.

Consumer Flex (2) Managing distributed generation with storage

- Expansion of rooftop PV questions the right size of PV assets vis-à-vis size of self-consumption; plus the lower storage costs expand set of choices for prosumers (1.2m in California)
- Management of distributed generation with storage opens the box of ‘price arbitrage’: grid tariffs for peak injection or withdrawal; supplier tariff for energy; support schemes for renewables… The prosumer can decide, act & react
- German company Sonnen sold > 60,000 home storages

Consumer Flex (3) Managing a flexible load being a storage: Electric Vehicles

- An EV is both a flexible load (it can charge at different points & different times) and a storage…
- '*Smart Charging*' means making arbitrage for EV charging
- '*Vehicle to Grid*' (V2G) adds options of injecting electricity into the grid > wider arbitrage perimeter.
- EV owners have to choose being active or passive; incl. for their car to be able to do V2G. But VolksWagen now installs V2G on all its EVs.
- EV owners can also arbitrage charging at home, work, or station

Consumer Flex (4) Integrating key consumption devices into transactive process

- Not so easy for consumers to evaluate all options & manage well flexibility of home (or shop, or building) consumption
- But it can be automatized: via a proper digitalization of key consumption devices (‘sensors’ + ‘actuators’ + ‘controller’)
- Let’s look at 2 pilots of ‘’*transactive energy*’’ in the US

Pilot called *‘’RATES’’* in suburb of Los Angeles: 3 years & 33,000 participants.

Similar pilot in Colorado, called *‘’TESS’’* with 58,000 participants.

Each key device gets sensors & an actuator

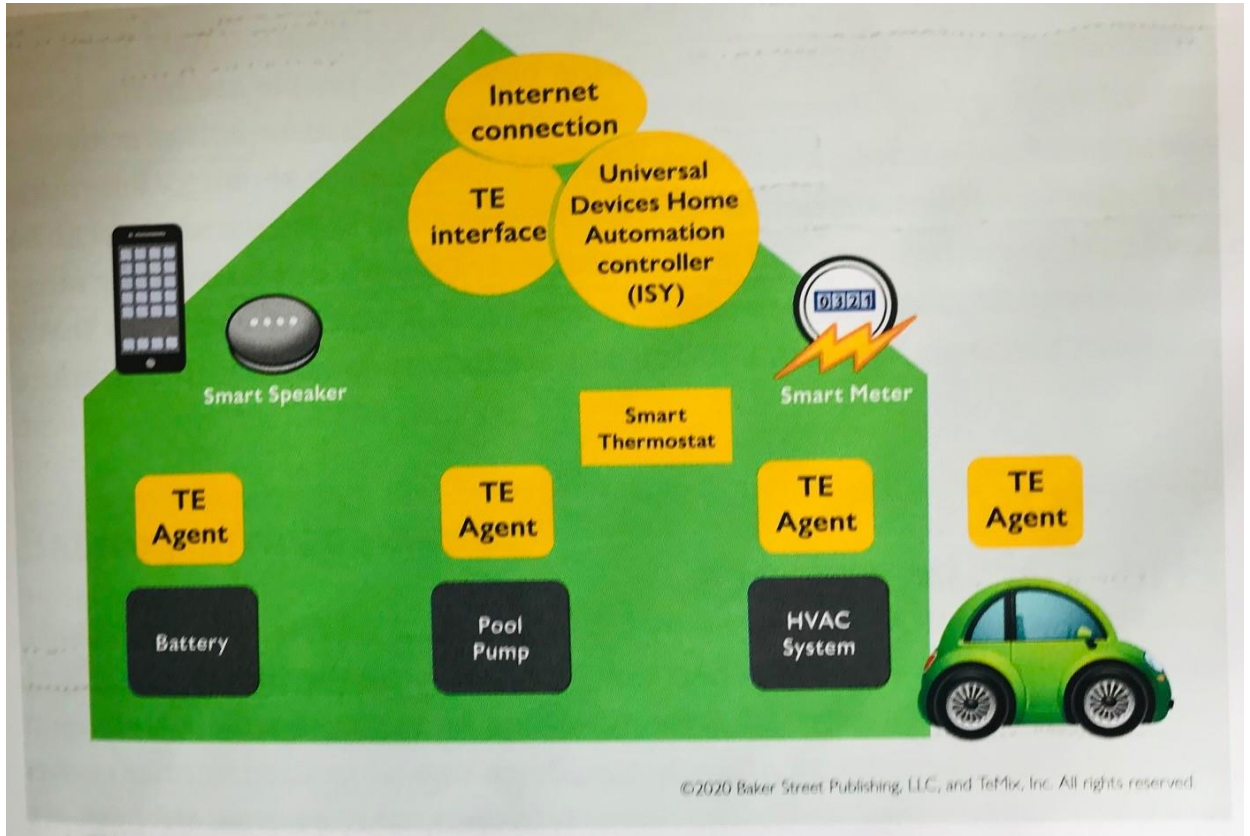
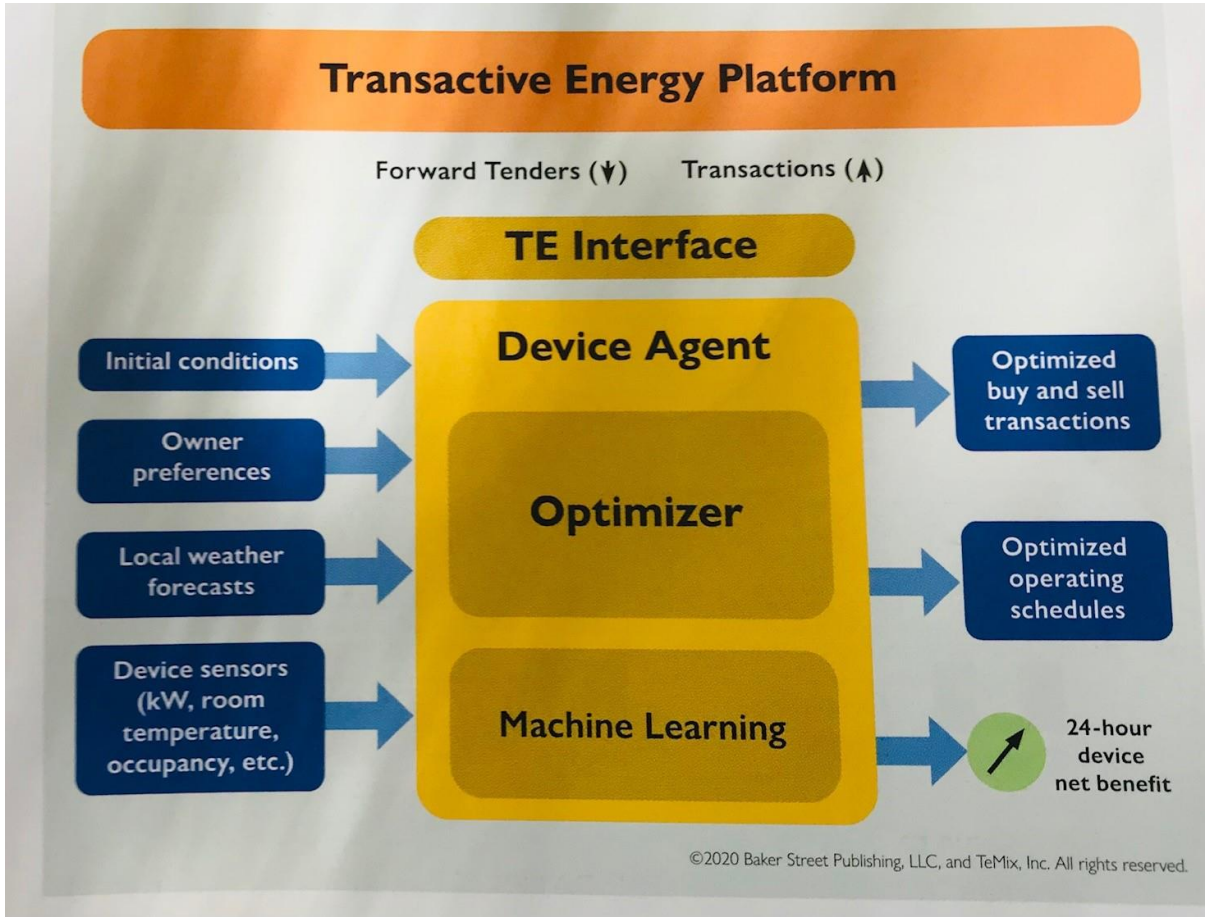
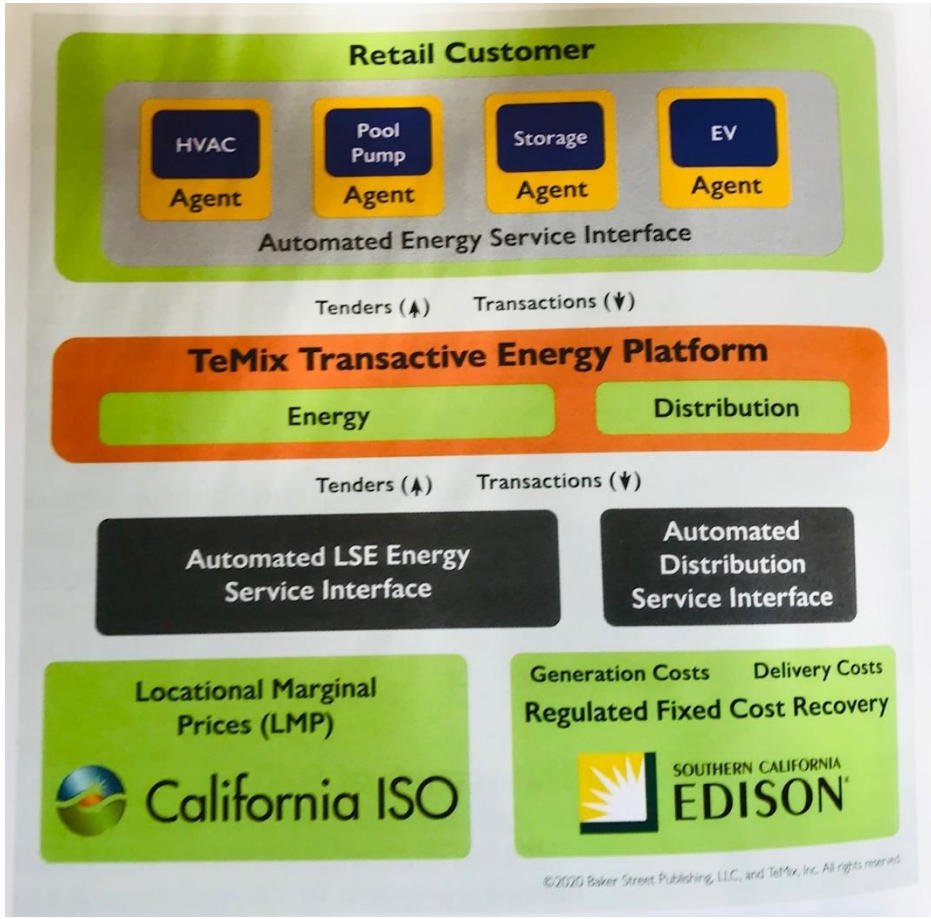


FIGURE 5-1 *RATES customer architecture for the Moorpark project*

Each device obeys owner preferences + machine learning advices via *Home Integrating Controller*



Txs to Platform, *Home Controller* interacts with System Op. pricing & Supplier tariffs

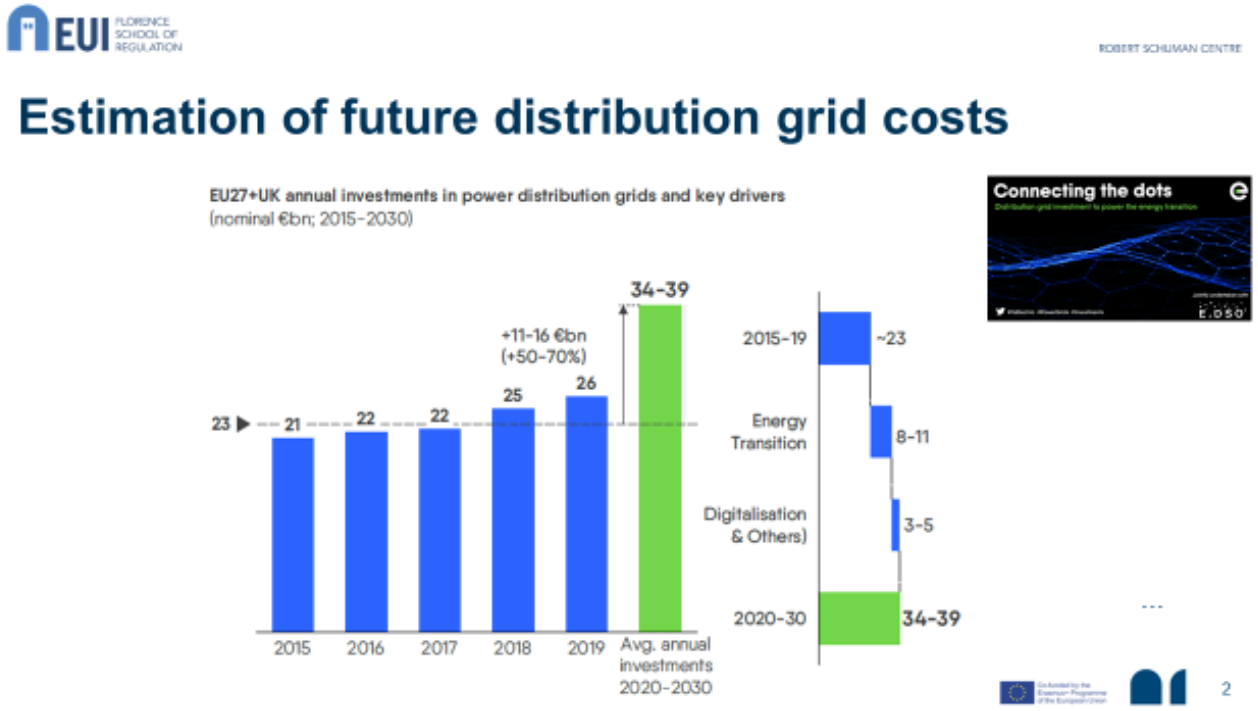


Flex. Use Level (1) At Transmission level

- Needs of flexibility at transmission level vary from one country to another; in same country from one electricity mix to another
- French Transmission System Operator 'RTE' just released its '2050 Net Zero' study. Central scenario sees electricity consumption in 2050 at +200 TWh (+40%)
- IF 51 GW nuclear in 2050 (today 61 GW) & 135 GW renewables, Flexibility by demand response & V2G is at 15 GW ~ France SoS needs additional 1 GW system battery.
- IF 0 Nuclear & 345 GW renewables, France SoS needs additional 26 GW system battery & 29 GW decarbonized thermal plants.

Flex. Use Level (2) At Distribution level

- Another story… RTE expects 135GW to 345GW renewables in France 2050: 110 GW to 285 GW connected to distribution grids

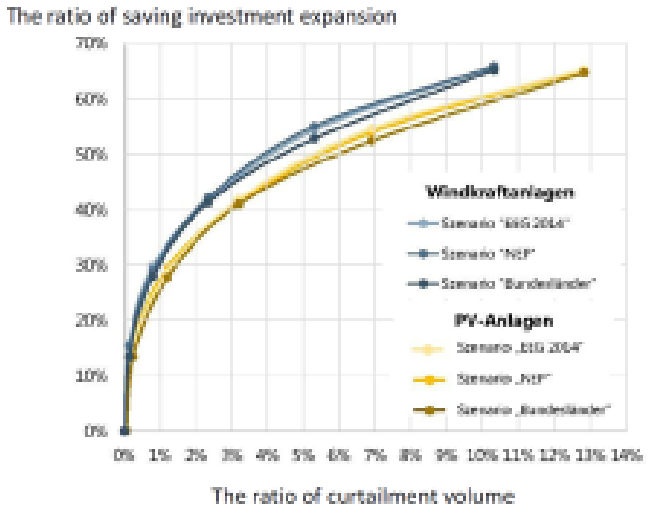


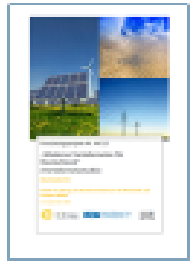
Flex. Use Level (2) At Distribution level

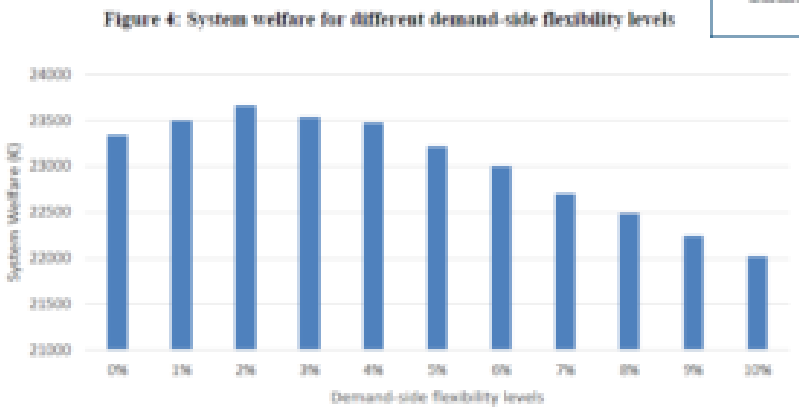
EUI FLORENCE SCHOOL OF REGULATION

ROBERT SCHUMAN CENTRE

Flexibility as a tool to reduce network investments







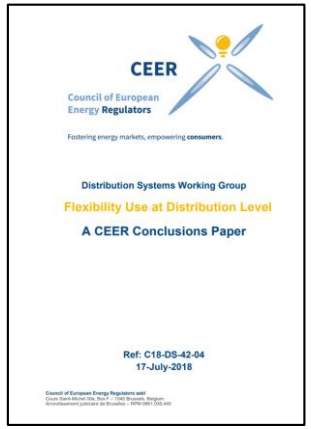
Flex. Use Level (2) Flex. Toolbox at Distribution level

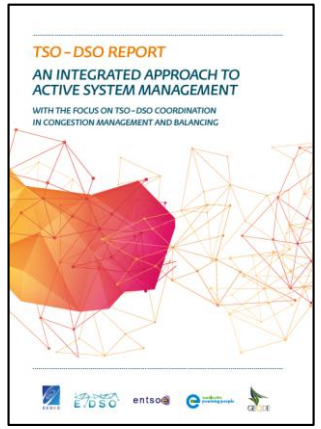
CEER

- Network tariffs
- Connection agreements
- Market-based procurement
- Rules-based approach

E.DSO

- Tariff solutions
- Connection agreement solutions
- Market-based solutions
- Rule-based solutions
- Technical solutions using grid assets





But 22 options: not agreed upon…

- Use case and voltage level
  - Congestion management and/or voltage control
  - Deferral of network investments
  - Planned maintenance
  - Incidents
- Market integration
  - TSO-DSO coordination
  - Timing and sequence in DAM/IDM
  - Single market vs series of call markets vs continuous market
- Market rules
  - Market objective
  - Integration of network constraints
  - Pricing scheme
  - Baseline approach
- Product definition
  - Tailored vs generic products
  - Fixed vs open attributes
  - Short vs long-term products
  - Active vs reactive power
- Roles and responsibilities
  - Market operator role
  - Market clearing role
  - Meter data operator role
  - (independent) aggregators
- Financial vs reputation vs regulatory incentives
- Calculation of cost and benefits flexibility markets
- Customer engagement

But EU Transm. & Distrib. Roadmap in June

CEDEC E.DSO entsoe eurelectric powering people GEODE

Roadmap on the Evolution of the Regulatory Framework for Distributed Flexibility

A joint report by ENTSO-E and the European Associations representing DSOs (CEDEC, E.DSO, Eurelectric, GEODE), June 2021

Contents

June 2021 EU Roadmap Transmission – Distribution
"A Regulatory Framework for Distributed Flexibility"
With 24 recommendations, in 4 areas

but… > 1/3 disagreements

¤ **Market Access & Rules for Aggregation** 5 Topics 100% agreement
¤ **Measurement, Validation & Settlement** 5 Topics 100% agreement

¤ **Product Design & Procurement** 5 Topics 100% disagreement
¤ **Market Processes & Transmission – Distribution coordination**
10 topics 40% disagreement

Flex. Use Level (3) *Behind-the-Meter*

- Aggregators & retailers play in the wholesale market. Retailers buy wholesale & fraction it for the consumers. Aggregators buy at consumers & repack at a wholesale size.
- Many other actions stay at the consumption level: ***behind the meter*** of the distribution grid. As: decentralized generation, decentralized storage, management of EV charging & V2G, etc.
- Here consumption flexibility can be directly integrated with operation of decentralized generation & decentralized storage. It is the 3d level of flexibility: the ***Behind-the-Meter flexibility***.

Flex. Use Level (3) *Behind-the-Meter*

- Prosumers & Prosumagers can prefer to get the integration of their assets & consumption from an 'asset light' professional
- UK supplier Octopus does it for owners of a Tesla + Powerwall storage + RoofPV, guaranteeing the smallest price for all complementary energy supply
- Sonnen in Germany does something similar with the batteries it sells, offering an "Energy Community" to their owners. Highest Sonnen battery "*Econlix*'' (10 kWh) also offered to control the consumption devices at home.
- Ausgrid & Reposit Power, in Australia, guarantee 5 years of free energy supply to all households investing into 6.6kW PV + 11.8kWh storage monitored & managed by Reposit Power 'home controller'

Flex. Use Level (3) *Behind-the-Meter*

- The EU legal definition of ‘’*Energy Communities*’’ (in “Clean Energy Package”) might open the way to collective actions, independent of market-based suppliers’ undertaking.
- See coming pioneering community “Solar” in city of Allensbach (Baden-Wurtemberg)
- Empowerment of prosumers & prosumagers can also give rise to “*Peer-to-Peer*” sharing of PV, storage, EV charging in a “*sharing economy*” scheme. *Digital Platforms* can play there a big role to simplify trade & transactions.

Conclusions

- 1¤ Wider electrification of EU energy systems will increase the role of decentralized resources, be they generation or storage, and the value of a deeper digitalisation of consumption devices, *Heat Pumps* or EVs. *Internet of Things* will permit billions of devices to emit, receive, act and interact.
- 2¤ Proper regulatory frame to reach the full potential of this wave is not yet defined. But regulators, grid operators, utilities, independent businesses, prosumers, communiites, EV owners are already thinking & testing. For the success of EU 2030 decarbonisation targets, one needs this EU Big Bang to succeed.

Conclusions

- 3¤ There is a big EU country, with a name starting with GER, where equipment with smart meters < 20%

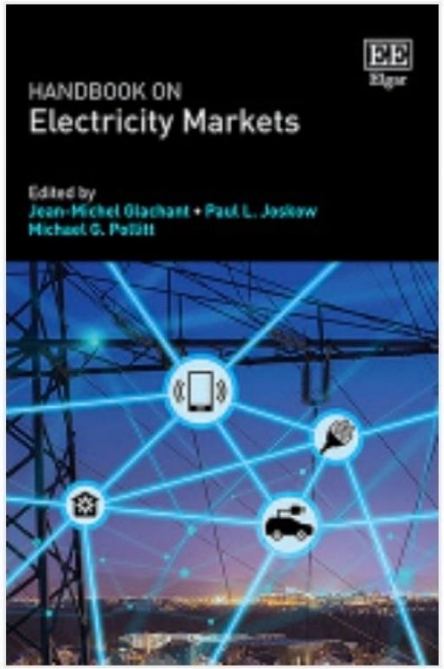
While both Spain & Italy do better than 97%

> *IN EINER VOLLSTANDIG DIGITALEN WELT, BITTE ERWACHT!*

Danke euch allen! Et pour Noël …

Add to Wish List ☆

Nov. 2021



Handbook on Electricity Markets

Edited by Jean-Michel Glachant, Paul L. Joskow, Michael G. Pollitt

Danke euch allen!

Email : ***jean-michel.glachant@eui.eu***

on Twitter: @JMGlachant ~103 000 tweets

on LinkedIn: *Jean-Michel Glachant*

Florence School Web Site: http://fsr.eui.eu/