NVE

Regional challenges in market integration and market design, interdependence with other dimensions

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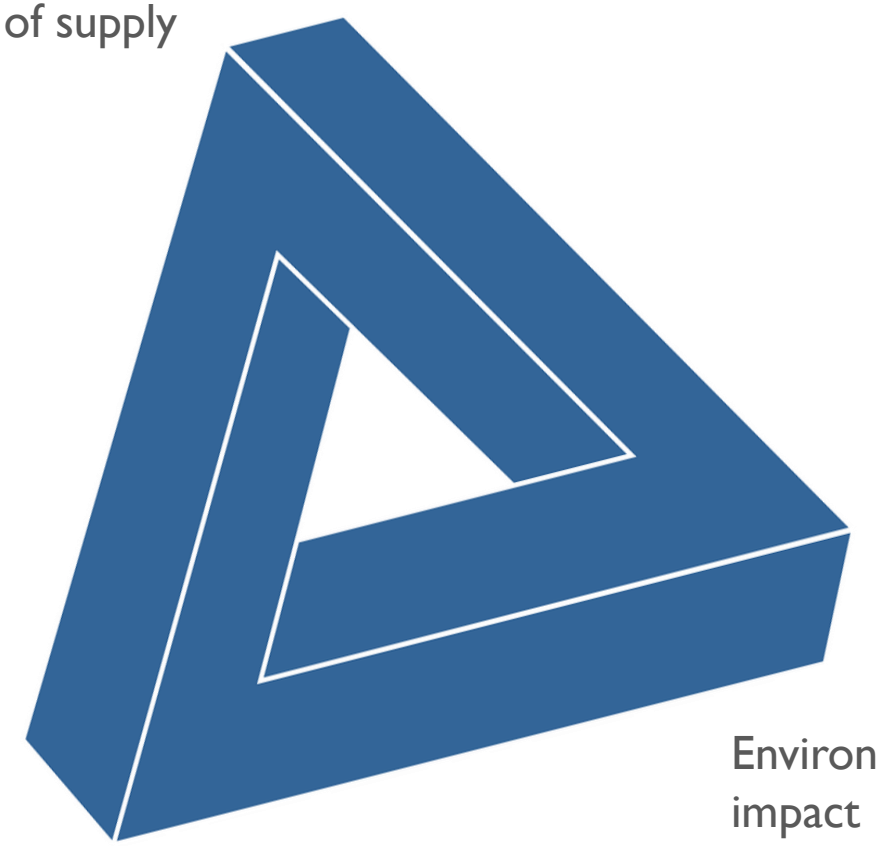
Crossborder trade reduces trade-offs and improves deliveries

Security of supply



Environmental impact

Economic efficiency

- ✓ Connecting what is different
- ✓ Enabling more renewable energy deployment
- ✓ Increased system complexity calls for enhanced co-operation on regional and European level

Trends

Production

From traditional, centralized

To intermittant, decentralized

Consumption

Improved energy efficiency

Increasing capacity demand - electrification

Self-production behind the meter

Challenges

Adequacy assessment

Balancing

Frequency quality

Grid stability

Voltage, quality of supply

Grid congestions

Capacity expansions with poor utilization?

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Solutions

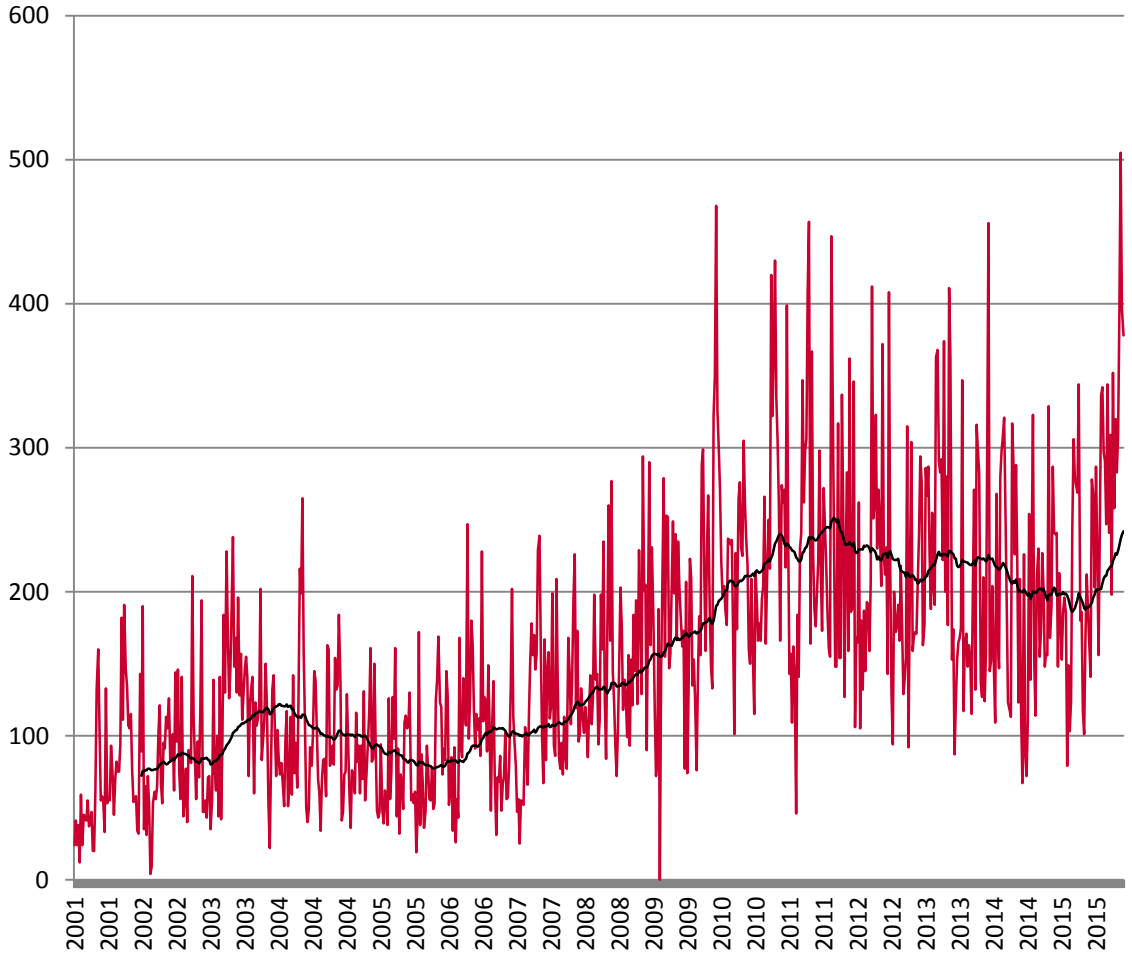
Digitalization

Automation

Integration

Market design and regulations facilitating efficient use of resources and new solutions

Example one Frequency quality in the Nordic syncronious area



Increased share of intermittant generation

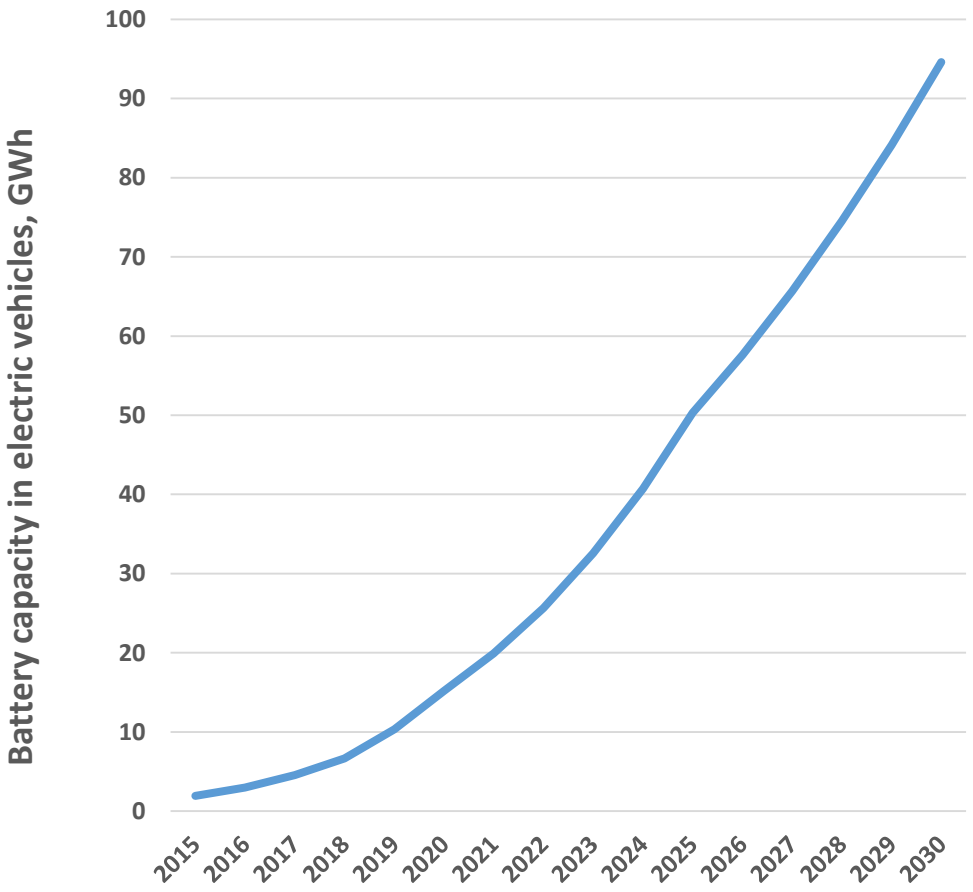
Larger influence from interconnected systems

Internal congestions in the Nordic syncronious area

Actions required

- **Improved market design and system operation products**
- **Digital, automatic, real-time operational procedures**

Example two Charging of electric vehicles in Norway



50 MW of new battery capacity is connected to the distribution grid every month. The pace of connections will increase rapidly

A challenge or an opportunity for the electricity system?

Case study I (DSO in medium-size city near Oslo)

- «Afternoon charging» - requires capacity investments in the distribution grid, 2500-5000 Euro pr consumer
- «Smart charging» - current grid capacity is sufficient

Case study II (NVE report)

- «Available» battery capacity in 2030 is estimated to equal 10 pct of current national peak demand

Enabling flexibility in the power system

Flexibility sources

- Generation
- Transmission
- Demand
- Storage

	Generators and consumers adapt to price signals	Generators and consumers offer flexibility in, or close to, the operating hour
Transmission & Wholesale level	Day ahead market, with bidding zones Pan-european intraday market	Modernized pan-european balancing market
Distribution & Retail level	Suppliers offer spot based contracts DSOs issue cost reflective grid tariffs	Suppliers / aggregators / consumers offer flexibility DSOs demand flexibility through market solutions DSO / TSO interface

Harmonize the right things at the right level

Harmonization and standardization can be important to achieve

- ✓ Economies of scale
- ✓ Level playing field
- ✓ Transparency

However,

- ➢ One size does not always fit all
- ➢ Too detailed harmonization can hamper innovation

Regulations should be predictable and dynamic

- ✓ Transparency and dialogue with stakeholders
- ✓ Point out regulatory direction
- ✓ Encourage pilots & innovation, «regulatory sand-box»

Thank you!

Charging station north of Oslo

Photo: Norwegian EV association