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Progress on an integrated European electricity market

David Newbery

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http://www.eprg.group.cam.ac.uk

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Outline

- Elements of the Target Electricity Model
  - market coupling
  - transmission rights
  - intraday trading, balancing
- Benefits of market coupling
- Need for transmission
- Is the TEM a suitable model - for Ireland?

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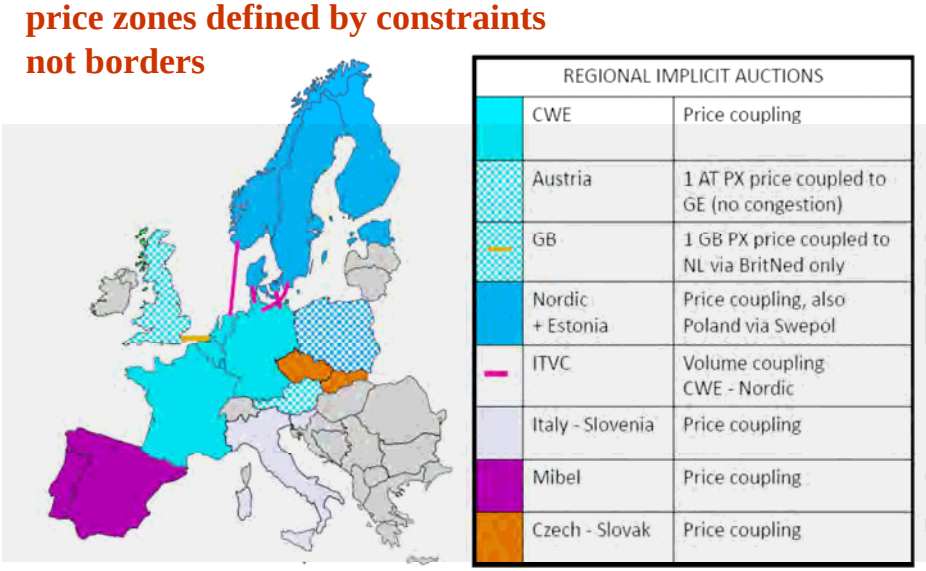
Current state

- Market coupling - regional coupling expanding
  - core seems to be on track for 2014, SEM 2016
  - zonal pricing not LMPs (yet)
  - problems with capacity payments
- Transmission rights mostly use-or-sell
  - CfDs in Nordpool, elsewhere PTRs of limited tenor
  - FTRs for up to 3 years awaited
- Intraday trading emerging (e.g. BritNed)
- Balancing - work in progress

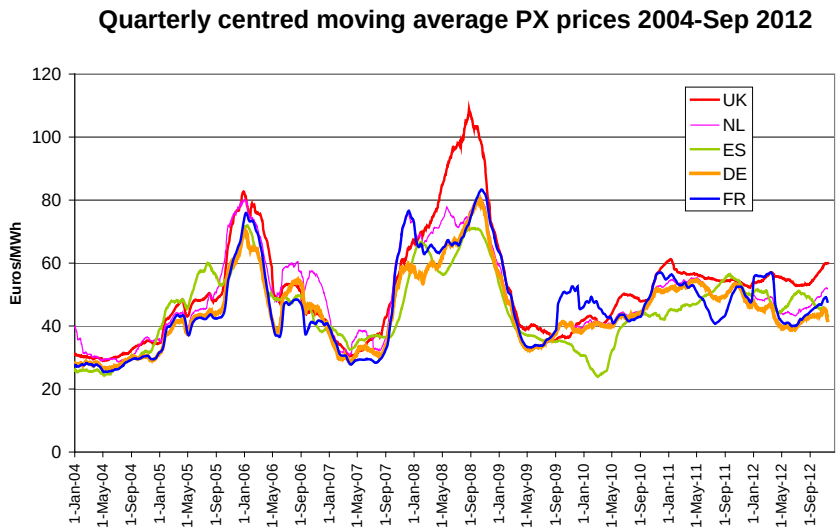
Market coupling - status 2011

price zones defined by constraints not borders

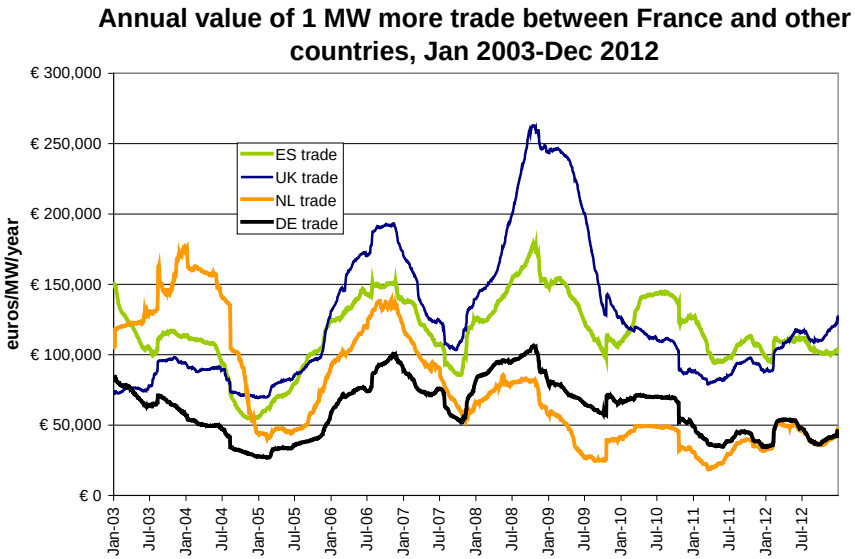


Source: Europex/ENTSO-E Florence Forum 2011

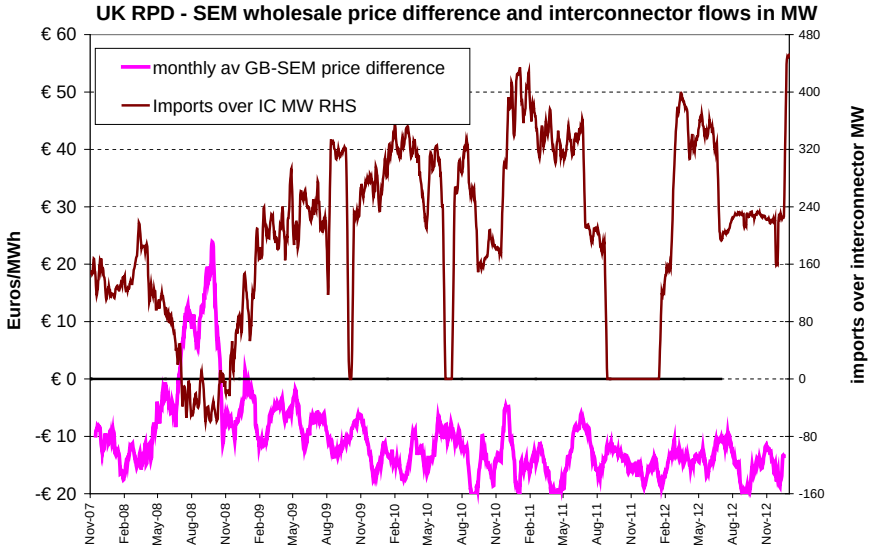
Electricity prices covary but differences remain



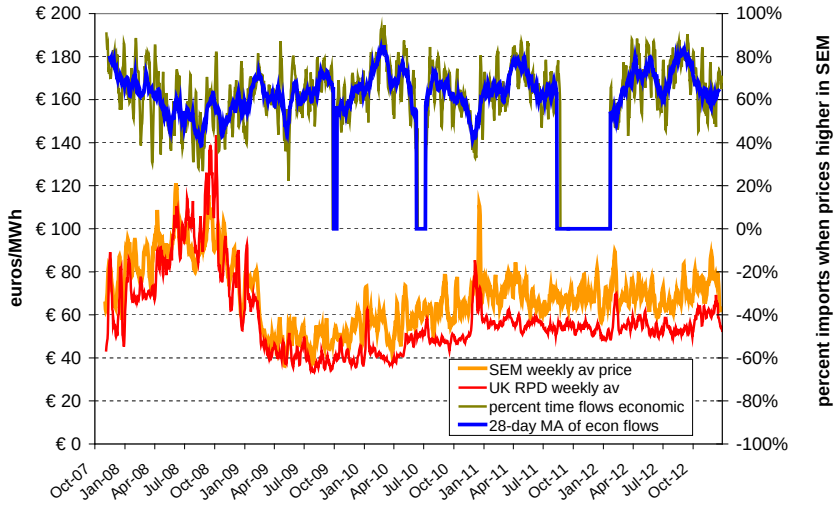
Interconnectors are hugely valuable



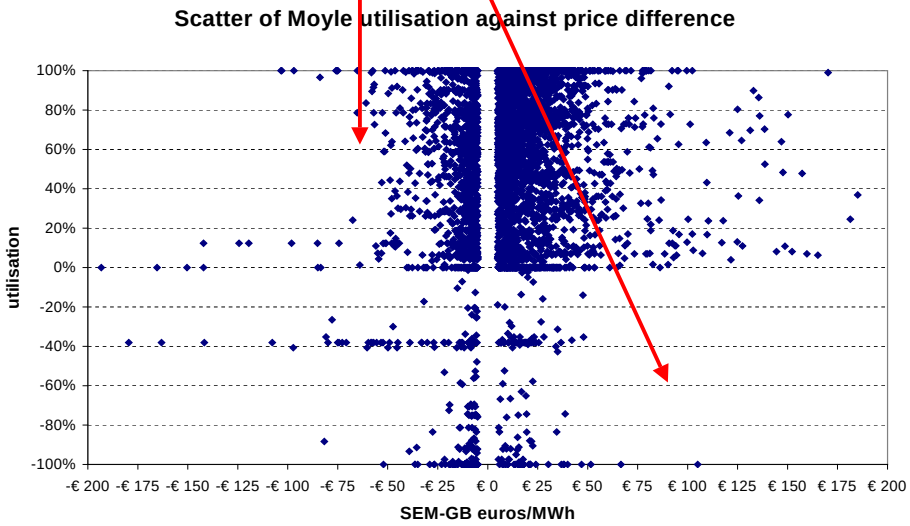
SEM normally imports over the Moyle IC



One-third of Moyle flows are perverse

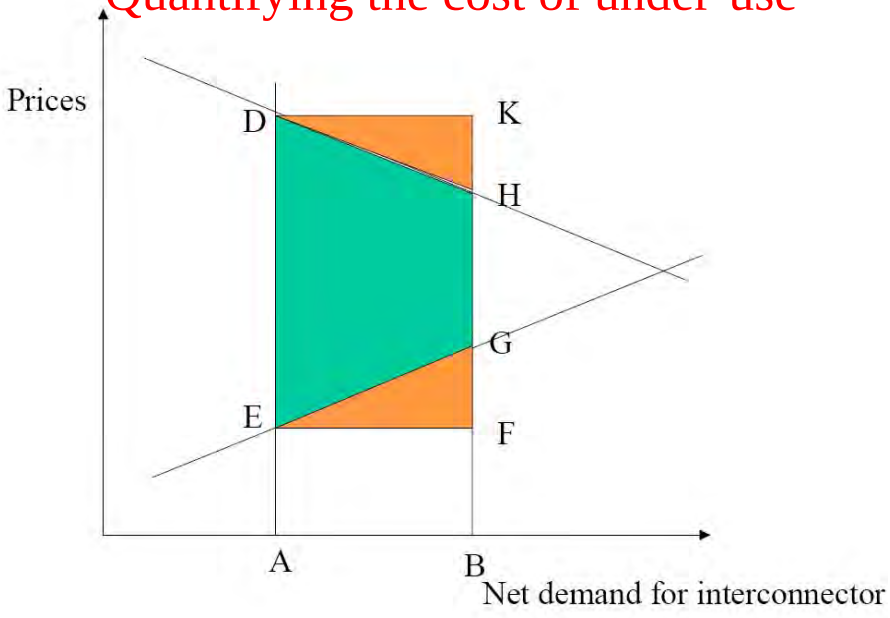


Perverse flows

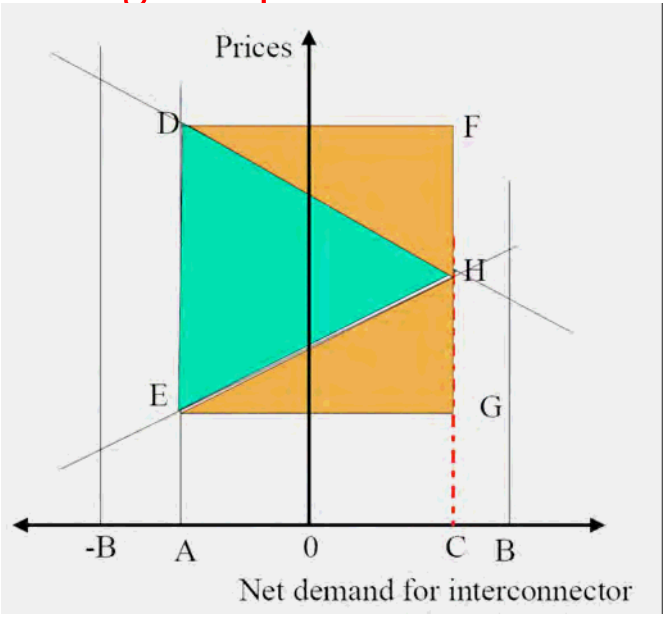


Capacity taken as max flow not nominal capacity - problems with outages

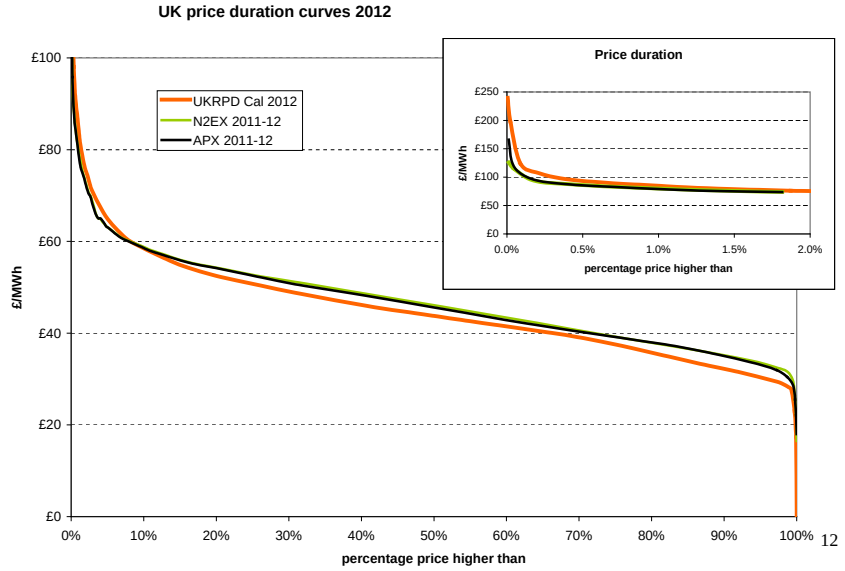
Quantifying the cost of under-use



Flow against price difference - FAPD



Estimating the impact of imports on GB prices = €1/MWh per GW change in supply



Losses from inefficient use of IFA

Table IFA trade data 2011 *Losses = 2%*

Potential value exports FR=>UK	€ 77,771,804	82%
Potential value exports UK=>FR	€ 17,386,895	18%
Potential total value trade	€ 95,158,699	100%
Loss underexport FR=>UK	€ 10,300,039	11%
Loss underexport UK=>FR	€ 8,477,715	9%
FAPD FR=>UK	€ 2,419,877	3%
FAPD UK=>FR	€ 1,210,576	1%
Total loss	€ 22,408,207	24%

=29% actual trade

Table IFA trade data 2012 *Losses = 2%*

Potential value exports FR=>UK	€ 108,728,968	73%
Potential value exports UK=>FR	€ 40,618,415	27%
Potential total value trade	€ 149,347,383	100%
Loss underexport FR=>UK	€ 10,271,789	7%
Loss underexport UK=>FR	€ 5,471,069	4%
FAPD FR=>UK	€ 2,361,956	2%
FAPD UK=>FR	€ 2,698,999	2%
Total loss	€ 20,803,814	14%

=16% actual trade

Losses from inefficient use of FR-ES IC

Table FR-ES trade data 2011

Potential value exports FR=>ES	€ 53,697,430	68%
Potential value exports ES=>FR	€ 25,517,523	32%
Potential total value trade	€ 79,214,953	100%
Loss underexport FR=>ES	€ 3,486,071	4%
Loss underexport ES=>FR	€ 3,331,524	4%
FAPD FR=>ES	€ 1,265,000	2%
FAPD ES=>FR	€ 260,053	0%
Total loss	€ 8,342,650	11%

=12% actual trade

Table FR-ES trade data 2012

Potential value exports FR=>ES	€ 56,482,617	55%
Potential value exports ES=>FR	€ 45,810,192	45%
Potential total value trade	€ 102,292,810	100%
Loss underexport FR=>ES	€ 5,648,860	6%
Loss underexport ES=>FR	€ 3,621,960	4%
FAPD FR=>ES	€ 986,480	1%
FAPD ES=>FR	€ 1,538,622	2%
Total loss	€ 11,795,923	12%

=13% actual trade

Losses from inefficient use of DE-FR

Estimated losses and trade DE-FR, Q1 2010-Q3, and actuals for Q4 2010 €Millions

Quarters	loss FR not exporting enough	Loss DE not exporting enough	FAPD FR	FAPD DE	total loss	actual trade	Potential trade
Q1 2010	€ 1.60	€ 2.59	€ 0.53	€ 0.88	€ 5.61	€ 43.88	€ 48.08
Q2 2010	€ 2.08	€ 4.97	€ 2.18	€ 0.97	€ 10.19	€ 14.85	€ 21.89
Q3 2010	€ 1.47	€ 4.41	€ 2.68	€ 0.46	€ 9.02	€ 20.02	€ 25.90
Q4 2010	€ 1.68	€ 3.34	€ 0.16	€ 0.66	€ 5.84	€ 36.87	€ 41.89
Year	€ 6.82	€ 15.31	€ 5.55	€ 2.97	€ 30.65	€ 115.62	€ 137.75

Markets coupled mid Q4 2010

=16% of trade in Q4

=32% of trade before coupling

Annual benefits from coupling Moyle *and EWIC* (950/910MW imports, 580MW exports)

Deadband (€/MWh)	Consumer Surplus (€ millions)	Producer Surplus (€ millions)	Total Potential Gain in Social Welfare (€ millions)
0	28.6	12.1	40.7
5	23.7	7.0	30.7
10	19.6	4.1	23.8
15	16.6	2.8	19.4

Note: **Deadband** is the remaining price difference below which traders are too risk averse to risk trading

Source: SEM-11-023

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Potential for future integration and the need for transmission

From the report to DG ENER *Benefits of an Integrated European Energy Market* by Newbery, Strbac, Pudjianto, Noël, Booz & Company and LeighFisher, 2013

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Estimated benefits from EU coupling

- Losses on these 4 IC s = 12%-30% of trade
- EU trade value = 10% final consumption

=> benefits of coupling = 1-3% consumption?

  – assuming the 4 IC s were typical

- total value of EU wholesale electricity at €50/MWh is €160 billion/yr

=> gross benefit €2-5 billion/yr?

  – of which some part already realised

Definitely worth having

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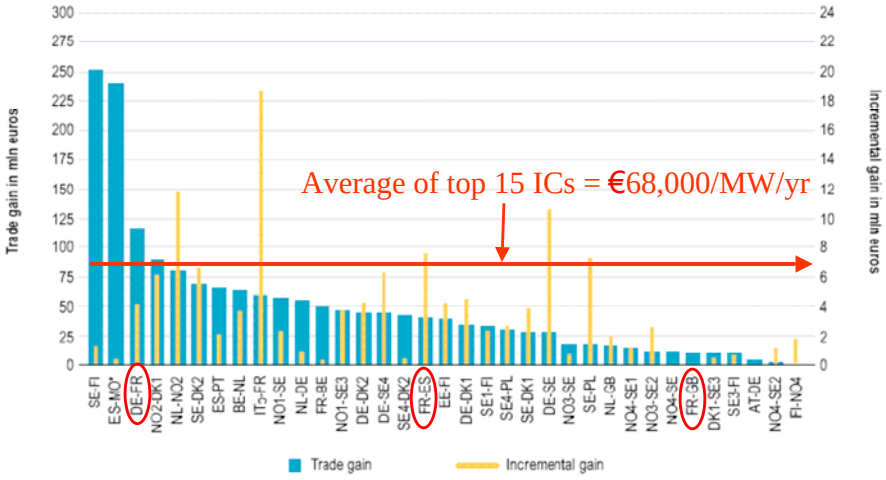
More interconnection

- Market coupling => raises efficiency of ICs
- Where highly profitable => increase IC capacity
- Third package requires 10 year transmission planning

=> Clarify who pays, how to secure planning

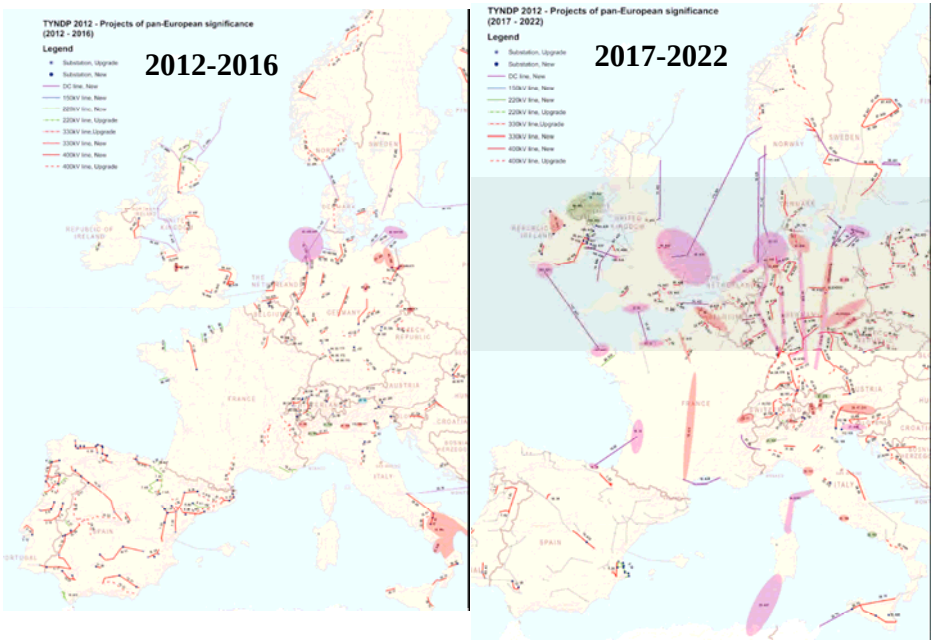
=> beneficiary pays, community improvement grants

Gross welfare benefits from cross-border trade and incremental gain per 100 MW – 2011 (€m/yr)



Source: PCR project, including APX-Endex, Epex Spot, Nordpool, GME, OMIE (2012)

ENTSO-E Ten-Year Development Plan 2012



ENTSO-E Ten-Year Development Plan 2012

52,300 km total, in +/-3,000 km of sub-sea routes, plus 10,000 km of offshore grid key-assets and +/-7,000 km of inland routes to bring peripheral power to load centers.

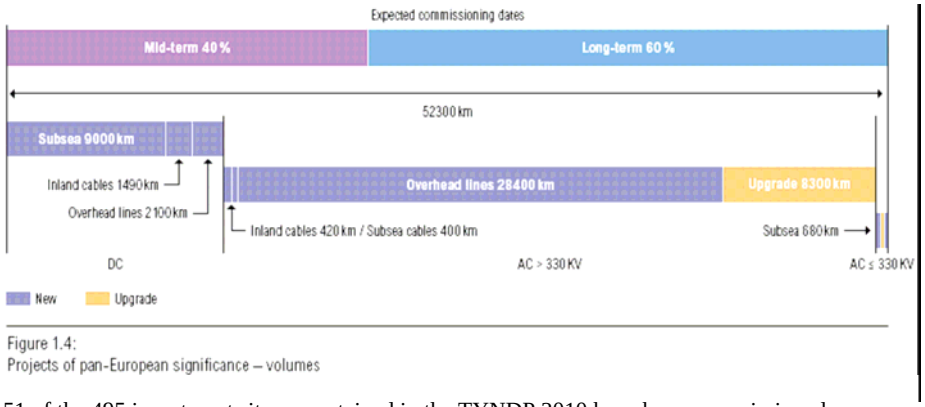


Figure 1.4:
Projects of pan-European significance – volumes

51 of the 495 investments items contained in the TYNDP 2010 have been commissioned to date (12 have been partly commissioned, 25 are expected to be commissioned in 2012)

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Estimated benefits from EU-wide balancing and reserves

- DG ENER/Mott MacDonald (Jan 2013) benefits:
  - shared balancing GB-FR 2011 = €40-56 m/year, cost €1 m
  - c.f. inefficiencies on GB-FR 2011 €22 m/year
    - "BALIT" mechanism only trading surpluses = €20-30 m/yr
  - shared Nordic tertiary reserves vs stand-alone = €184 m/yr
  - ***simulation*** shared reserves two 450 TWh markets, 30% wind, sharing 2 GW reserves = €200-400 m/yr
- 900 TWh market is 25% of total EU => €1 billion/yr?

More wind raises value of sharing

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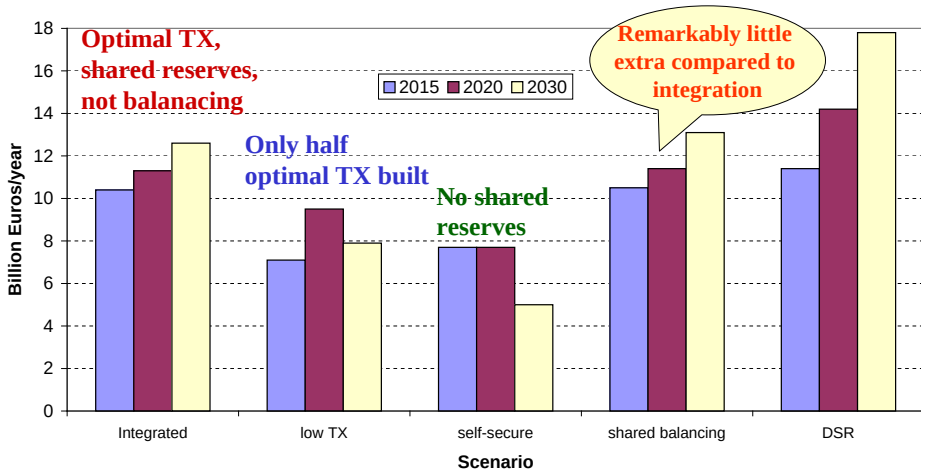
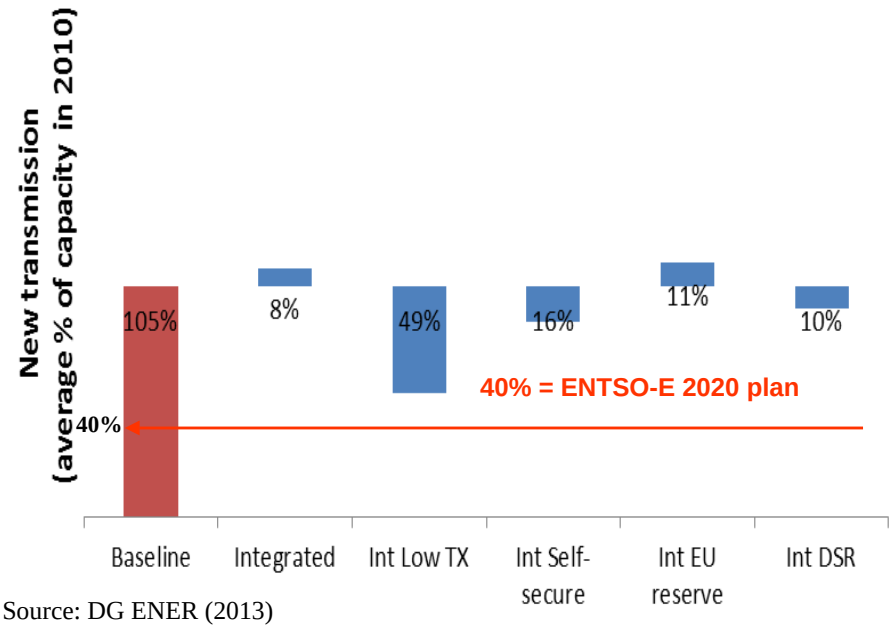
Benefits of market integration for EU 27+2 relative to base case



Base case: each country matches average production to consumption arbitrages over coupled IC's, no shared balancing or reserves

Source: DG ENER (2013)

Extra interconnection for full 2030 integration



Source: DG ENER (2013)

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The Target Electricity Model (TEM) meets the Irish Single Electricity Market (SEM)

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Adapting to the TEM

- Mismatches between TEM and SEM
  - energy-only market, simple bids to PXs vs complex bids & centralised dispatch with capacity payments
  - SEM: no firm day-ahead prices for market coupling
- Is an energy-only market a regulatory distortion?
- Principle: keep central dispatch for SEM
  - what is the simplest route to the TEM?
  - Will the SEM have price splitting?

Key issue - delivering security at least cost

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Day-ahead pricing

- SEM sets price on basis of ex-post dispatch
- DA markets set price on ex-ante bids
  - difference are balancing actions to be charged out
  - easy to distinguish and to allocate?
- E.g: MO submits simple bid and offers,
  - removes price uncertainty, but charge imbalances
- May require that capacity charges are adjusted to better reflect value (availability, scarcity etc)
- Real time adjustments should be suitably rewarded

Does good market design drive out bad or v.v.?

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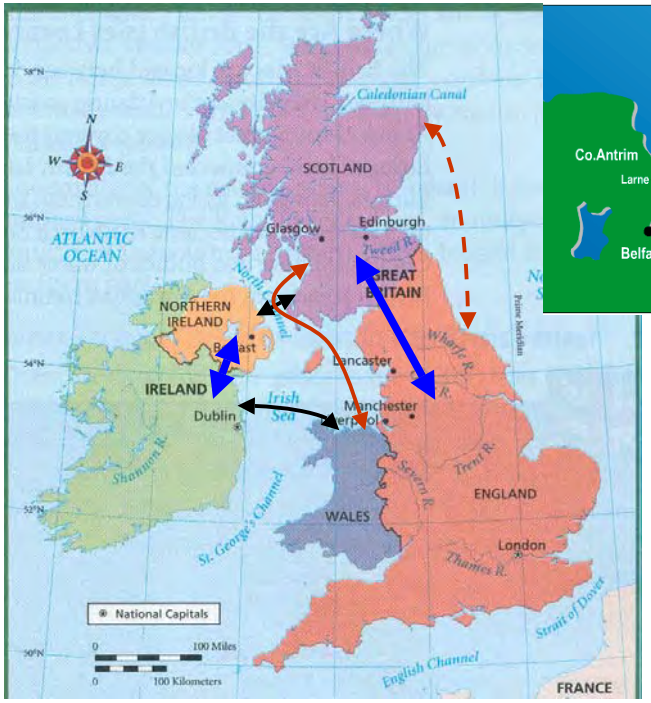
Price splitting

- TEM requires identifying significant constraints
  - cost of counter-trading outweighs liquidity benefit
- candidates: Cheviot boundary and NI-RoI?
- Interconnectors join SC-NI and RoI-E&W
- High wind: flows SC=>NI=>RoI=>E&W?
- "Bootstraps" NI=>SC=>E&W=>RoI?



4 possible zones
SC, NI, RoI, E&W
Congestion?
SC-NI
NI-RoI?

"Bootstrap"
Constraint

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Conclusions

- TEM coupling forces improved use of interconnectors - possibly worth € 2-5 bill/yr to EU
  - good progress in realising these gains
- Transmission investment highly valuable
  - first half delivers most of benefits but even that is challenging
- Market design not best suited for all countries
  - still need to resolve capacity payments, nodal pricing

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Acronyms

BETTA	British Electricity Trading and Transmission Arrangements
CPF	carbon price floor
CWE	Central West Europe
DA	Day ahead
EMR	(UK) Electricity Market Reform
EPS	emissions performance standard
ETS	Emissions Trading System
EUA	EU Allowance for 1 tonne CO_2
E&W	England and Wales
FTR	Financial Transmission Rights
IC	Interconnector
MA	Moving average
MIBEL	Market of Spain and Portugal
MIP	Market Index Price (prompt PX price)
NL	The Netherlands
RES	Renewable Electricity Supply
SC	Scotland
SEM	Single Electricity Market for Ireland
TEM	Target Electricity Market

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References

Booz & Company, D. Newbery, G. Strbac, D. Pudjianto, P. Noël, and LeighFisher, (2013) *Benefits of an Integrated European Energy Market*, Draft Report for DG ENER

Mott MacDonald (2013) *Impact Assessment on European Electricity Balancing Market*, Draft Report for DG ENER