New Business Models for Distribution Network Operators

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Drivers for change and emerging trends

Drivers for change

- **3Ds of change for local grids**
  - Distributed resources
  - Digitisation
  - Decarbonisation
- **Two-way flows of energy and data across all levels of network**

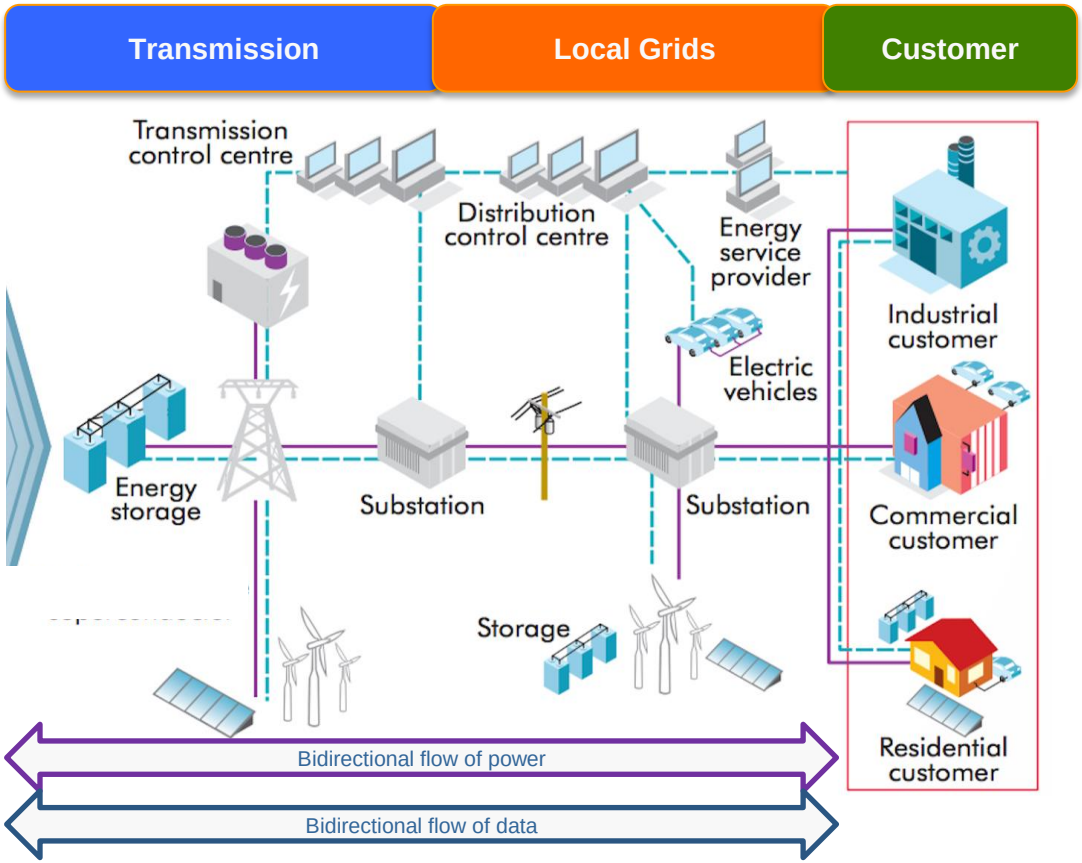
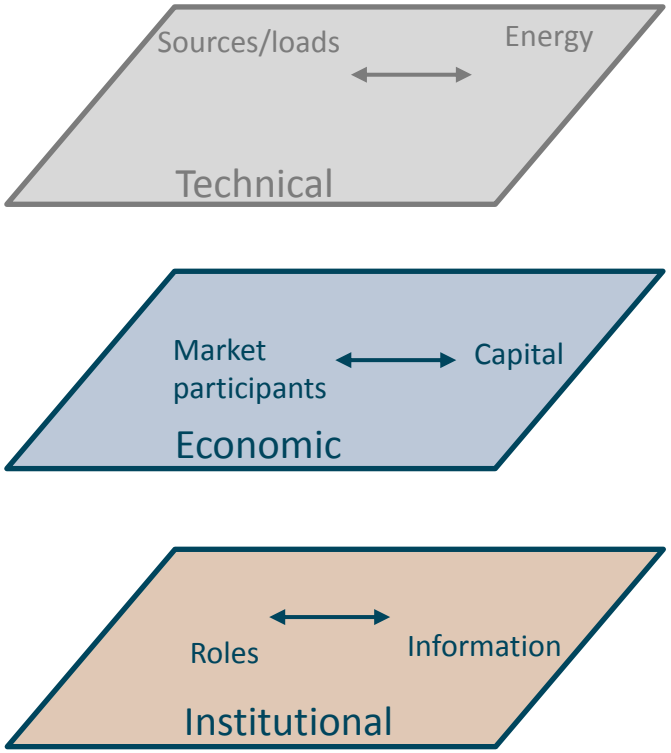


Image source: RMI

Three domains of change

- **Technical: more complex power flows**
  - New technologies, role of data
- **Economic: new value streams**
  - Innovative business models change customer engagement in energy markets
  - Social fairness at stake: tariffs and taxation
- **Institutional: new roles and responsibilities**
  - Inconsistencies between commercial arrangements and grid operations
  - Technological changes challenge today's institutional setting and regulatory paradigms



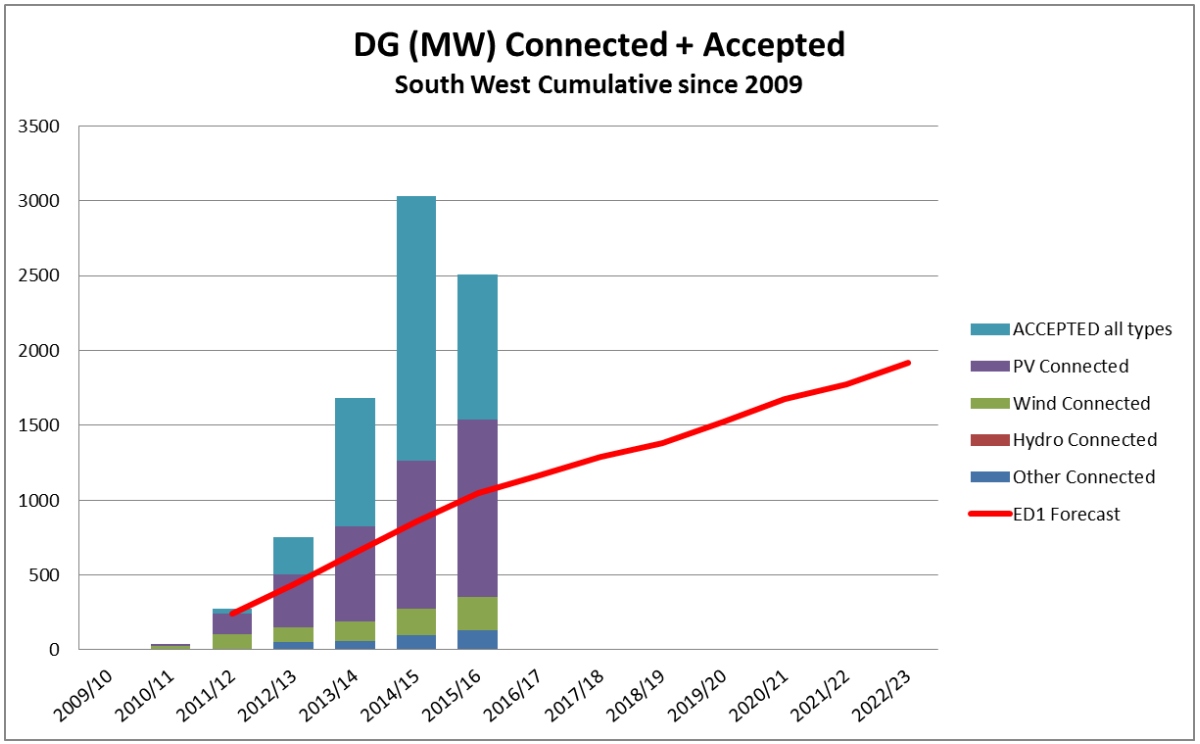
Distributed Energy Resources (DER)

- Distributed energy resources (DER) are typically modular and/or small scale, connected to a local network, with the capability to provide (or facilitate) energy or system services.
- Examples:
  - distributed renewables, especially solar photovoltaics (PV)
  - small combined heat and power (CHP) plants often running on natural gas
  - Battery storage systems and actively controlled demand

DER are a cornerstone in the transition to clean, 21st century energy systems.

Things can move quickly …

Distributed generation in Western Power Distribution area, United Kingdom

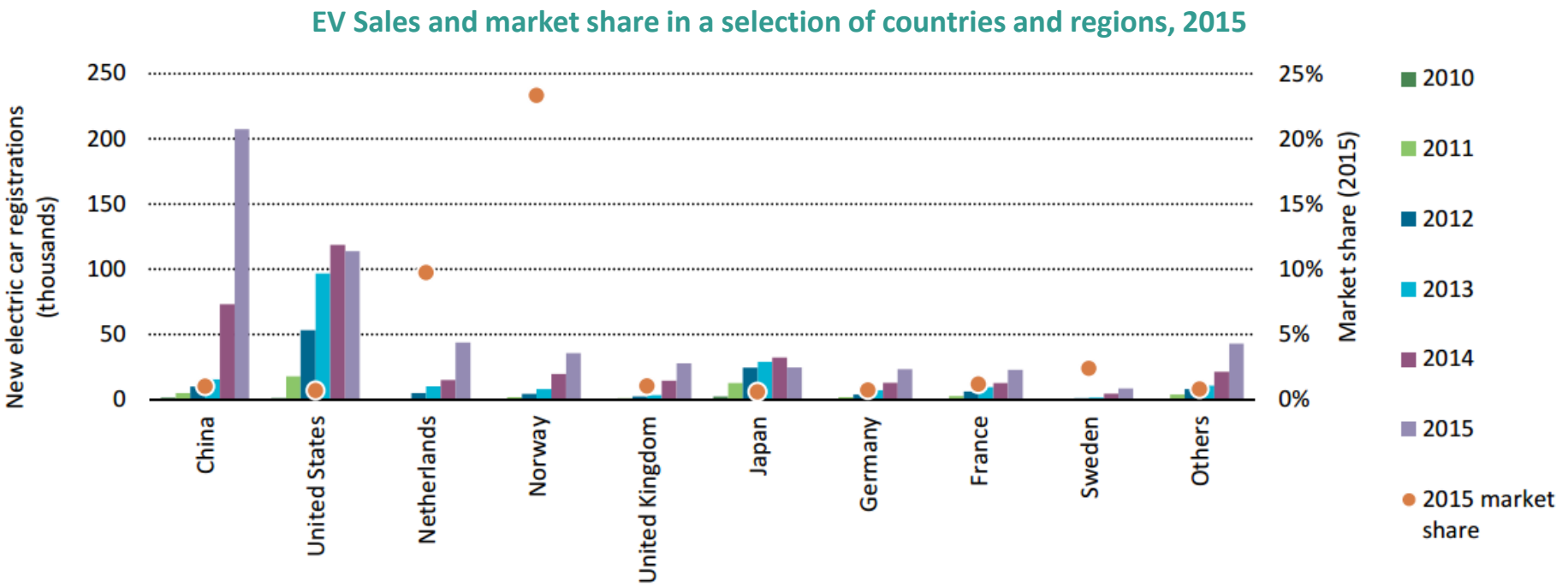


- **Driven by the policy framework in the UK, distributed solar PV was economically very attractive, triggering rapid deployment**

Image source: Western Power Distribution

… and multiple trends combine
2015 – The year EVs went mainstream

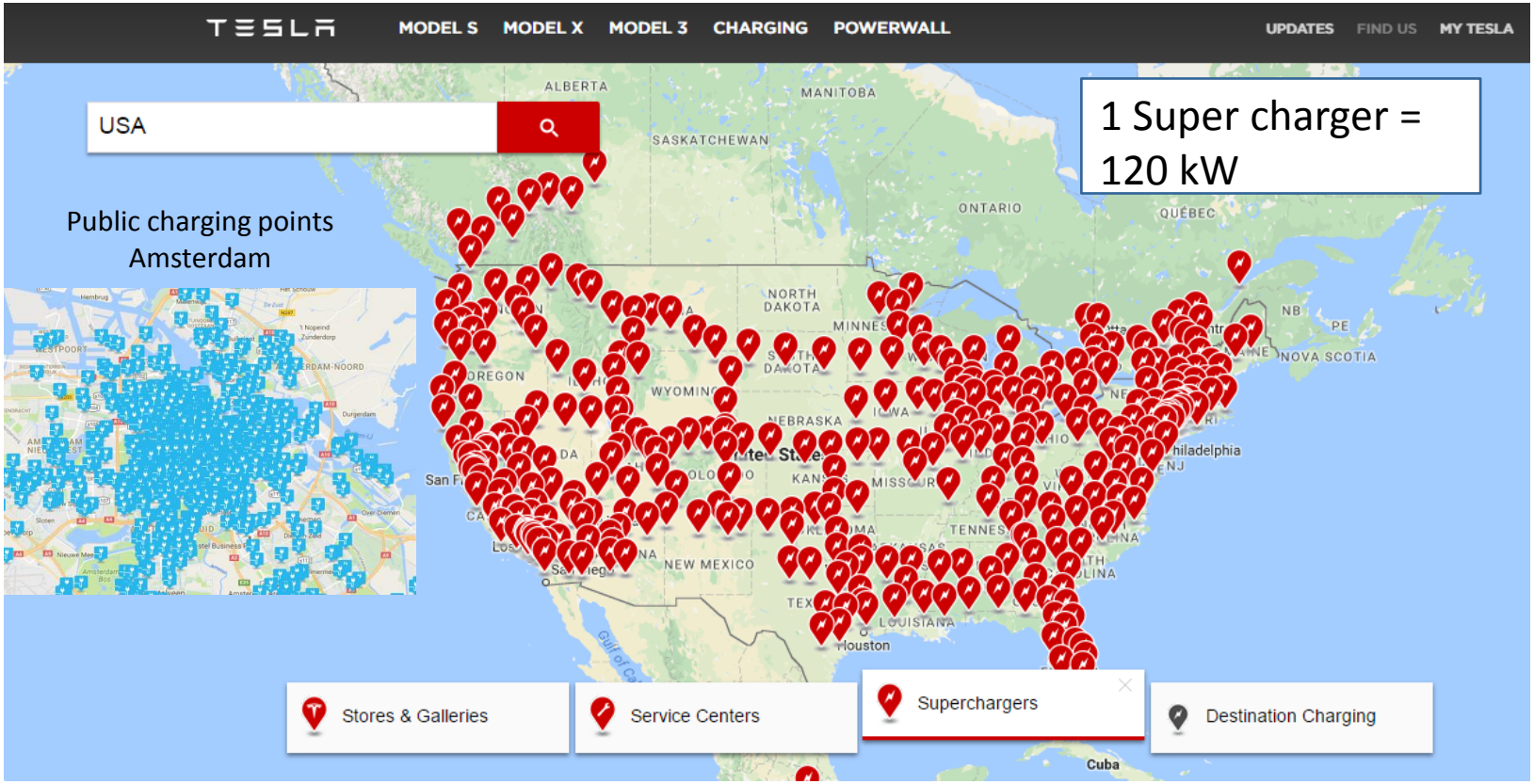
- With 550 000 EVs sold in 2015, the global electric car stock reached 1.26 million (0.1% of global car fleet)
- This went hand in hand with a tenfold increase in the global market for batteries



IEA (2016), Global EV Outlook

Charging EVs emerging role for local grids

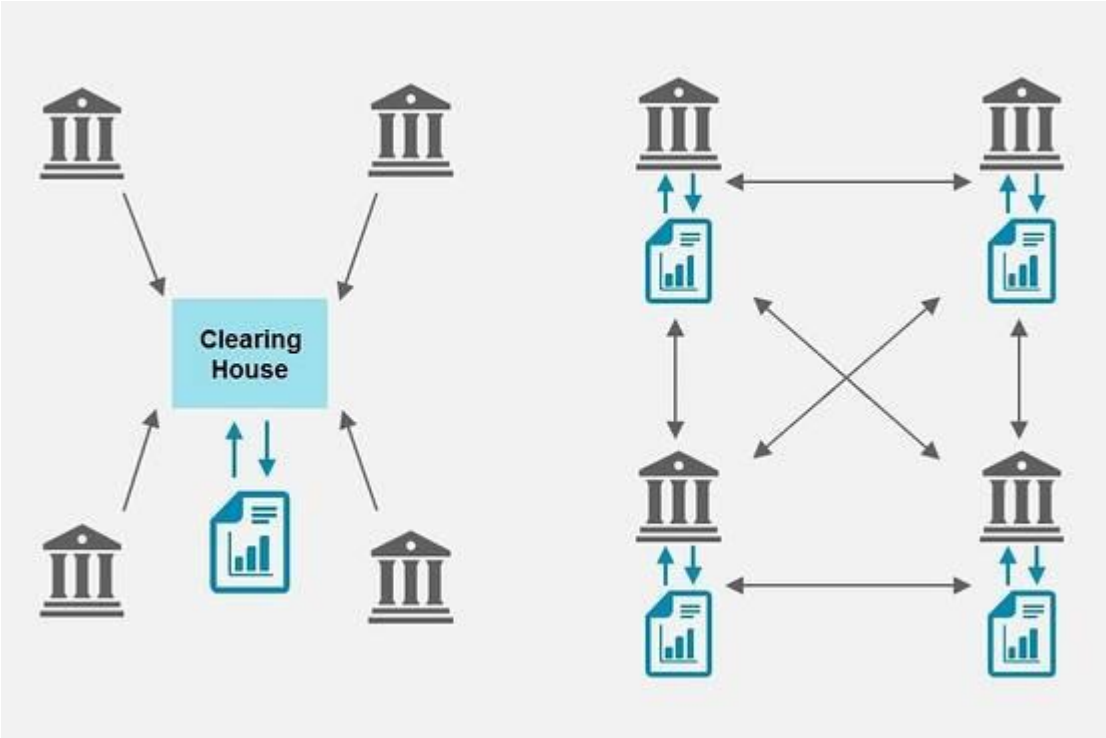
Charging networks for EV – TESLA super chargers in US, public charging in Amsterdam, 2016



Key point: *Charging points for EV will increasingly be a major load on local grids – adapting planning frameworks for both distributed generation and EVs will be relevant going forward*

Blockchain: Technology revolution ahead

Conceptual illustration of centralised claring hourse vs block chain approach



Key point:	*Wholesale market liberalisation was only possible due to computer technology – a new innovation step may now allow for transactions without a central clearing house.*

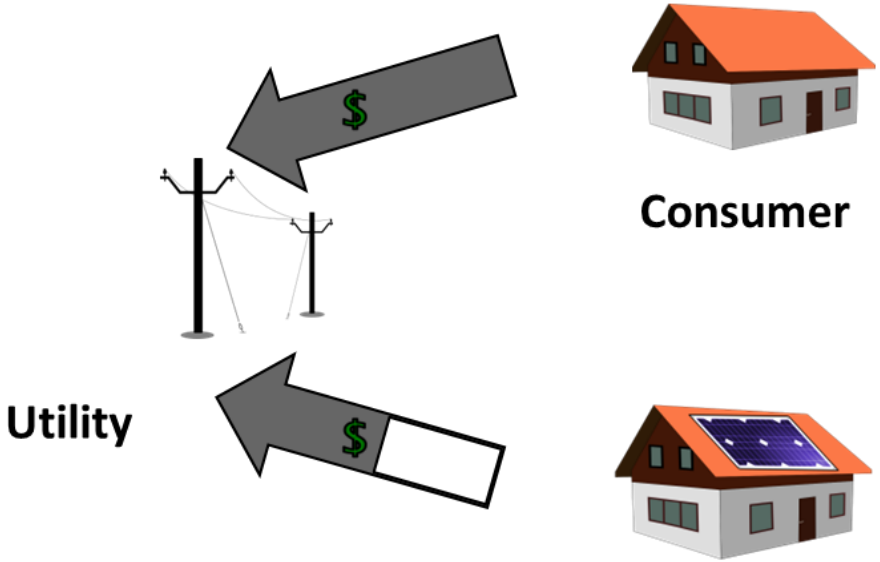
Image source: WSJ

Implications for DSOs

Current situation in many countries

Payment for provided services

Consumers pay fixed & volumetric charges
→ No incentive to reduce peak load contribution



Net Energy Metering is applied for DER
→ Reduced revenues for utilities
→ No incentive for DER to provide system services

Concerns: grid costs and integration

- **Grid cost concerns**
  - T&D costs 30-50% of retail costs, but only 0-15% recovered through fixed payments for efficiency/equity reasons
  - Self-consumers pay less but still benefit from the grid; cross-subsidy!
  - ➔ Self-consumption may call for some network tariff changes
    Preferably toward some time-based grid pricing structure, e.g. California bill adopted in September 2013: small fixed fee introduced, and time-of-use pricing forthcoming
- **Integration concerns**
  - Self-consumption and surplus in-feed may increase imbalance of supplier without prosumers paying for this
  - Depending on correlation with system demand:
    - *Serving residual demand more/less costly to meet per kWh than average*
    - *Excess generation more/less valuable than average*
  - ➔ Tariff-design for injections should reflect value of electricity

Concerns: taxes, surcharges, subsidies

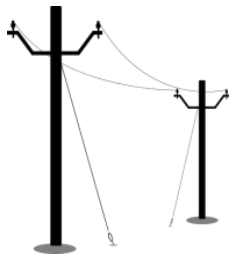
- **Forgone tax revenue concerns**
  - Less energy sold, less taxes raised
  - Taxation of self-consumption problematic
  - ➔ Evaluate taxation framework, avoid double taxation
    E.g. charging VAT on systems and on excess electricity
- **Forgone renewable energy surcharge concerns**
  - Tariffs often contain surcharge for RE
  - A RE surcharge on RE self-consumption?
  - ➔ Contributing to learning investment that has lead to socket-parity
- **Forgone cross-subsidy concerns**
  - Customers with highest prices have biggest incentive
  - May be due to cross-subsidies to other consumer groups
  - ➔ Anticipate impact on overall revenues

Objectives

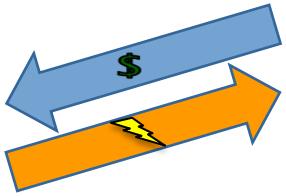
Key objectives

Provide load management incentive

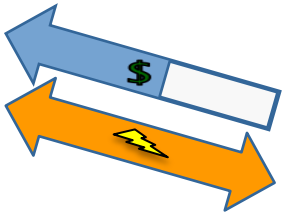
Enable reliable revenue



Utility



Consumer

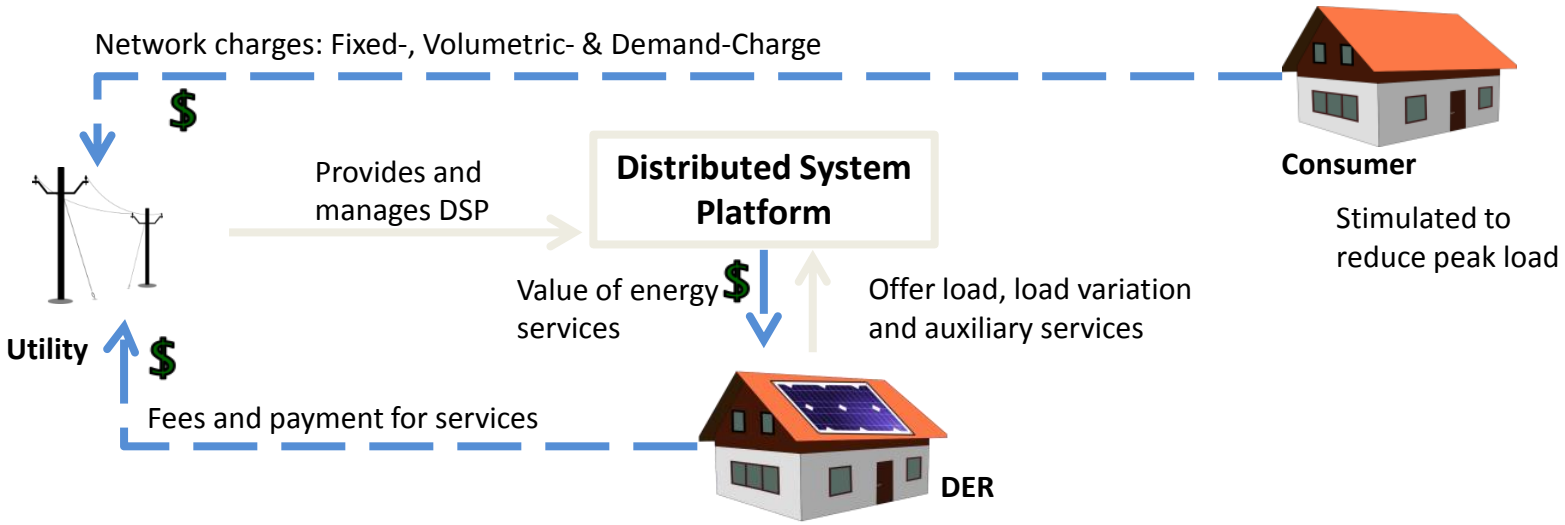


DER

Enable and remunerate DER-auxiliary services

New markets can emerge

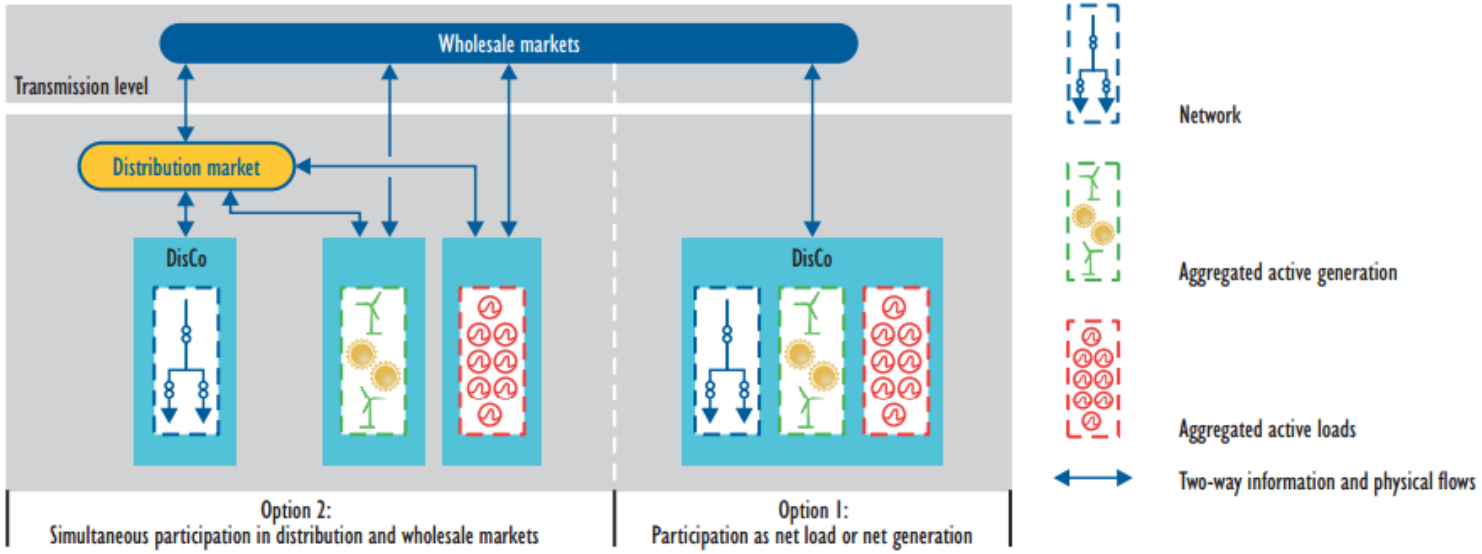
- The State of NY launched the Reforming the Energy Vision (REV) initiative.
- Under REV, existing and new stakeholders compete on local markets for energy services, approaching the customer with innovative business models
- The utility becomes the market facilitator
- Enhanced demand-side participation reduces grid investment needs



Key point: *By welcoming new stakeholders with innovative business models, REV seeks to find market-based solution to tackle new system needs*

Many questions

- **How far to go with unbundling:**
  - Network ownership, operations; supplier; aggregator …
- **How to adapt regulatory incentives:**
  - How much innovation is good?
- **How do we adapt planning standards and when to invest?**
- **How to handle the interface between transmission and distribution level?**



Note: DisCo = distribution company.

A possible framework of dos and don'ts

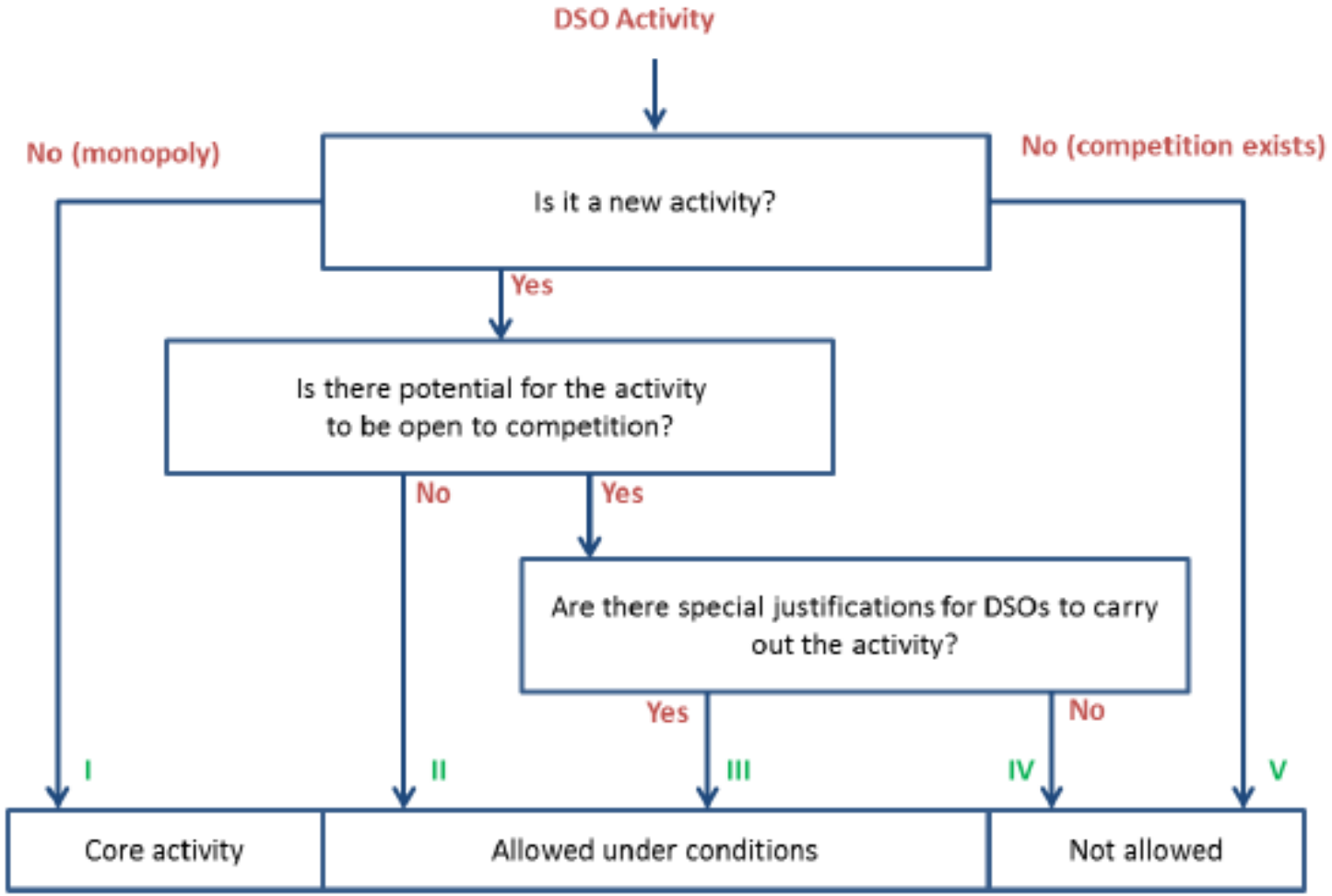


Image source: CEER

Distributed resources: areas for policy attention

Grid Planning & Operations	Communica-tions & Control	Assessment & Modelling	Institutional coordi-nation	Tariff design
Interconnecti on rules	Real-time Monitoring	Hosting capacity analysis	Operations roles and responsibilities	Cost recovery
Coordination among grid operators	Automated demand response	Power flow forecasting	Market facilitation by utilities	Social equity and fairness
Local system operations	Data processing	Screening techniques	Data sharing & processing	Capacity cost

Conclusions

- **A number of drivers are aligning to fundamentally change local grids – away from passive distribution towards active networks of electricity and data**
- **Change can happen quickly and experience shows that regulation and policy is often poorly prepared**
- **Regulatory reform needs to consider all three layers**
  - Technical
  - Economic
  - Institutional
- **Hot topics for reforming DSOs**
  - How much unbundling?
  - How to adapt regulatory incentives?
  - How to adjust planning standards?

Thanks

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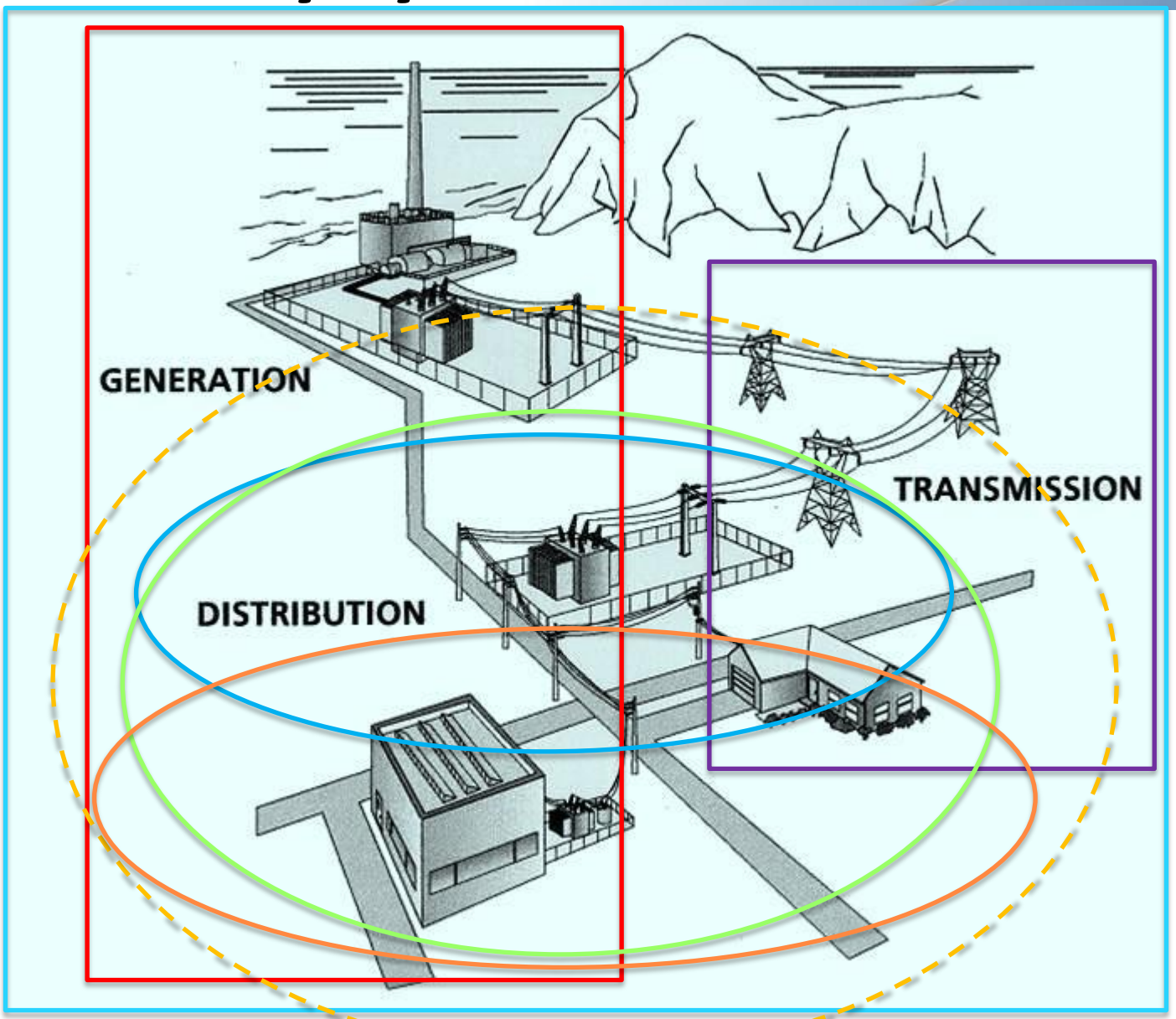
Fundamental roles in the electricity system



(Regulator)

Integrated utility

Unbundled utility

Transmission system operator

Distribution system operator

Retailer

Aggregator

ICT provider

New ways to conceptualise roles

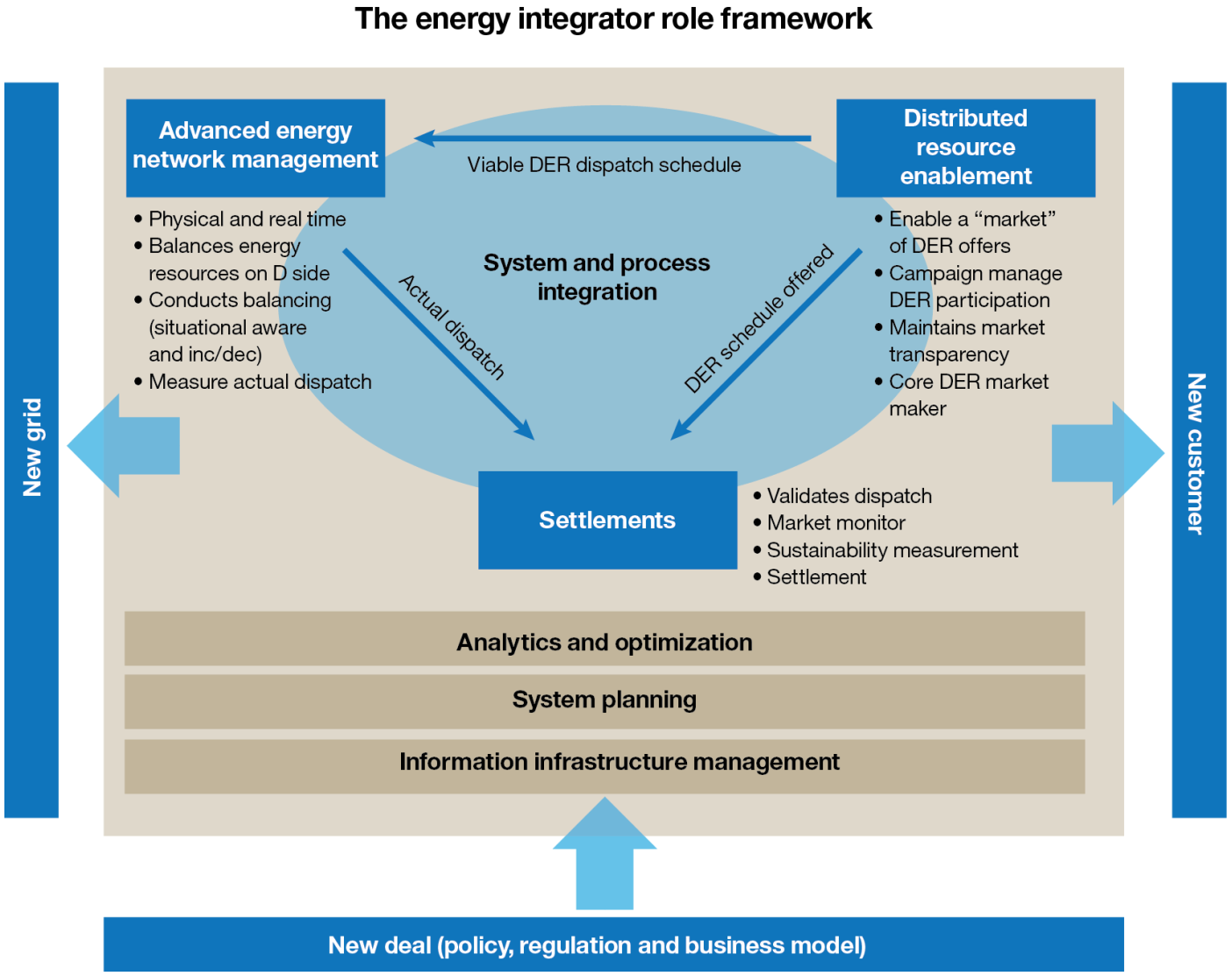


Image source: IBM