

# Implications of RES in the EU

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*30 May 2013*

# 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

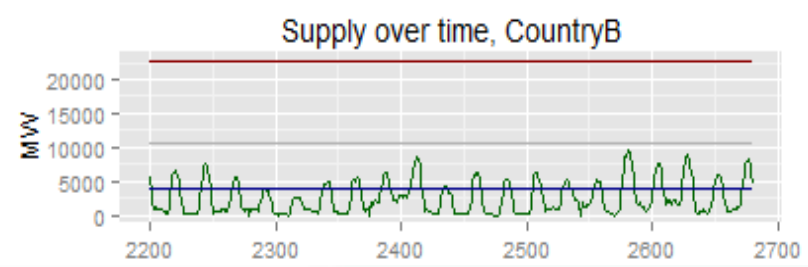
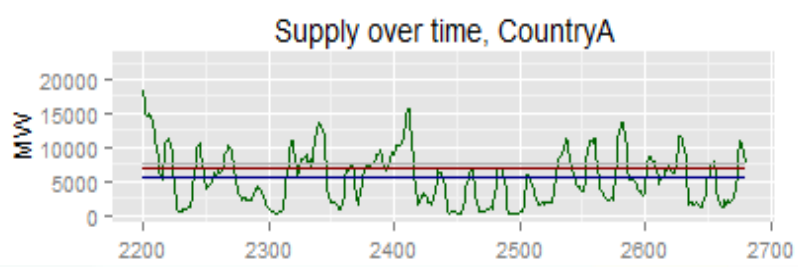
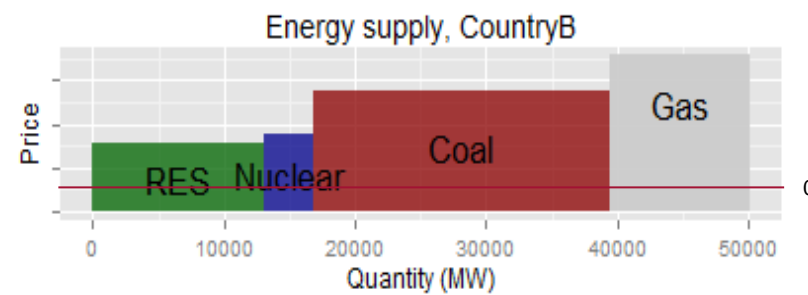
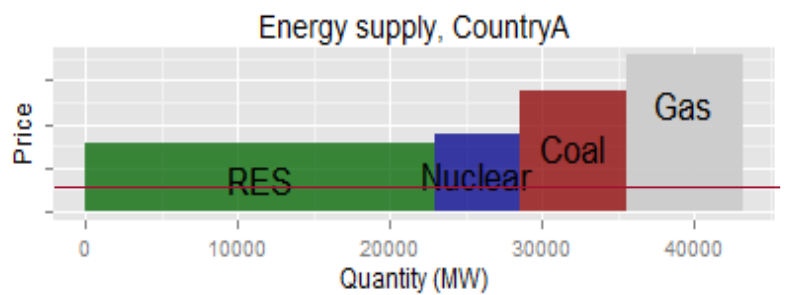
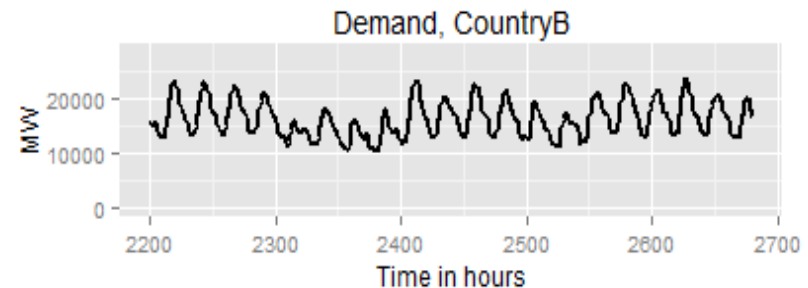
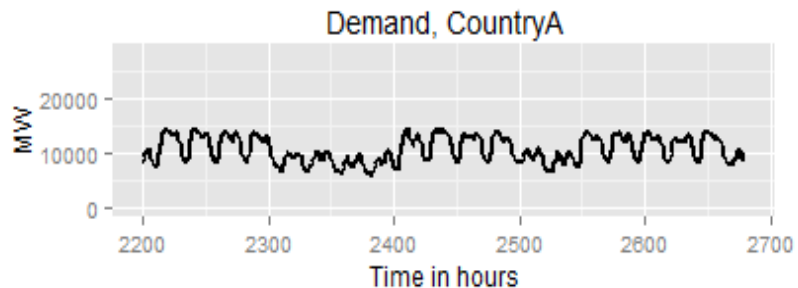
## ■ Four technologies

	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)

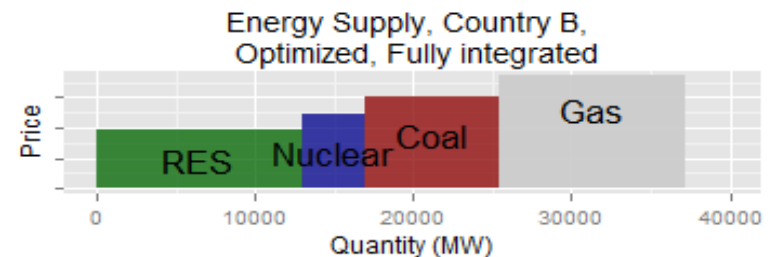
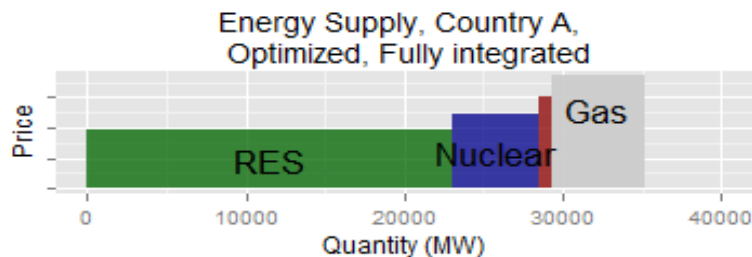
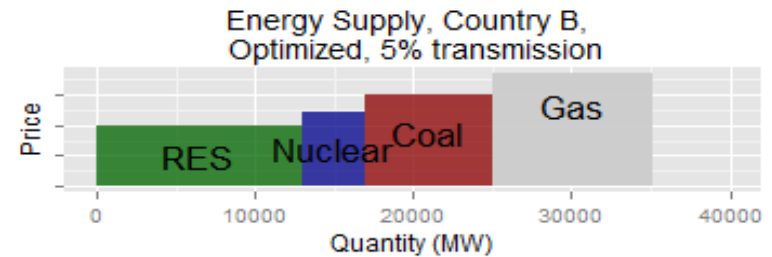
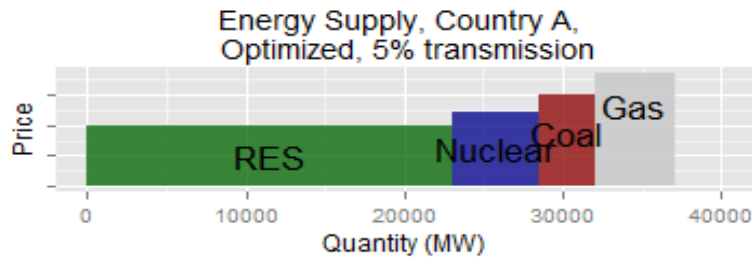
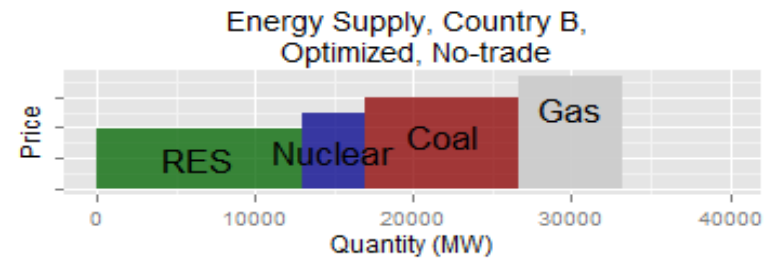
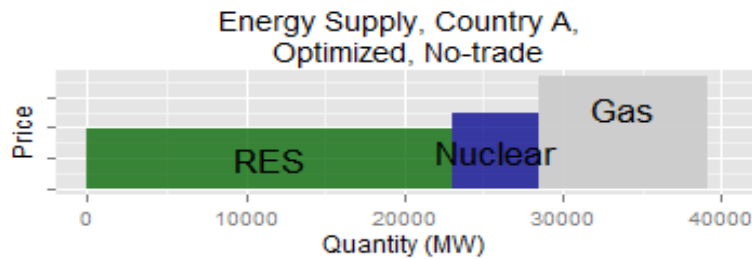
# Static efficiencies of integration



## 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

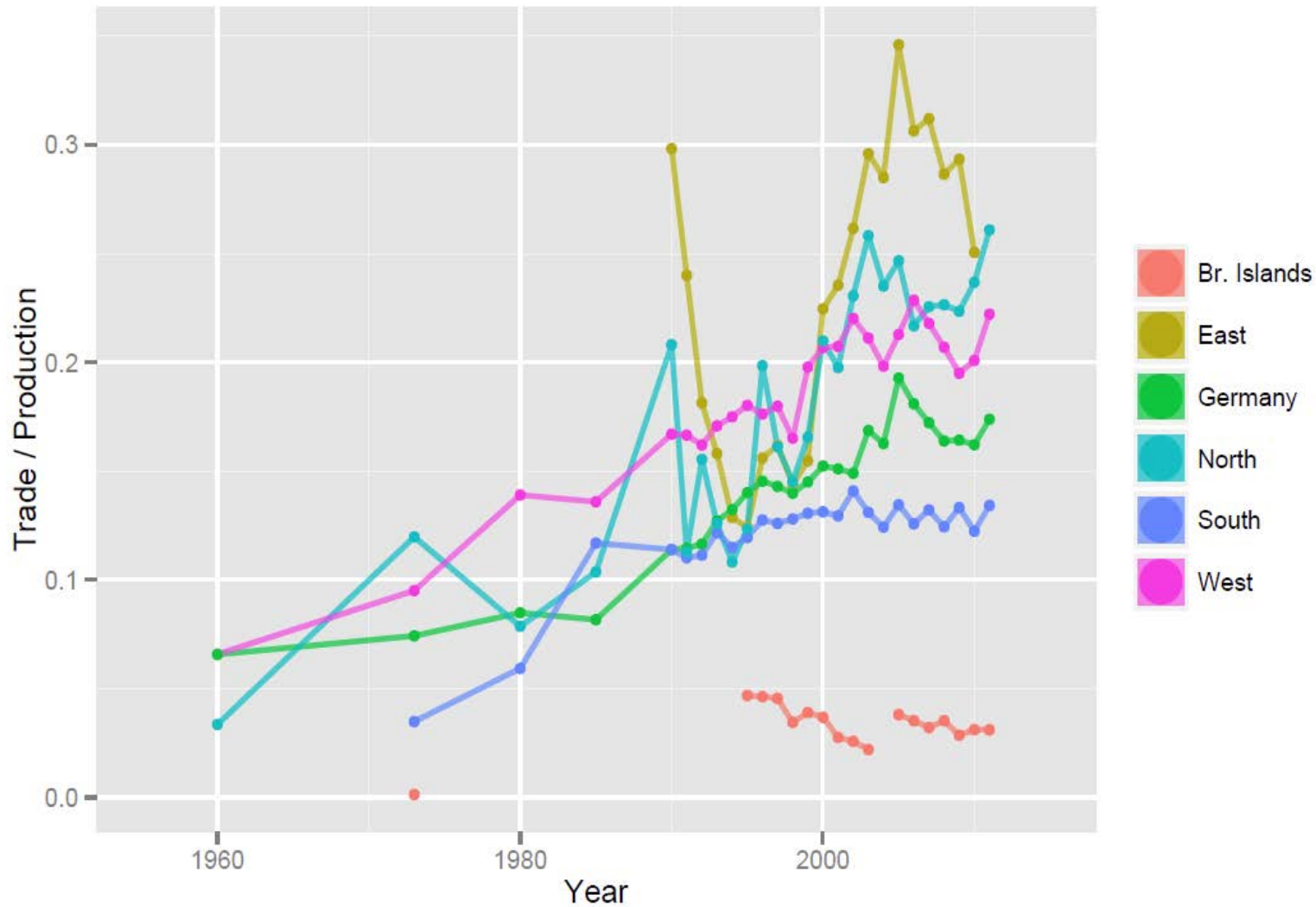
- 1. Most (static) trade benefits accrue already at limited trade**
- 2. Full trade has some marginal benefits**
- 3. Additional gain in Reoptimisation of power plant park**
- 4. Increasing RES share increases the value of interconnection**



# 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

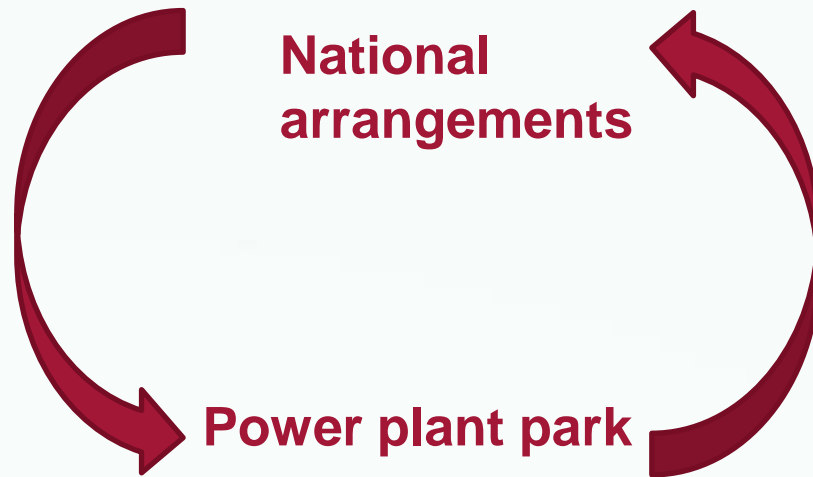
- The **physical network** and its operation have to reliably ensure the optimal cross-border exchanges
- **Market Design** has to ensure that production, consumption and investment decisions do depend on the cost (incl. externalities) and not on the country

# 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

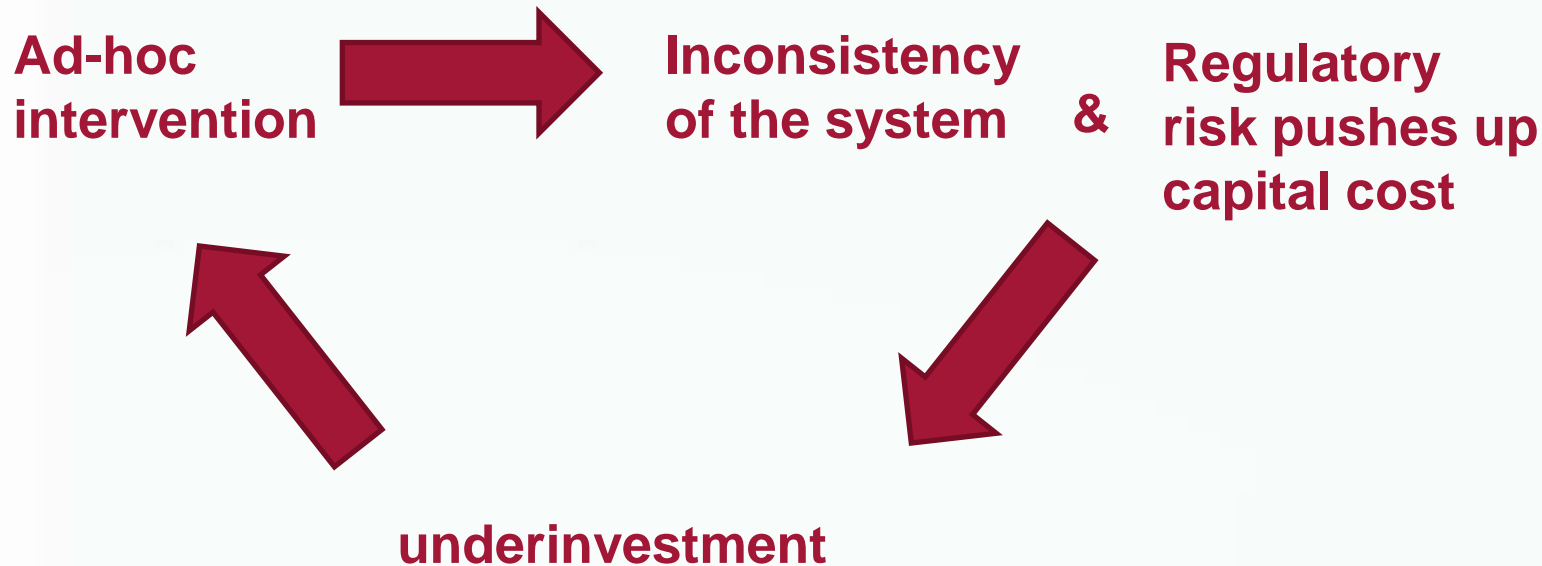
# Political constraints



-> 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

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

# 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

