Energy research Centre of the Netherlands

How changes in network regulation can contribute to power sector decarbonisation

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ECN Policy Studies: “We provide knowledge and strategies for a sustainable energy system”

Key characteristics

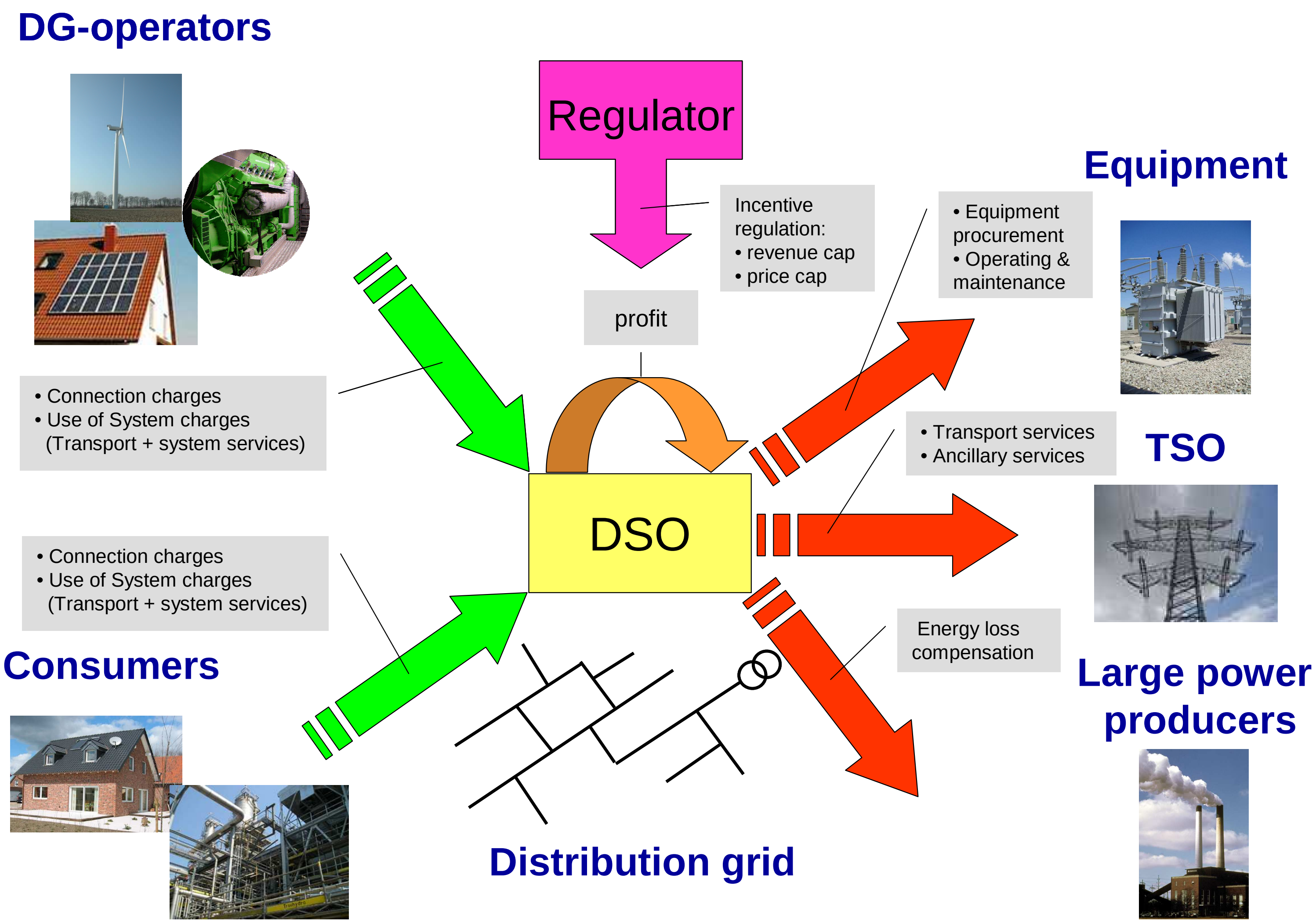
- Think tank, 65 researchers with multi disciplinary background
- Independent
- Integral: combine insights about energy use, markets, technology, behaviour and policies
- Advanced in quantitative analysis, but increasingly also qualitative
- Offices in Petten and Amsterdam

Issue at stake

- Driver:
  - Increasing need to integrate renewable / decentralised / intermittent electricity generation in distribution networks

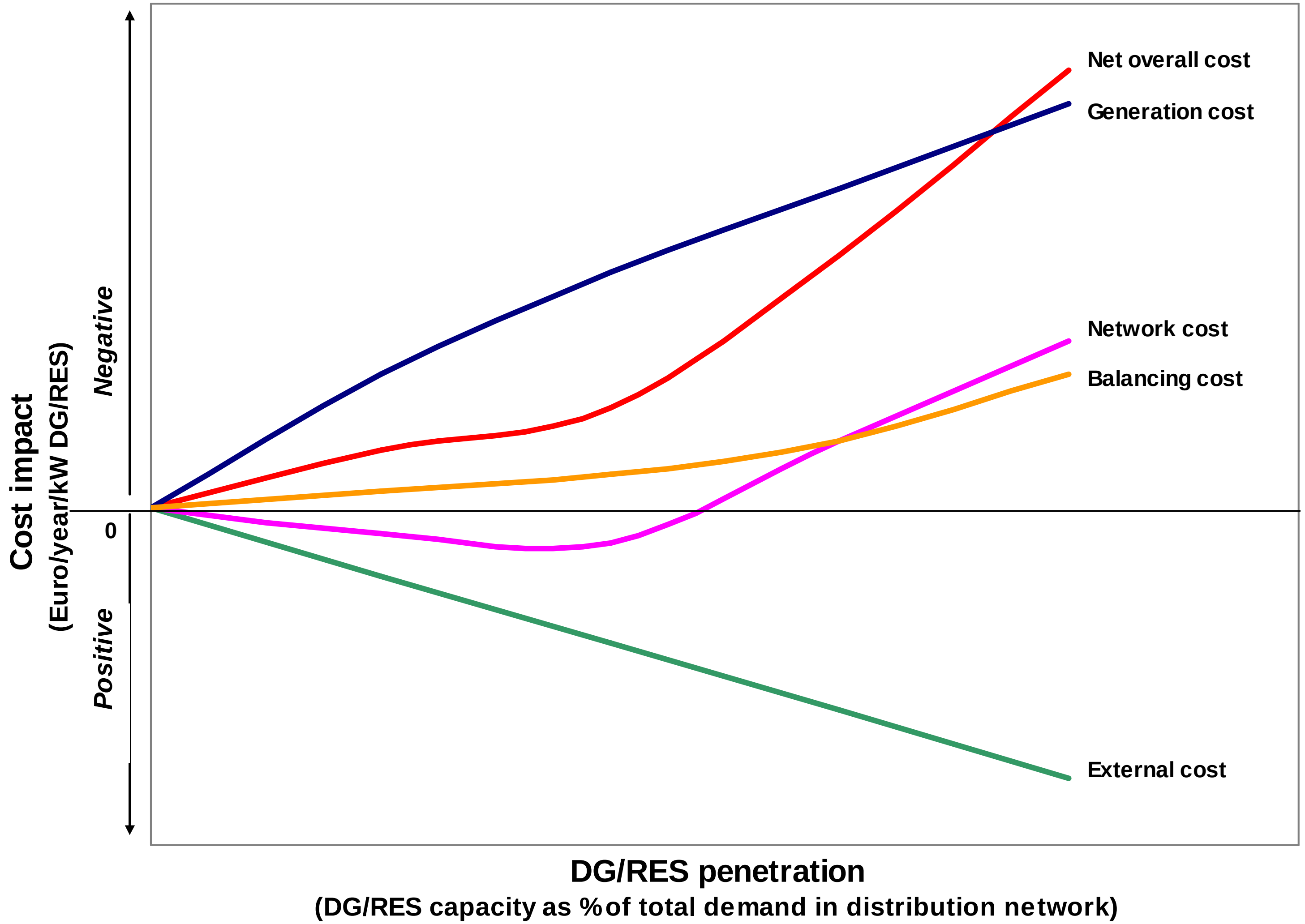
    → DG/RES-E (intermittent and non-intermittent)
- Context:
  - Liberalised electricity market
  - Regulated (distribution) networks
- Challenge:
  - Optimal integration with respect to public goals of sustainability, affordability (efficiency) and security of supply (network quality)

The regulated environment of the distribution system operator (DSO)



From current situation…

Illustration of impact of DG/RES-E on electricity system

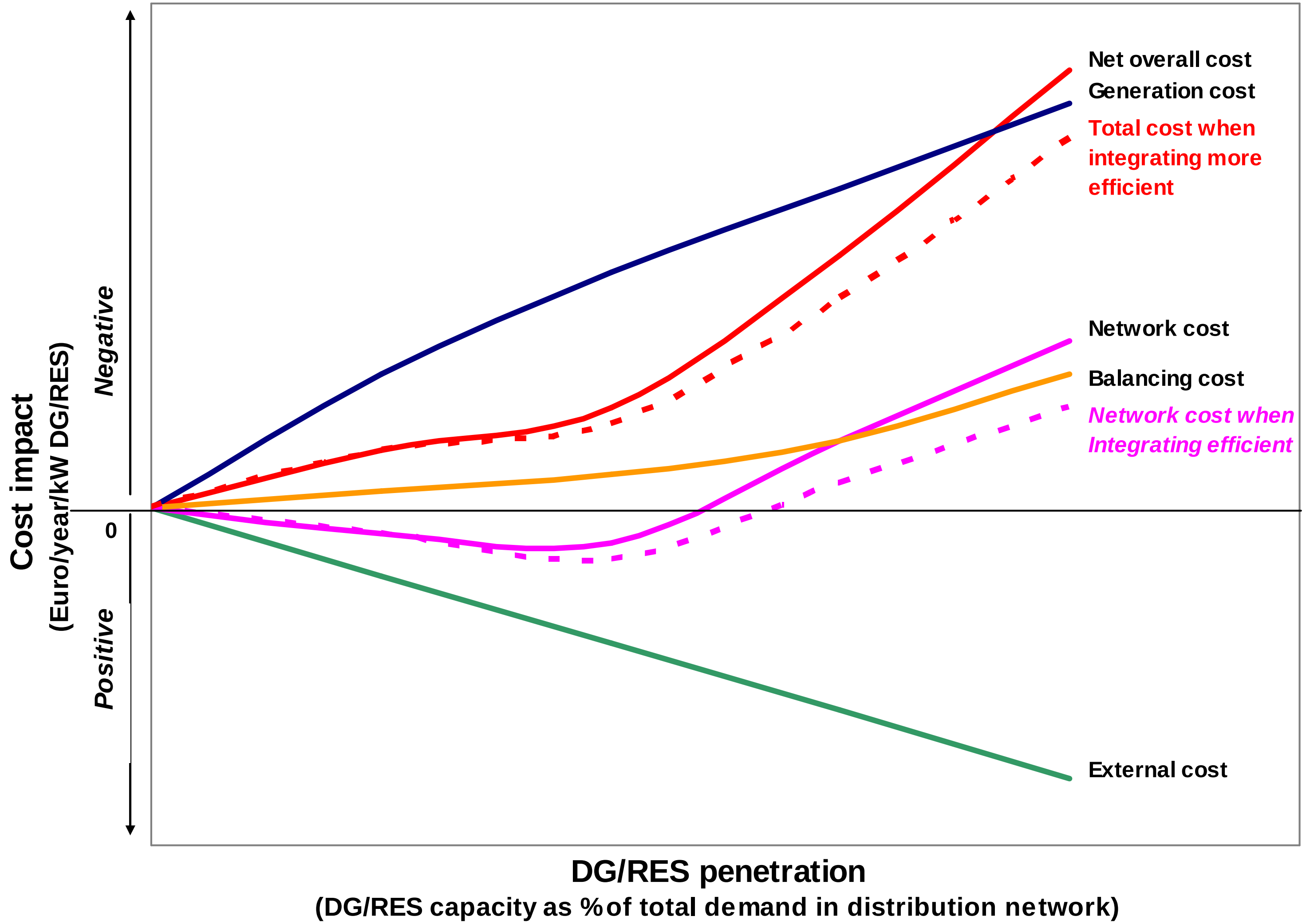


Note: illustration, no actual results

Network impact of DG/RES-E integration

- Based on generic simulation analyses in DG-Grid:
  - Network reinforcement costs increase progressively (from zero) with amount of DG
  - Energy losses are initially reduced, but increase with large amount of DG
  - DG penetration may postpone higher voltage network reinforcements
- Validated in application to real distribution networks in three countries
  - Impact dependent on distribution network characteristics (meshedness / density), geographical spread of load and generation
- Current DSO regulation may not account for differential impact across DSOs → barrier for further DG/RES-E integration.

Objective: more efficient integration



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Which type of solutions are available in reaching this objective?

1. Influence DG/RES-E behaviour
2. Encourage DSO to implement Active Network Management (ANM)/ Smart Grid (SG) solutions
3. Adapt current performance-based distribution network regulation

- Combination of all is required for efficient integration

1. Influence DG/RES-E behaviour

RESPOND

IM PRO GRES

- Introduce use of system charges for generation
  - Safeguard level playing field central generation vs. DG/RES-e
  - Preferably time and location dependent
- Maintain shallow connection charges
  - low barrier for further DG/RES-E integration
- Socialisation of network integration costs through use of system charge

DG-GRID

- Design issues:
  - Fully cost-reflective location and/or time of use incentives may create uncertainty and hinder further DG/RES-e investment
  - Which degree of socialisation is desirable?

2.Implement ANM / SG solutions

- Type of solutions:
  - Demand response
  - Control strategies DG/RES-E
  - Interruptibility contracts
  - Smart meters

- Distribution network-specific case studies show that ANM / SG solutions may reduce the network integration cost impact

Do (regulated) DSOs have sufficient incentives to adopt ANM / SG?

- Not necessarily, due to externalities
  - DSO often does not capture full benefits of implementation
- Internalise this effect by introducing output related incentive such as DG/RES-E hosting capacity
  - Hosting capacity dependent on network configuration, demand and generation characteristics, etc.
  - Requires more transparency

3. Compensation of DG/RES-E related network costs

- Prevent uncertainty on recovery of DG/RES-E related costs to act as barrier to further integration

- Take into account incremental impact of DG integration on operational and capital expenditures through:
  - Allowance for DG/RES-e investment in regulated asset base (RAB)
  - Allowance for a direct revenue driver
  - DSO benchmarking considering DG as cost driver
  - Tariff adjustment factor (ex post)

- What is the impact of adaptations on efficiency incentives?
- (Some) overcompensation may act as extra stimulus
- Best practice implementation across EU
  - But country and network characteristics may favour different solutions

Research issues

- Relation between network regulation and DG/RES-E support schemes
  - Design support schemes in such a way that DG/RES-E optimally contribute to the system
- Country/network specific menu of solutions
  - Overall adoption framework for regulatory authorities
- Trade-off between efficiency and sustainability
  - Impact of solutions on efficiency properties of regulatory regime
- Role for DG/RES-E in network quality

Thank you for your attention!

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Studies on DG/RES-E integration with ECN participation

- SUSTELNET
  - EU funded (FP5); coordinated by ECN; completed in 2003
  - Qualitative study; regulatory road maps
  - www.ecn.nl/en/ps/onderzoeksprogramma/energievoorziening/sustelnet/
- DG-GRID
  - EU funded (IEE); coordinated by ECN; completed in 2007
  - Quantitative study; economic impact of DG on DSOs regulated business
  - www.dg-grid.org
- FENIX
  - EU funded (FP6); coordinated by Iberdrola; completed in 2009
  - Virtual Power Plants (VPP); economic, contractual and regulatory issues (ECN and Pöyry)
  - www.fenix-project.org
- RESPOND
  - XXXX
  - XXXX
  - XXXX
- IMPROGRES
  - EU-funded (IEE); coordinated by ECN; running until 2010
  - Quantitative study; trade-offs between regulatory framework, electricity market prices and support schemes
  - www.improgres.org

Energy research Centre of the Netherlands

- Since 1950s: nuclear research centre
  - Now in separate company, NRG
- Focus on “developing clean technology and bringing it to the market”
- Ca. 700 employees
- Seven units: solar energy, wind energy, hydrogen and clean fossil fuels, biomass, coal and environment, energy efficiency, engineering and services, and policy studies