The need for a clever regulation to achieve a clean and efficient future

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Projeto P&D: Modernização das Tarifas de Distribuição de Energia Elétrica
Workshop III
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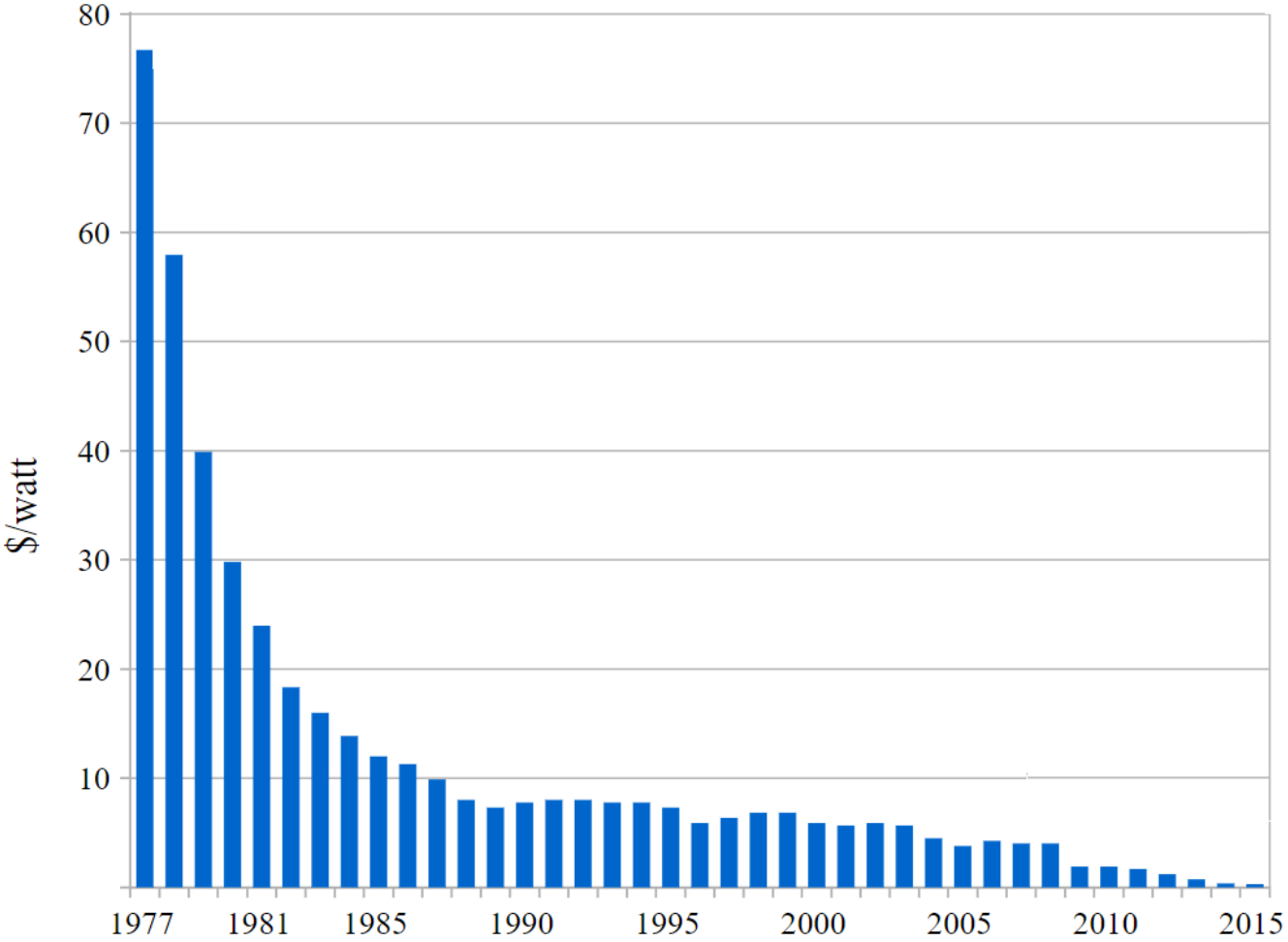
Introduction
Renewables and distributed resources

Renewables and distributed resources

Learning curve or learning *cliff*

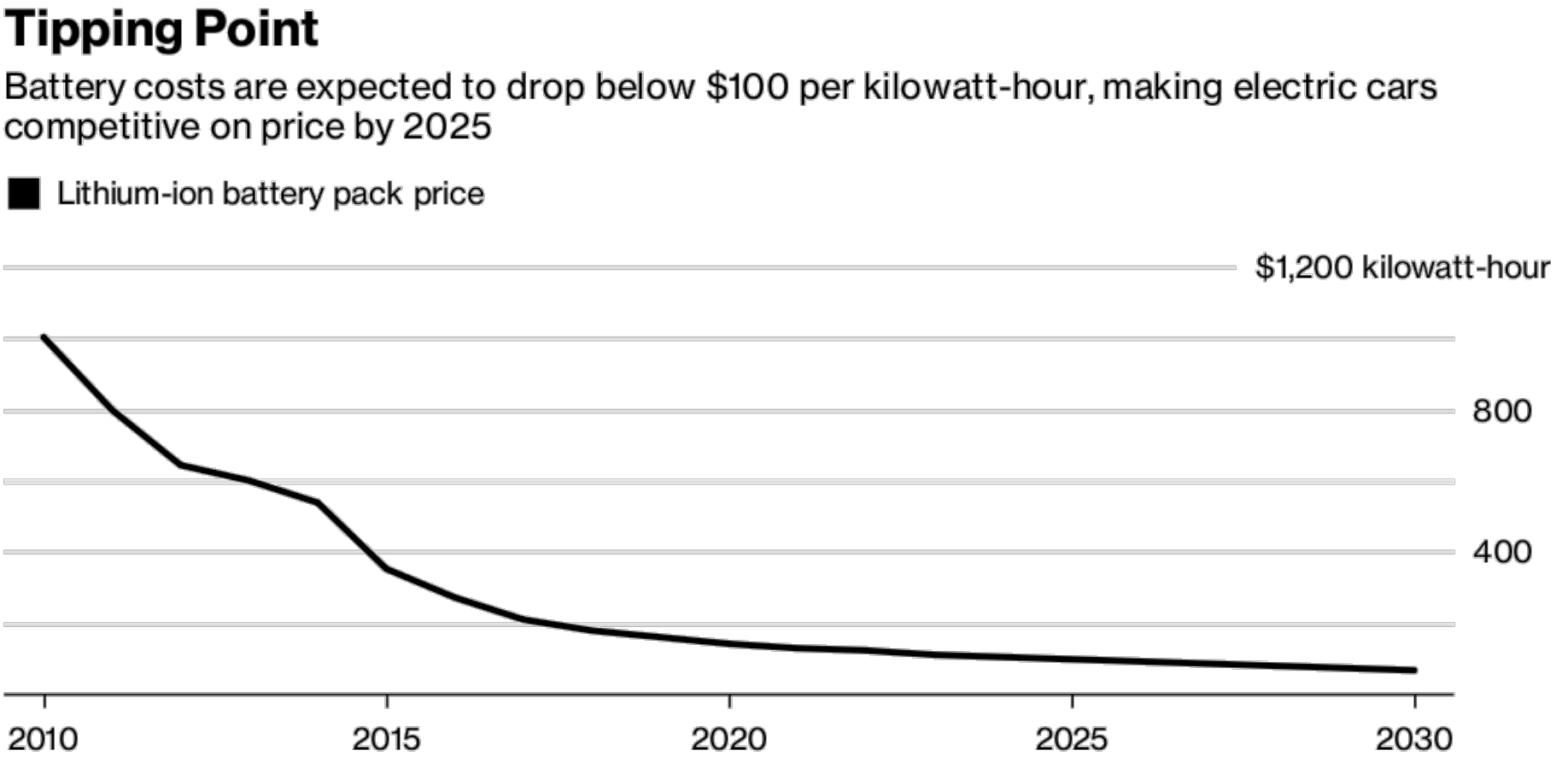
- **Silicon PV cells price**



Source: Bloomberg New Energy Finance & pv.energytrend.com

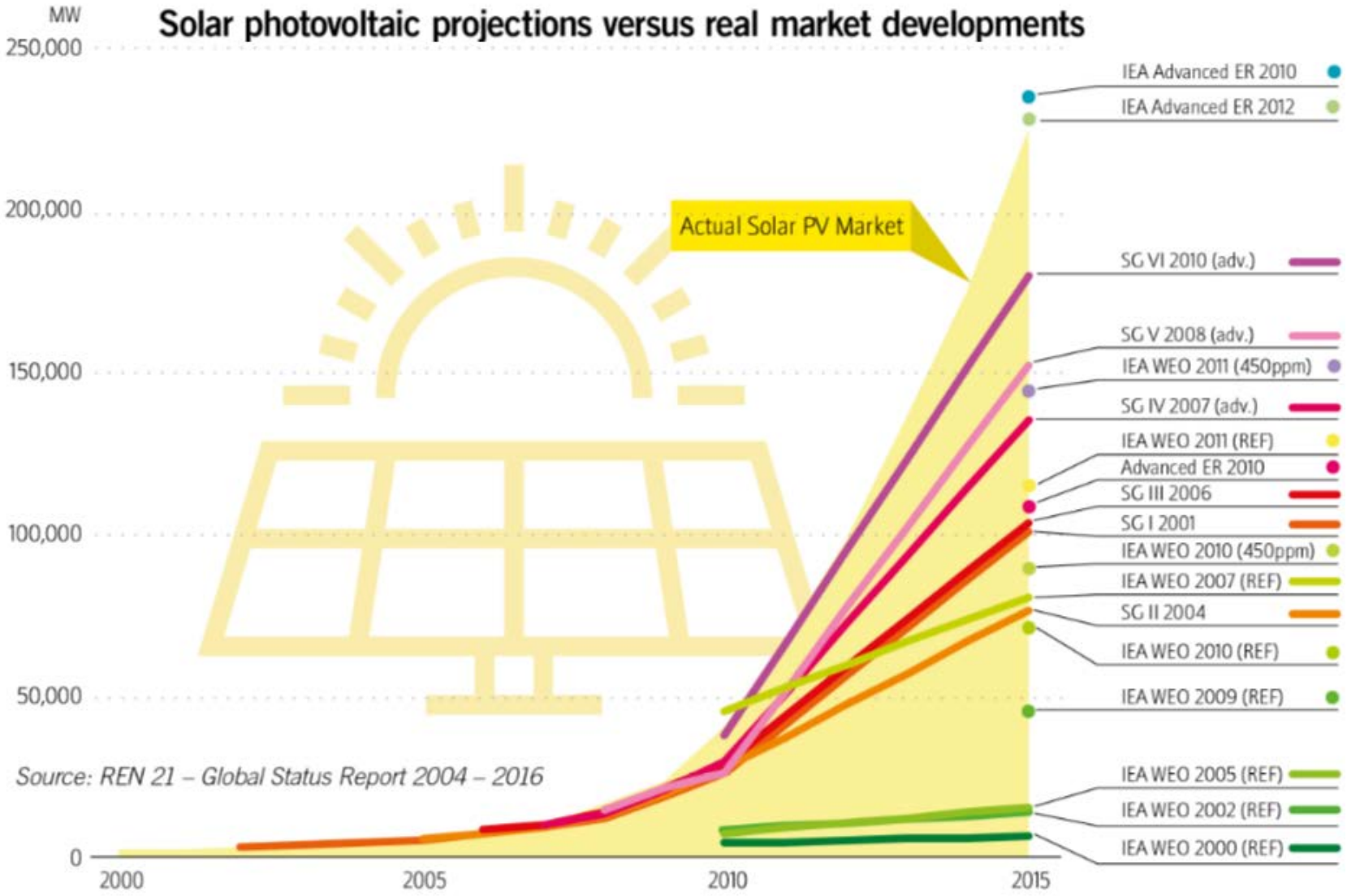
Storage

- Learning pace?



Renewables and distributed resources

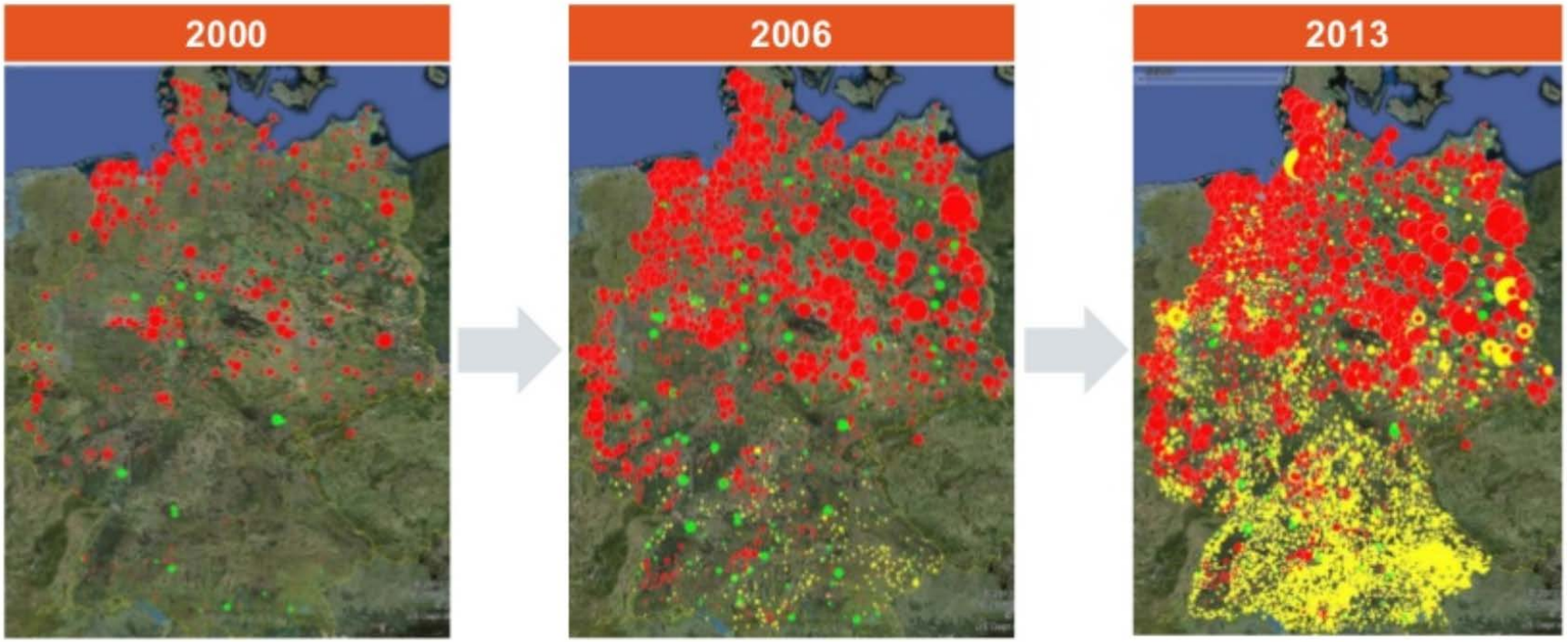
Learning *cliff*



Renewables and distributed resources

Decentralization

- ***Sunny* Germany**



wind photovoltaics biomass

Coloured area proportional to installed capacity

Source: 50Hertz, TenneT, Amprion, TransnetBW, Google Earth

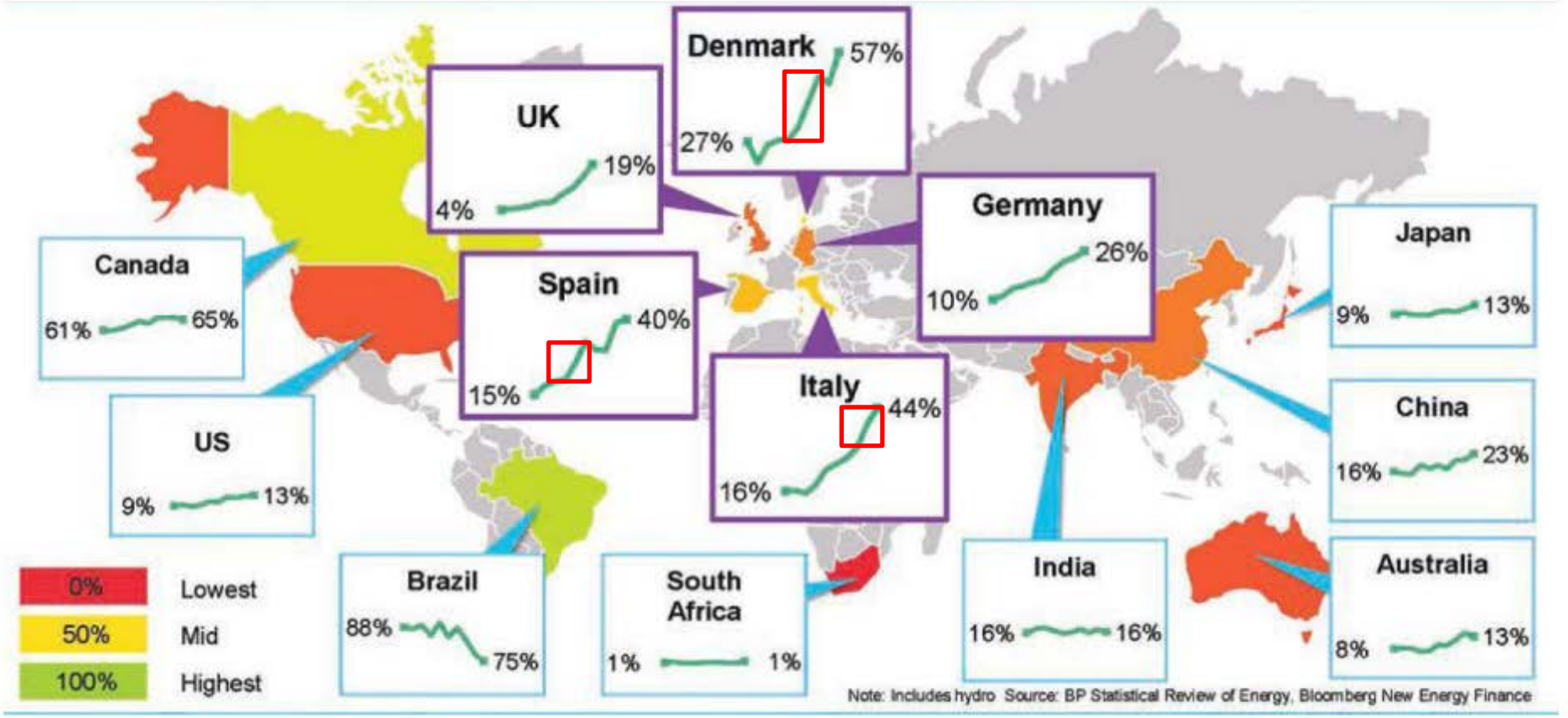
EEG figures end of 2013:

- Capacity: >83 GW
- Energy: ~125 TWh

Renewables and distributed resources

Impact of policies and regulations

Figure 1.3: Renewable Energy's Share of Power Generation, 2004–2014

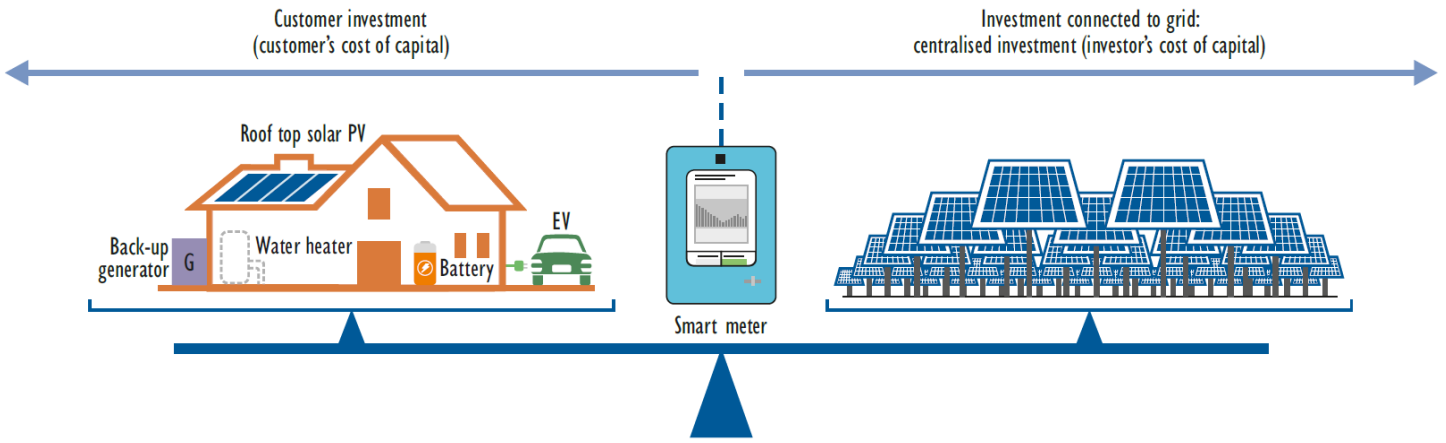


Source: Liebreich 2016. Reprinted with permission from Bloomberg New Energy Finance (BNEF); figure from a presentation given at BNEF Summit: New York, April 5, 2016.

Regulation
The instrumental efficiency toolbox

Regulation: the instrumental efficiency toolbox
Integrated operation and planning

- **How to integrate (wholesale and network) exploitation of investments (eg. storage)?**
- **Which regulatory business models are need to take the most out of DERs?**
  - E.g. rate signals or long-term contracts?



Repowering markets (www.iea.org)

Regulation: the instrumental efficiency toolbox

All about getting the right mix

or

or

or

Regulation: the instrumental efficiency toolbox

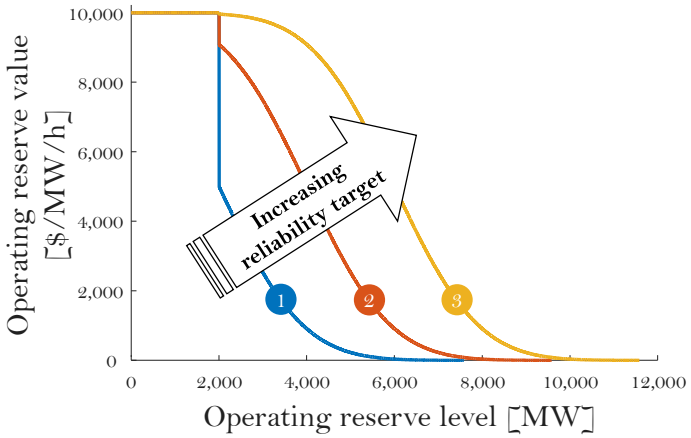
Tools

- Updating wholesale market design
- Distribution remuneration and planning
- Revisiting industry structure
- Efficient design of prices and charges

Energy and ancillary services

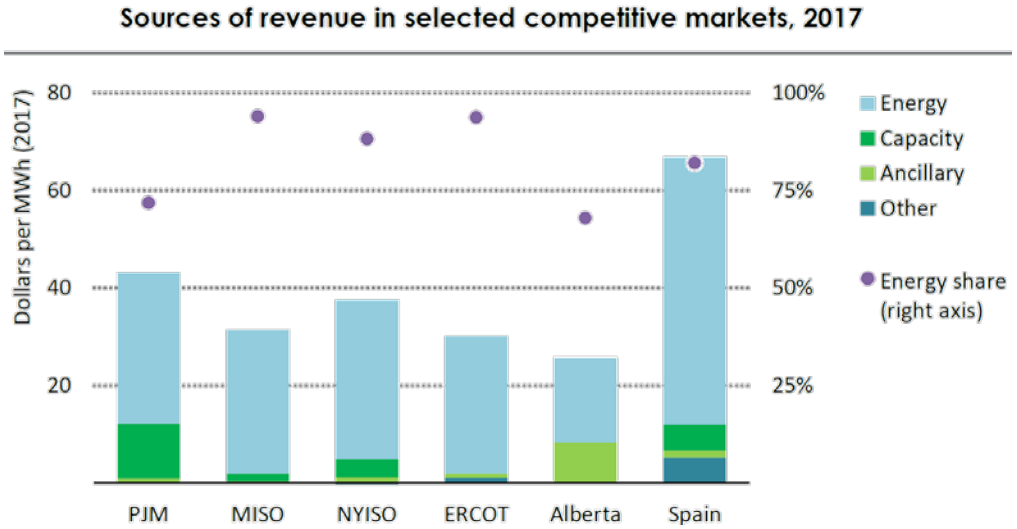
Updating wholesale market design

- **Market mechanisms to enhance efficiency in short-term operations and long-term investment**
  - Participation of DERs in wholesale and ancillary services markets
  - E.g. bidding formats in short-term markets, ORDCs, etc.



Updating wholesale market design

- **Efficient regulatory interventions, such as long-term contracting or capacity/RES-E remuneration mechanisms**
  - E.g. capacity credit of DERs in capacity markets?
  - E.g. how to make subsidies for DERs market-compatible?



IEA, International Energy Agency, 2018. World Energy Outlook.

Distribution

Remuneration

- **TotEx and output-based regulation**
  - Regulatory tools to induce accurate utility forecasts and minimize strategy behavior
  - Incentives for longer-term innovation and demonstration projects

Distribution
Remuneration

- **Non-Wires Alternatives**

REV CONNECT

UPDATED OCTOBER 25, 2018

Non-Wire Alternatives projects allow utilities to defer or avoid conventional infrastructure investments by procuring distributed energy resources (DER) that lower costs and emissions while maintaining or improving system reliability. We invite you to browse the current and upcoming Non-Wire Alternatives procurements of each utility. Responses to open Non-Wire Alternatives procurements should be made directly to the offering utility. Do not submit RFP/RFI responses to REV Connect.

+ CENTRAL HUDSON OPPORTUNITIES

+ CON EDISON OPPORTUNITIES

+ NATIONAL GRID OPPORTUNITIES

+ NYSEG OPPORTUNITIES

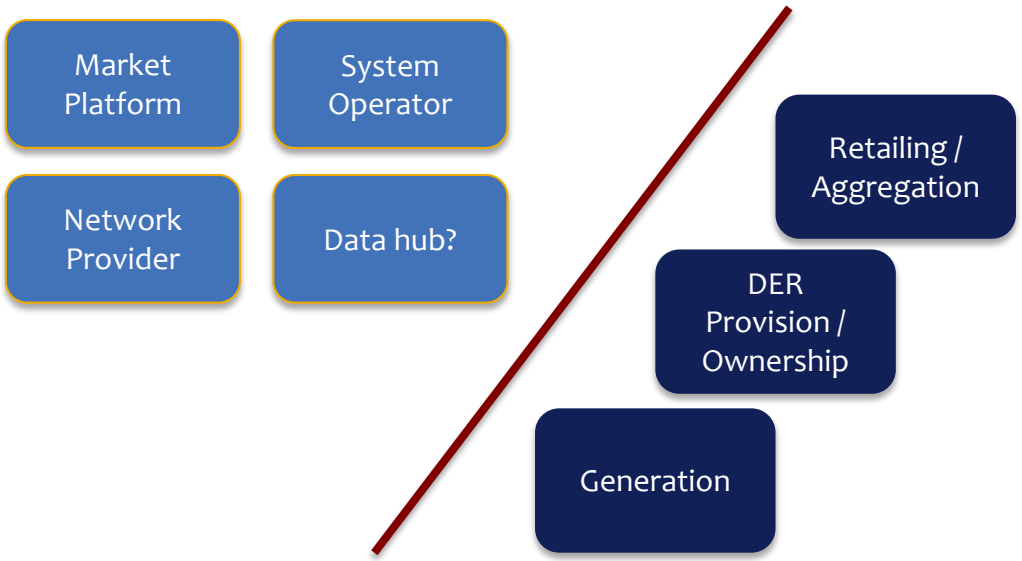
+ ORANGE AND ROCKLAND OPPORTUNITIES

+ RG&E OPPORTUNITIES

Revisiting Industry Structure

Role of the DSO

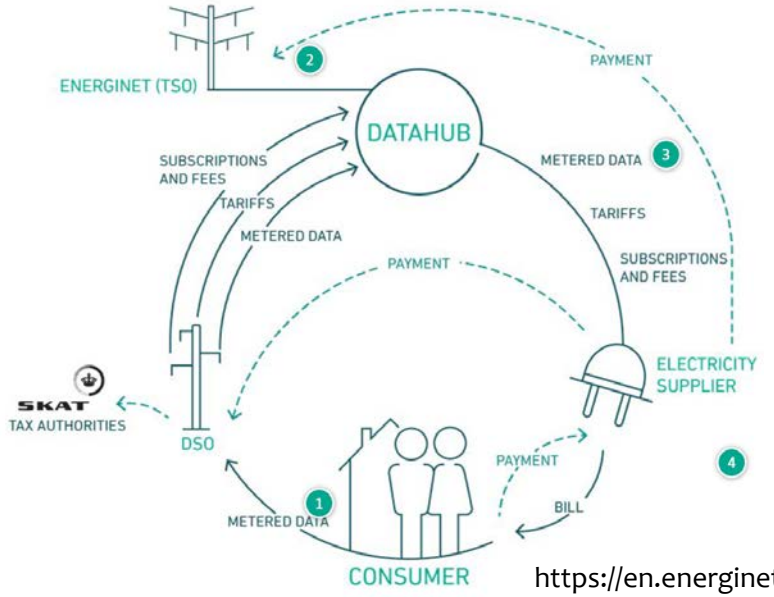
- **Independent or otherwise – in future system operations?**
  - Should DSOs be separated from DNOS to ensure neutrality?
  - Should DNOs be allowed to own and operate DERs?



Revisiting Industry Structure

DSO-TSO coordination and data

- **Which the best model for coordinating DSOs and bulk system Balancing Authorities would be?**
- **How should data be managed**
  - Is an independent data manager necessary?



https://en.energinet.dk/Electricity/DataHub#Documents

Regulation: the instrumental efficiency toolbox

Tools

- Updating wholesale market design
- Distribution remuneration and planning
- Revisiting industry structure
- **Efficient design of prices and charges**
  - End-user rate design
  - Pricing for efficient distribution planning

Efficient design of prices and charges

Efficient design of prices and charges

End-user rate design

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Key concepts: Forward looking (marginal) costs and residual costs

- Efficient behaviour means the electricity consumption and investment decisions the user would make if they were only charged the **forward-looking (marginal cost)** of increases in their electricity use
- Natural monopoly nature of electricity networks (high upfront costs) means marginal costs will not normally recover total costs – results in **residual costs**
- Economic efficiency is maximised when residual costs are recovered in a way which minimises the distortion to user's efficient behaviour
- Leads to different principles applied to design of forward-looking and residual costs

Forward-looking cost principles

1. Arrangements support efficient use and development of system capacity
2. Arrangements support the needs of consumers as appropriate for an essential service
3. Any changes are practical and proportionate

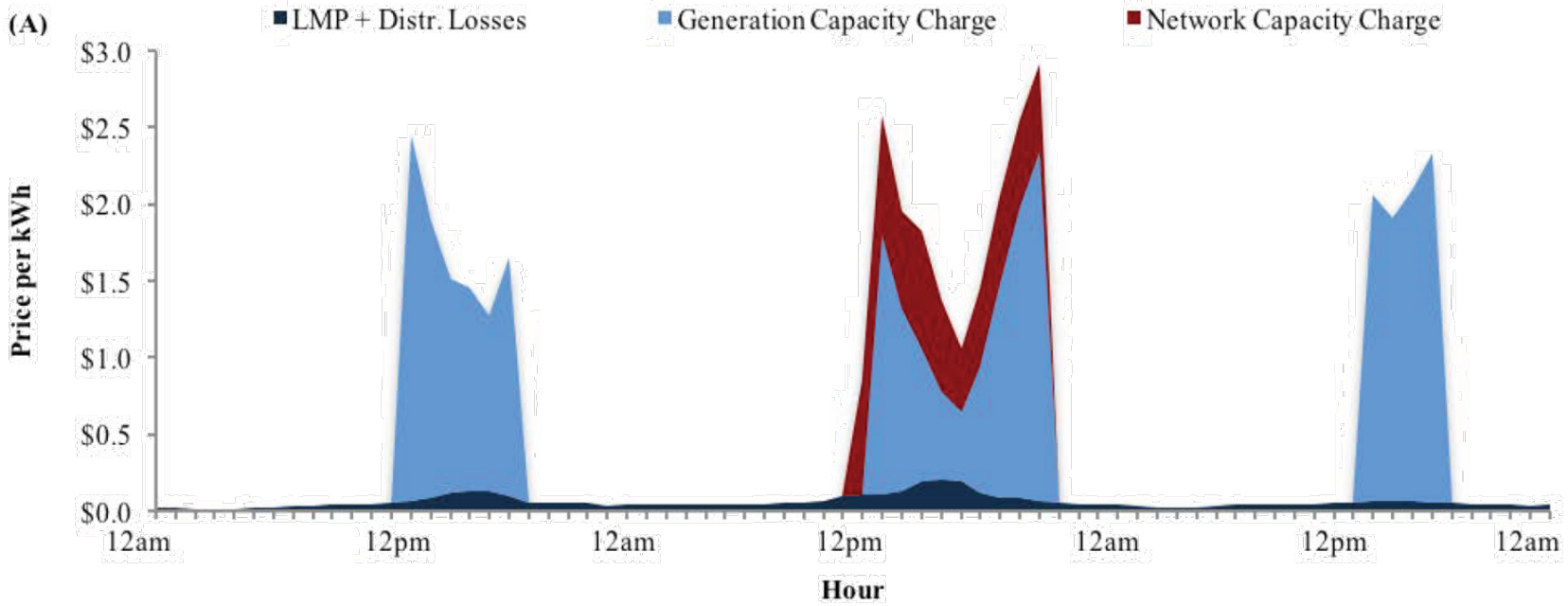
Residual cost principles

1. Reducing harmful distortions
2. Fairness
3. Proportionality and practicality considerations

End-user rates

Forward-looking marginal cost

- **Efficient pricing would unwind cross-subsidies result in variability in charges**
- **Is there any feasible rate design to avoid inefficient end-user operation and investment decisions?**

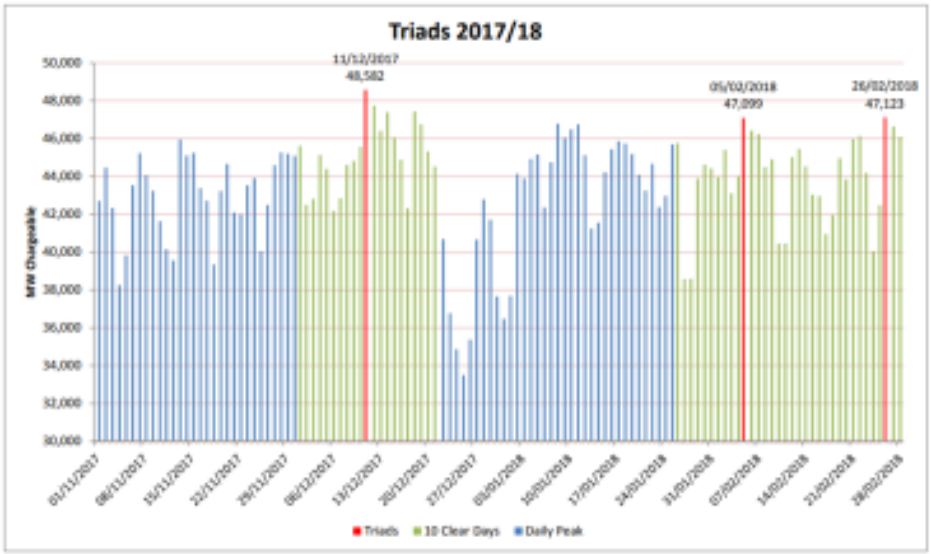


End-user rates
Forward-looking marginal cost

ofgem Making a positive difference for energy consumers

Example: Problems with current arrangements – transmission charges for demand users

- Retailers charged on the basis of gross demand over 3 top half hour periods at each point where the distribution and transmission networks meet ("Triads")
- Very strong price signals – has been effective in inducing demand side response from large users
- But problems with the approach, price signal:
- Too strong?
  - Can avoid forward-looking and residual costs
- Too narrow?
  - Demand has flattened over time, and locational differences
- Too uncertain?
  - Triad periods determined ex-post



How much does it cost to boil a kettle in Great Britain during a Triad period?

Efficient residual cost allocation

The sense of urgency

Efficient residual cost allocation

The sense of urgency

Efficient residual cost allocation

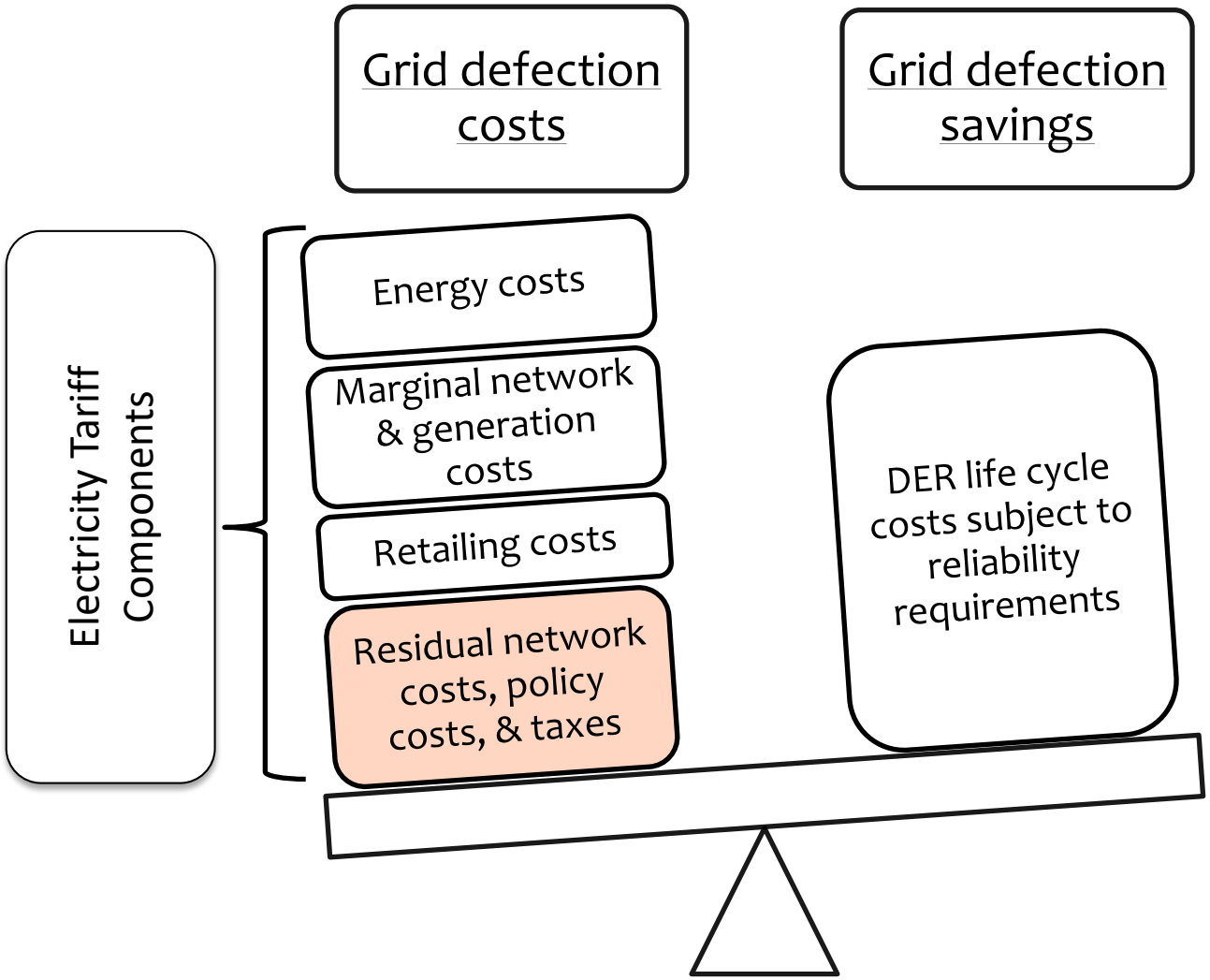
The sense of urgency

Efficient residual cost allocation

The sense of urgency

Long-term demand elasticity

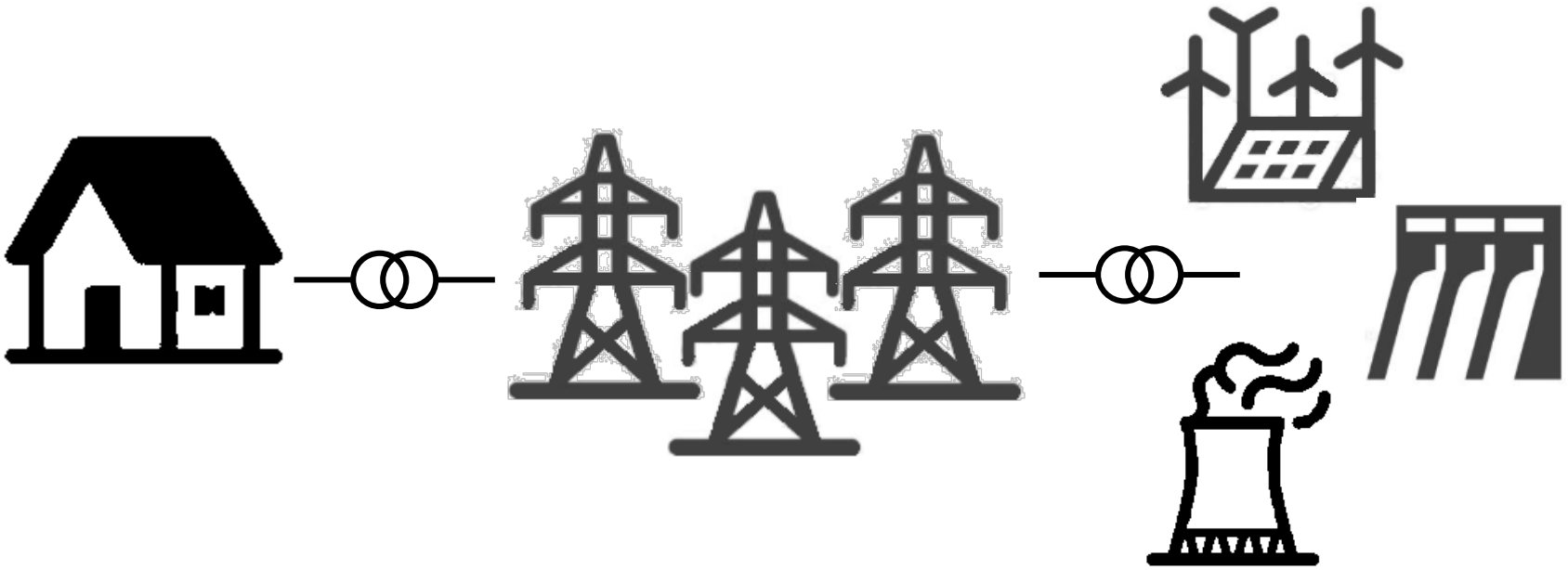
Grid defection or cessation



Long-term demand elasticity

Grid defection or cessation

- **Electric power system**



Long-term demand elasticity

Grid defection or cessation

- **Electric power battery system**

Residual costs

- **The optimal residual cost allocation method depends on a variety of factors**
  - Customer benefits of interconnection
  - Elasticity of customer demand to fixed charges
  - The ability of customers to avoid paying for residual costs by defecting from the grid
  - The information available to the regulator

Long-term elasticity and grid defection and disconnection

Recovering unassignable residual costs

- **Thresholds based on stand-alone system costs**
- **Prior to risk to disconnection**
  - Uneven fixed charges
    - Equity balance
    - Backwards-looking marginal costs
- **In face of risk of disconnection**
  - Exit fees
  - Real-estate taxes
  - State budget

End-user rate design
Forward-looking and residual charging

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Ofgem's Future Charging and Access programme



The energy system transformation will create challenges and opportunities for our electricity networks. We have a programme of work considering how electricity network access and charging should be reformed to address these changes and existing issues

The **Future Charging and Access** reforms are being undertaken as a holistic review of transmission, distribution and balancing charging

- **Electricity Network Access and Forward-looking Charging reform (Access SCR)**
  - Ofgem-led Significant Code Review (SCR) to develop improved access and forward-looking charging arrangements
  - In parallel, industry is undertaking a review of aspects of allocation of access rights, including improved queue management and the scope for trading
- **Targeted Charging Review (TCR)**
  - Ofgem-led SCR to develop new residual charging arrangements and reform the arrangements which give rise to other non-locational "embedded benefits"
  - in parallel, industry is bringing forward changes to ensure storage pays proportionate charges
- **Balancing Services Taskforce (BSUoS Taskforce)**
  - Industry is leading a review of balancing services charges in parallel with Access reform and the TCR.

These three elements run in parallel and are all engaging stakeholders through the Charging Futures Forum (CFF) - the forum and website established to facilitate improved stakeholder engagement on electricity network charging related reforms.

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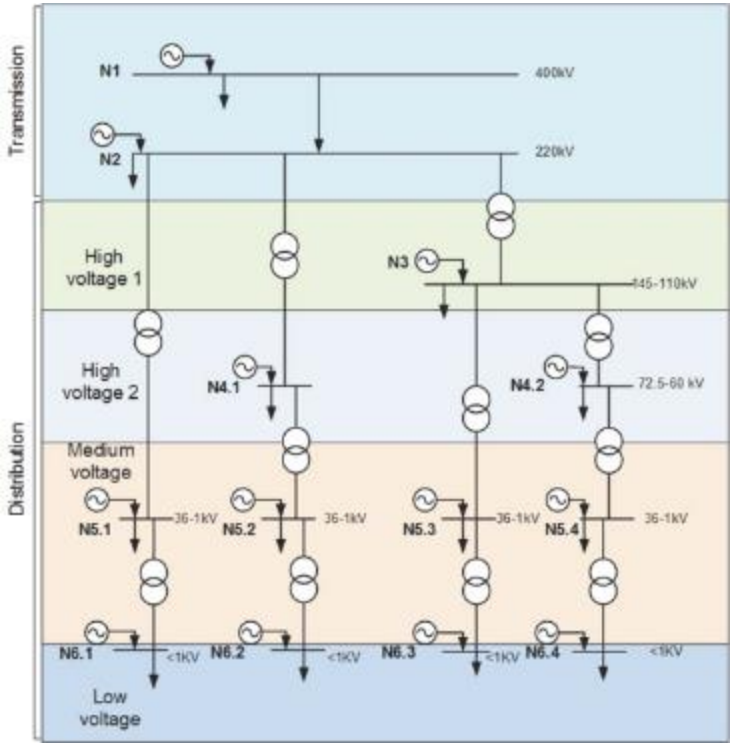
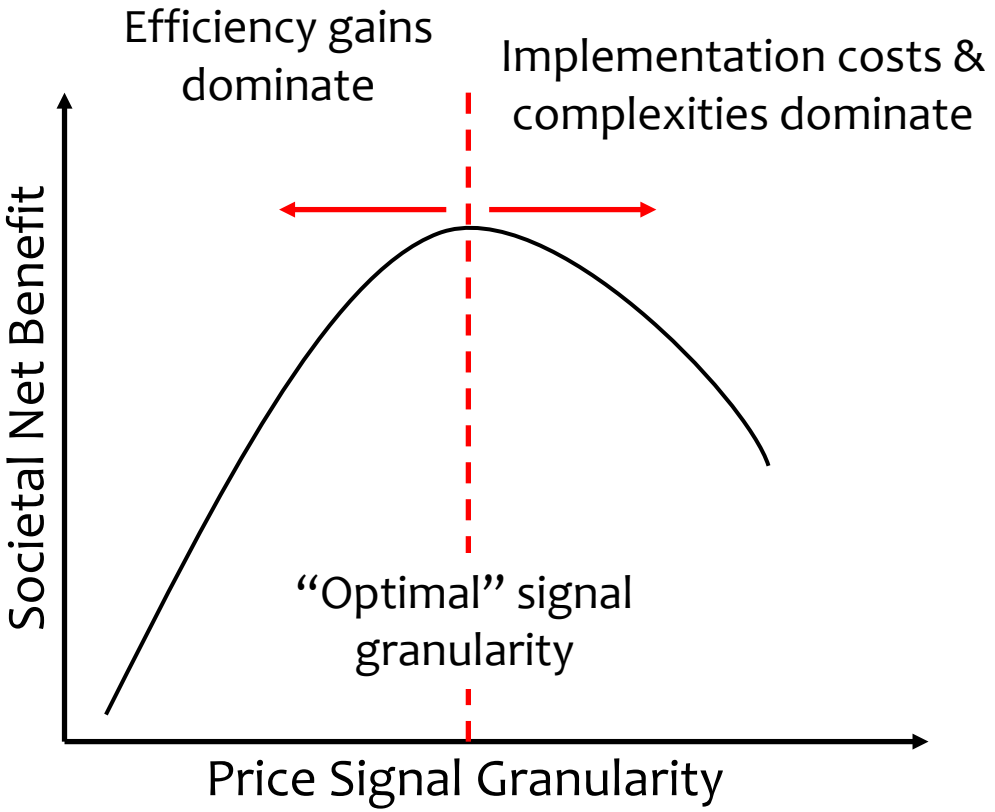
Scott Sandles, 2019. Current electricity network tariff reforms in Great Britain. FSR Summer School On Regulation Of Energy Utilities

Pricing for efficient distribution planning

Tradeoffs of granular price signals

- **System efficiency gains vs. implementation costs**

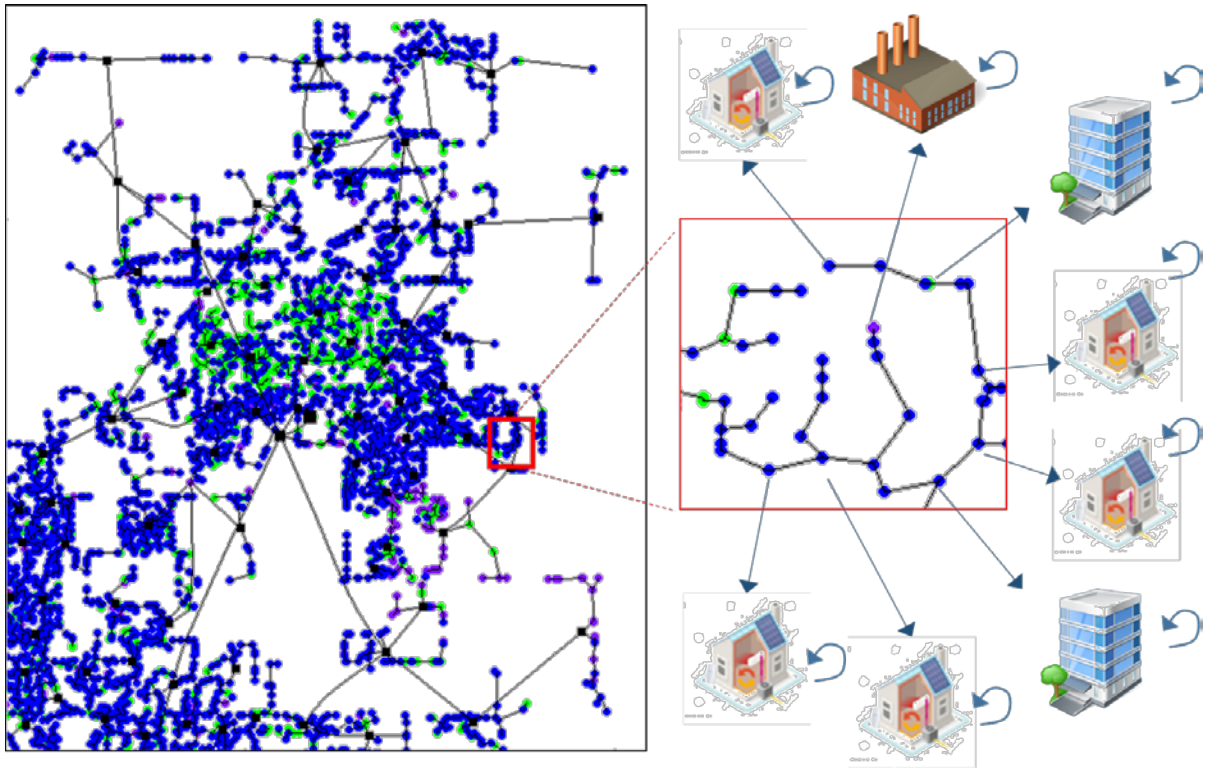




Pricing for efficient distribution planning

Efficiency and level of granularity

- **How good is good enough for electricity pricing granularity?**
  - System efficiency gains vs. implementation costs

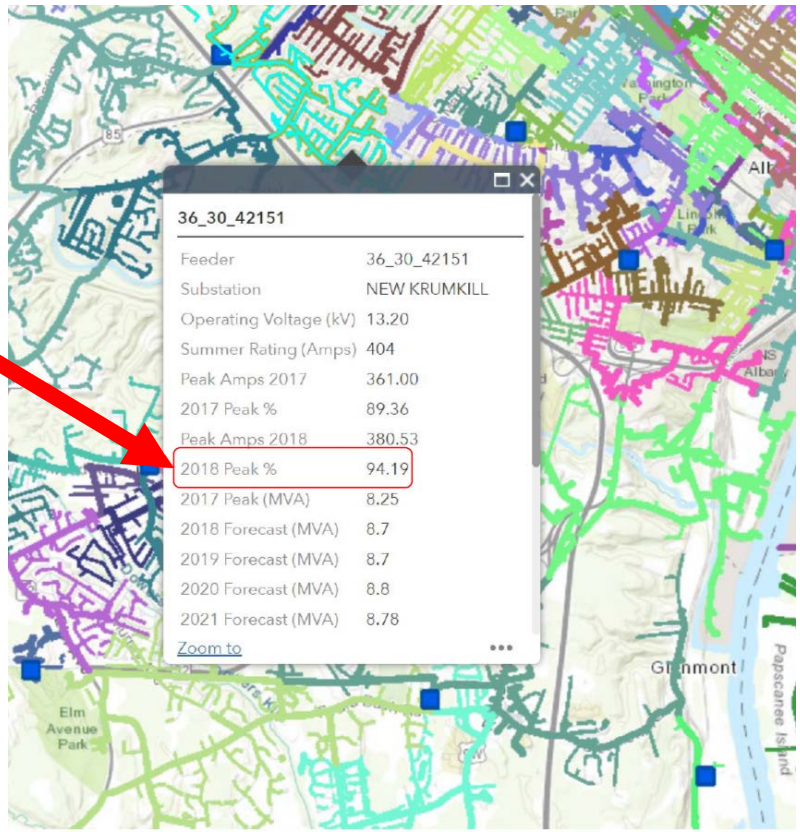


Pricing for efficient distribution planning

Hosting capacity

- **Amount of distributed generation that the grid can efficiently host, above which the system performance turns unacceptable**

Peak loading is 95% of the circuit's rated capacity. Peak demand reductions could eliminate or delay circuit upgrades

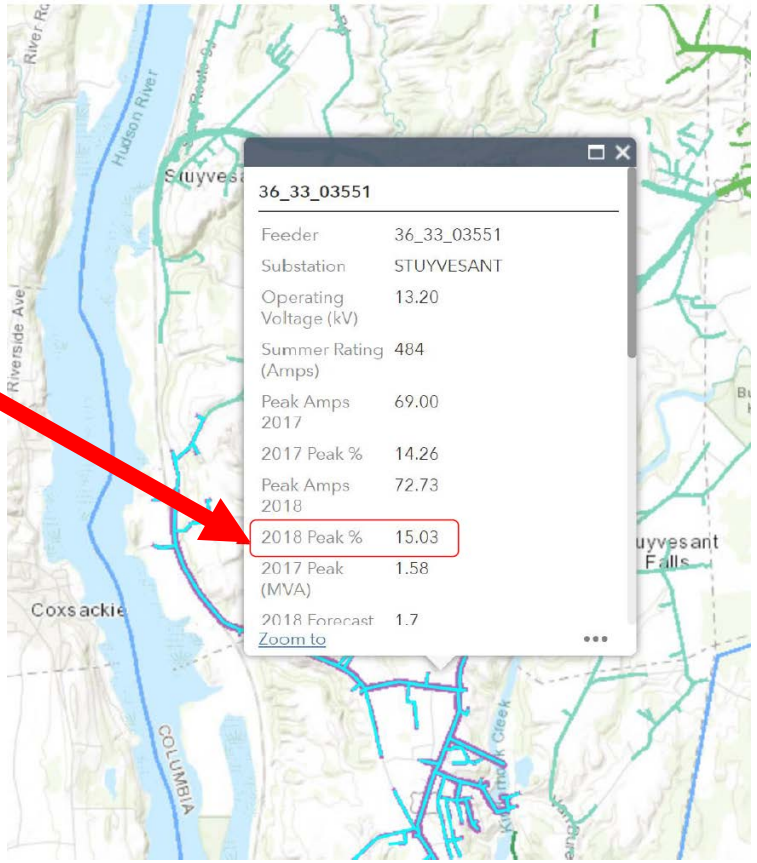


Pricing for efficient distribution planning

Hosting capacity

- **Amount of distributed generation that the grid can efficiently host, above which the system performance turns unacceptable**

Peak loading on the circuit is only 15% of the circuit's rated capacity. Peak demand reduction has almost no immediate value

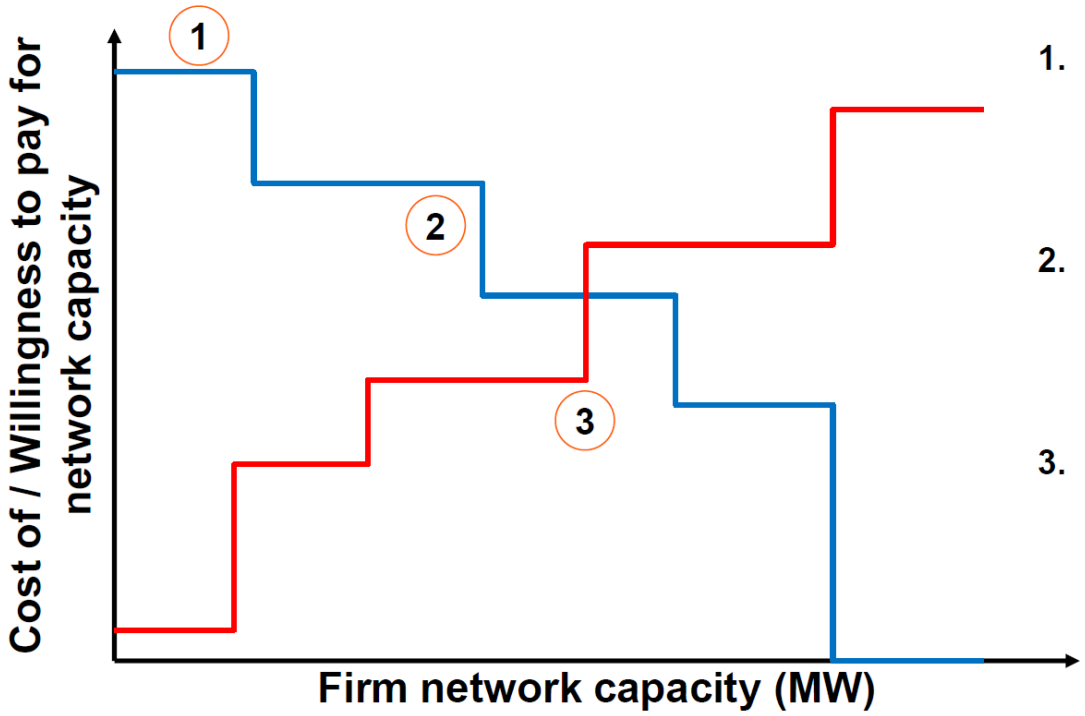


Pricing for efficient distribution planning

Local auctions

In the future, auctions for firm network capacity could better align investment decisions with consumer interests – these auctions would act as hedges against peak charges for consumers

Auctions for network access rights/ network capacity options are actively being explored by regulatory agencies such as Ofgem



1. **Inelastic/ inattentive customers allocated a conservative quantity of network capacity**
2. **Flexible customers provided the opportunity to express willingness to pay for network capacity**
3. **Network, demand, and generation resources placed on equal footing**

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