

Implications of RES in the EU

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Messages

- **Benefits of cooperation increase**
- **To reap these benefits:**
 - “ Market design needs to be updated
 - “ System operation needs to be Europeanised
 - “ Network development needs to follow welfare-optimisation
- **Alternatively, scope for markets will vanish**

Agenda

- 1. Benefits of cooperation**
- 2. Reaping the benefits**
- 3. Discussion**

Effects of integrating renewables

- **Renewables will make the residual demand more volatile**
 - **Renewables will be produced at different location**
 - **At some hours almost no renewable unit will run**
 - **Significant shift of supplies might happen at rather short notice**
- ⇒ **sufficient complementary technologies needed (transmission, demand response, conventional generation, storage)**
- ⇒ **Appropriate market design to remunerate the investment and operation of these technologies needed**

More integration is part of the least cost solution

- **Geographic averaging of individual resources**
- **Pooling of national resources**
- **Pooling of reserves**

- **For small and medium countries**
 - “ Larger portfolio of plants possible (reactiveness, marginal cost, fix cost, fuels)
 - “ Competition at all steps of the merit order curve

Simulation exercise

- **Two countries**

- “ Solar correlation 98%,
- “ Wind correlation 76.5%,
- “ Demand correlation 78%
- “ 28 h are among the 100 h with the highest residual demand in both countries

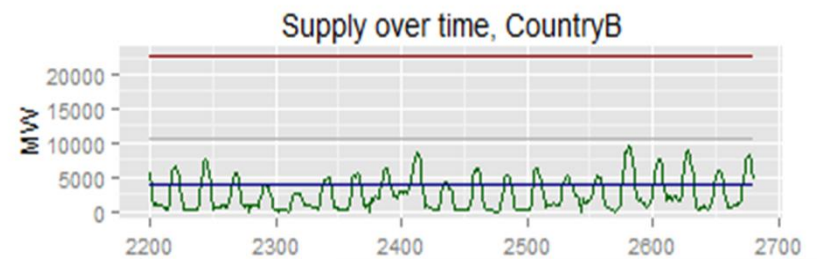
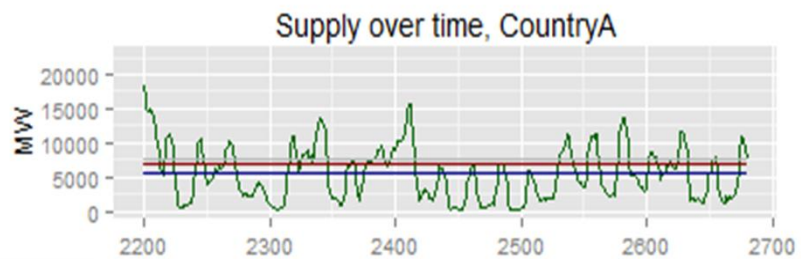
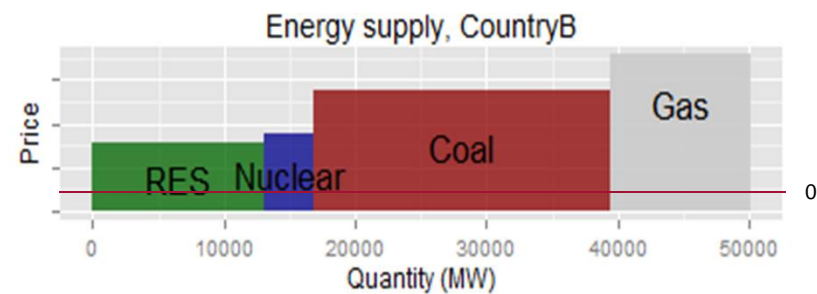
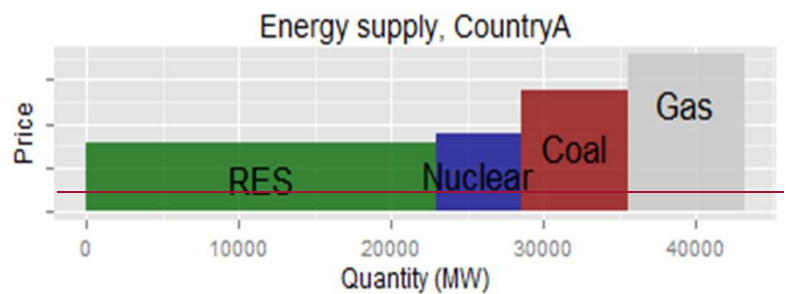
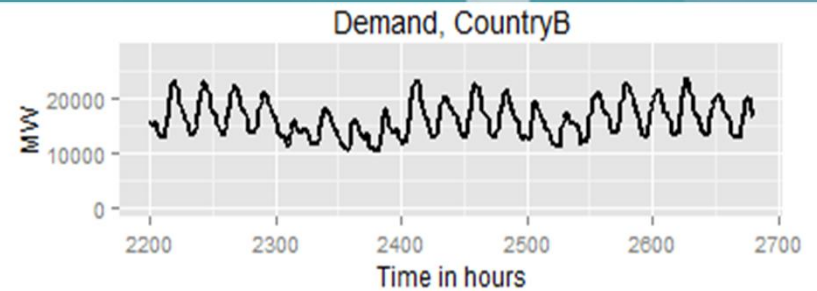
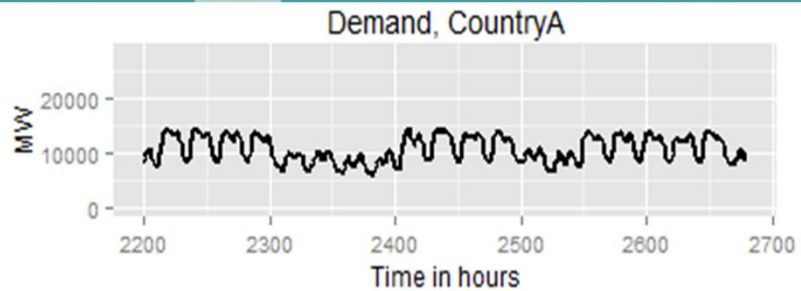
- **Four technologies**

	Capacity, Country A (MW)	Capacity, Country B (MW)	Fixed cost in Euro/MW/y	Variable cost in Euro/MWh
Renewables	23,000	13,000	120,000	0
Nuclear	5,500	3,900	190,000	10
Coal	7,100	22,600	100,000	21
Gas	7,600	10,600	40,000	35

- **Four scenarios:**

1. No trade
2. Limited trade
3. Full trade
4. Reoptimisation of power plant park (excl. RES and nuclear)

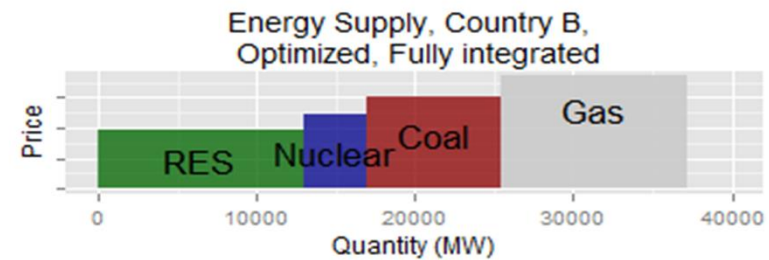
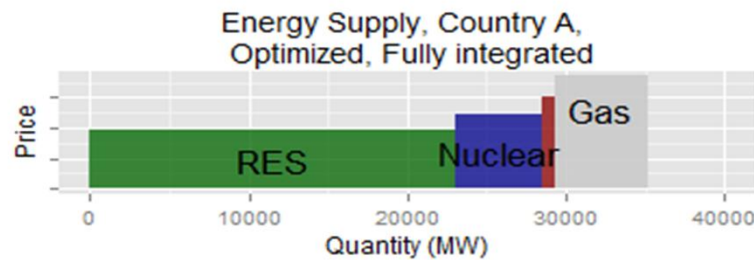
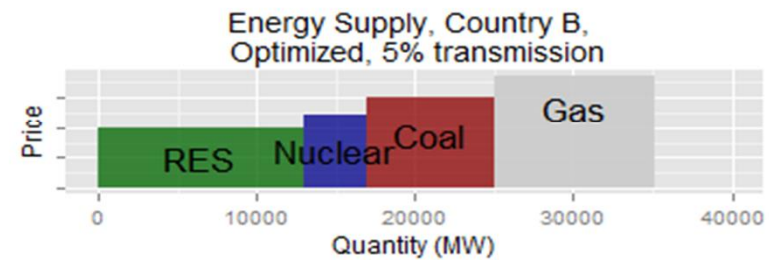
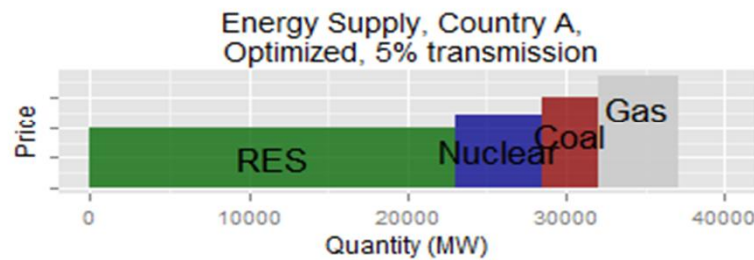
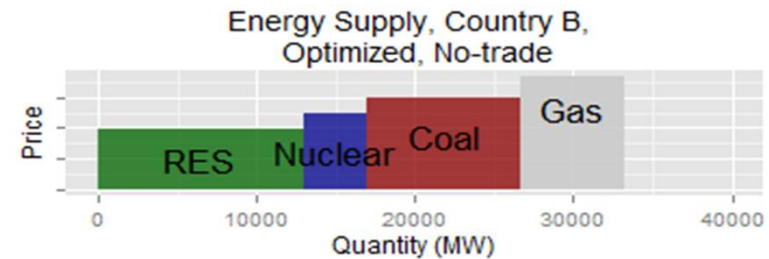
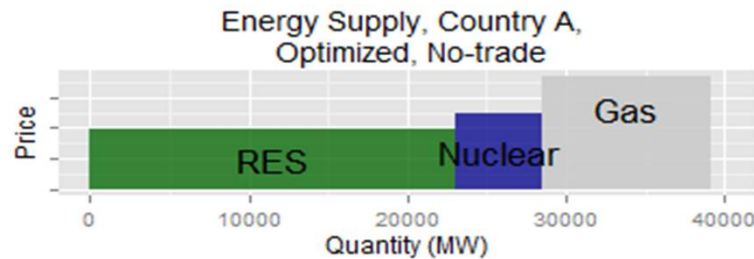
Static efficiencies of integration



System cost under different scenarios

	No Integration	5% Transmission	Full Integration
Total costs	100	99.1	98.1

Going from an individually to jointly optimised system



	No Integration	5% Transmission	Full Integration
System cost	100	98.9	97.5

Gains of integration at higher shares of RES

	No Integration	5% Transmission	Full Integration
Current Renewables	100	98.9	97.5
High Renewables	100	97.5	95.4

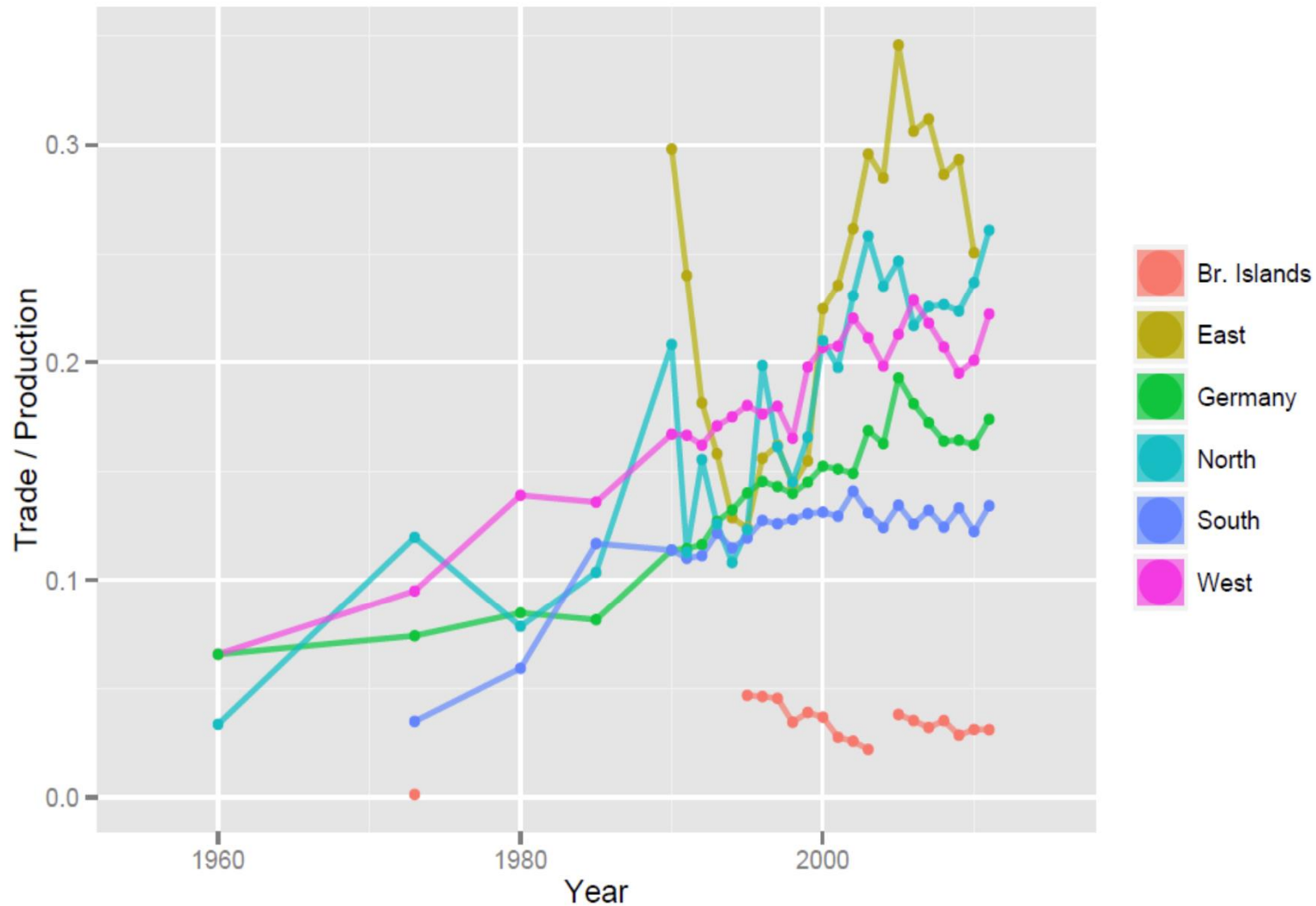
Interpretation

- 1. Most (static) trade benefits accrue already at limited trade**
- 2. Full trade has some marginal benefits**
- 3. Additional gain in Reoptimisation of power plant park**
- 4. Increasing RES share increases the value of interconnection**

Reaping the benefits

1. Benefits of cooperation
2. Reaping the benefits
3. Discussion

Important benefits have been reaped in the past



Reaping the benefits

Requirements

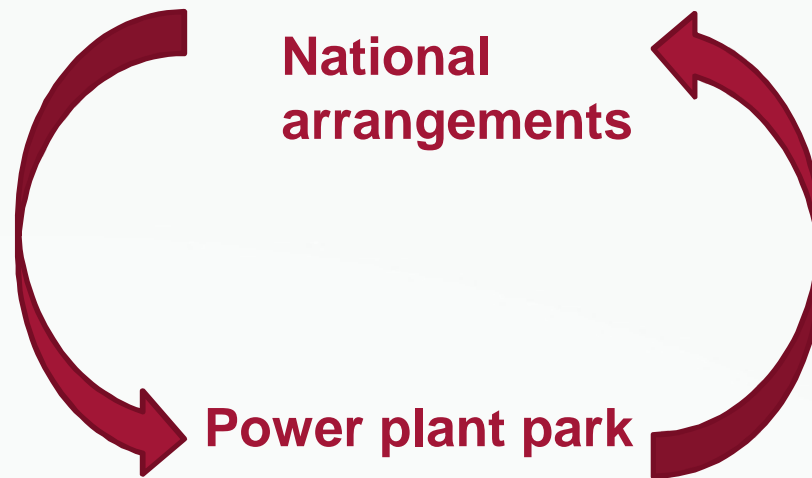
- The **physical network** and its operation have to reliably ensure the optimal cross-border exchanges
- **Market Design** has to ensure that production, consumption and investment decisions do depend on the cost (incl. externalities) and not on the country

Electricity has multiple dimensions that can be individually traded

	Nationally administered	National market	National market with an interface for imports/exports	European market	Expected change in Importance
Ancillary services					+
Intraday & Balancing			Nordic+		+
Day-ahead delivery of electricity					-
Supply Adequacy					+
Location			Nordic		+
Greenness		Quotas			+
Emissions				ETS	

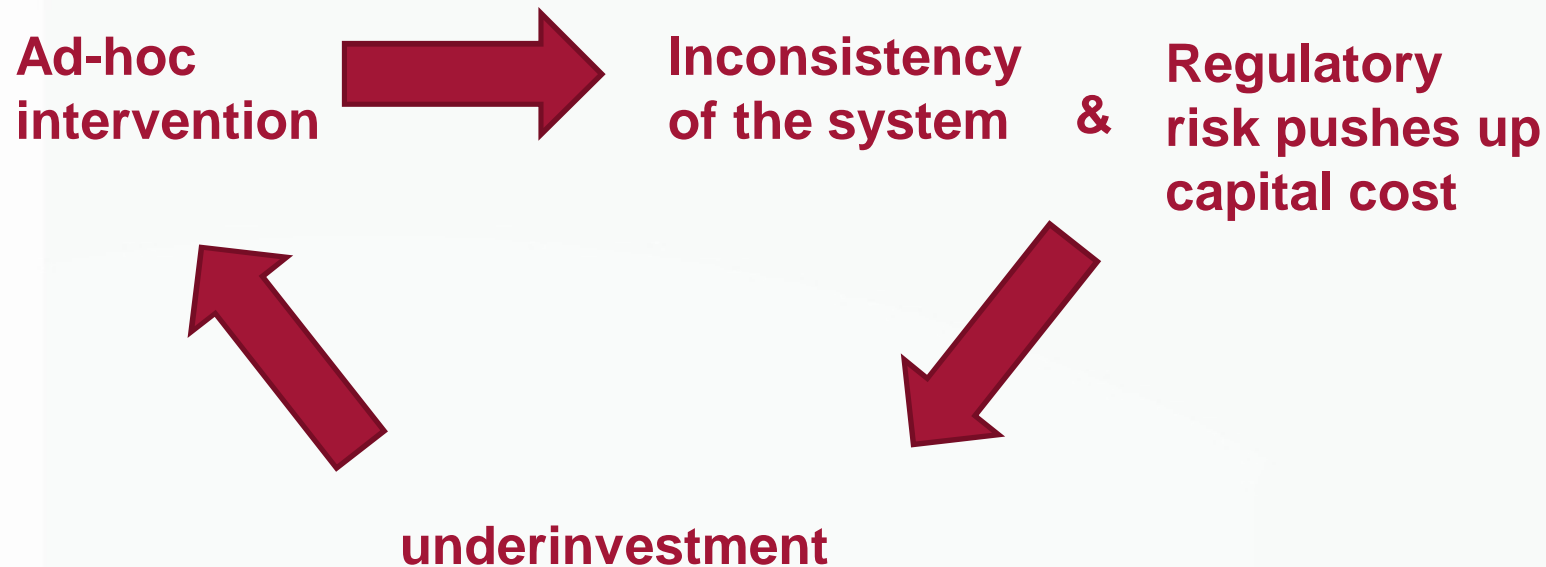
- Dimensions interact: => **grand design** or complex set of interfaces

Political constraints



-> cross-border harmonisation produces losers

Inconsistent system tends towards re-nationalisation



- Exit towards a consistent system is difficult
- Exit towards re-nationalisation might be cheaper at some stage

Discussion

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Discussion: Governance

Different regional settings

- EU 27+ (ENTSO, ACER, EU)
- NWE
- Penta-lateral
- Bilateral (FR-DE)

Different institutional frameworks

- “ Merger of TSOs
- “ Independent system operator
- “ Merger of PX
- “ Joint regulator

Back-up

Day-ahead wind forecast error in Germany 2012 in MW

