

Market Design for a low-carbon future

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The slides in red are comments to help people reading this presentation on the web see how the sections run into each other, but were not part of the presentation as given

Disclaimer

The views in this presentation are those of Professor Richard Green, and are not necessarily those of Fingrid Oyj or of the partners in the Supergen Flexnet Consortium

The first few slides just set the scene, and point out that markets both send signals and move money around



What is a market *for*?

- Choosing how much to produce
- Choosing who gets to produce
- Choosing who gets to consume
 - These are all about *information*
- Moving cash from consumers to producers
 - This is unfortunate (and essential)

Information, Prices and Markets

- No-one can know everything
- Prices summarise what you don't know
- In most markets, you see a price and respond on the basis of private information
- In many electricity markets, you give out your private information as a price

These slides are a defence of the marginal pricing market mechanism (as opposed to pay-as-bid) – the pictures are an animation sequence (which may not work fully on the web) showing how the bid will change when the rules do, and how pay-as-bid can lead to mistakes



Trading oil

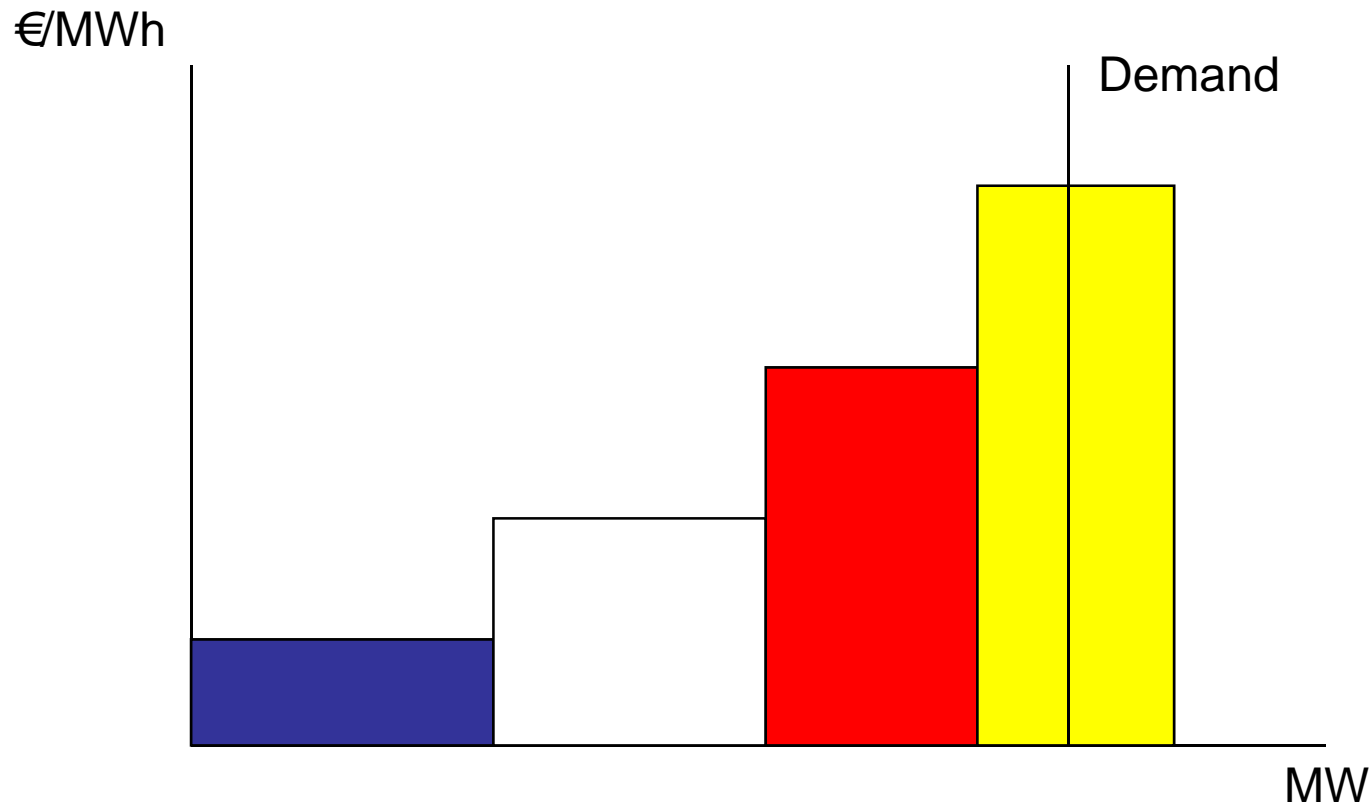
- Companies buy and sell in bilateral deals
- Prices get reported
- I'll sell if the market price is above what the oil is worth to me (my production cost)
- Forward and futures markets give hedges



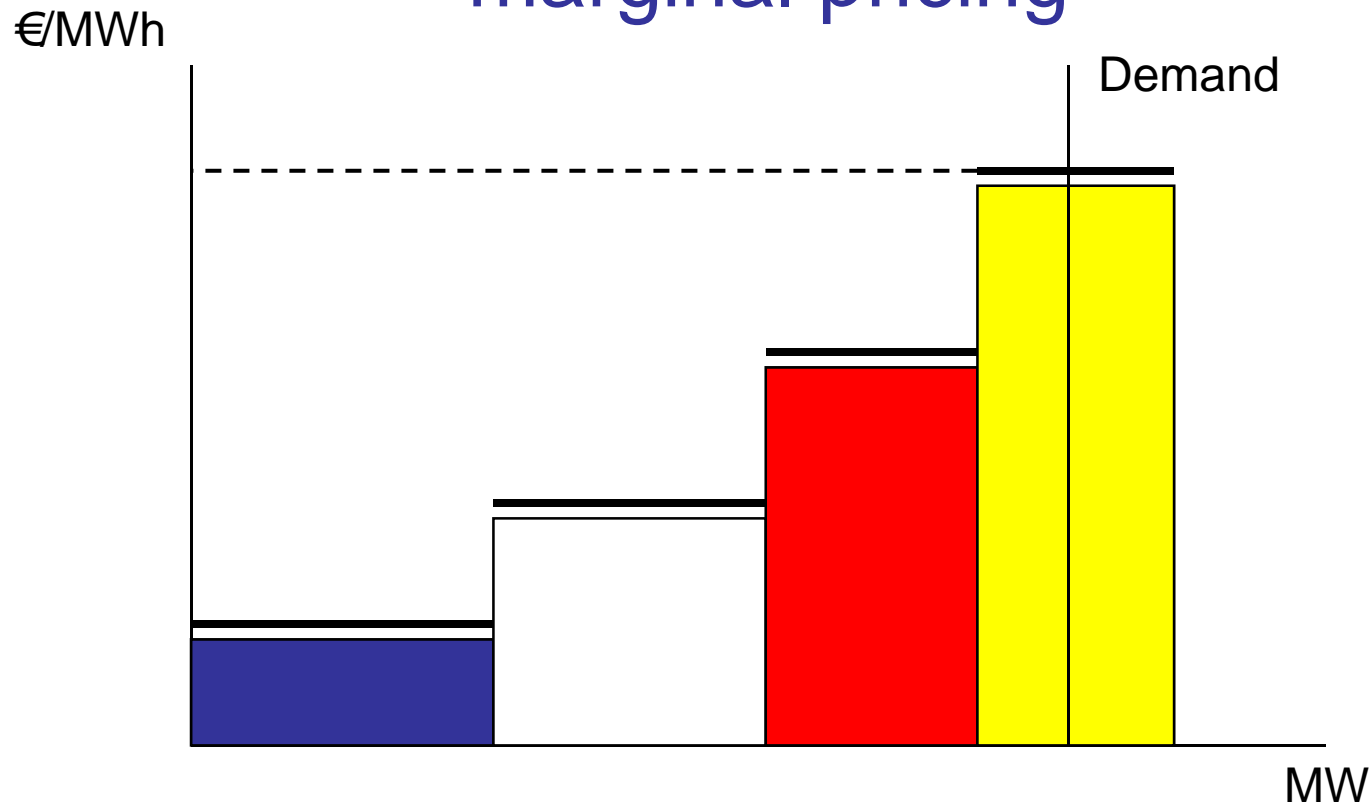
Trading power

- Many deals are still bilateral – buyer and seller agree a price
- Most markets also have an auction
- Generators offer prices; buyers may bid actively

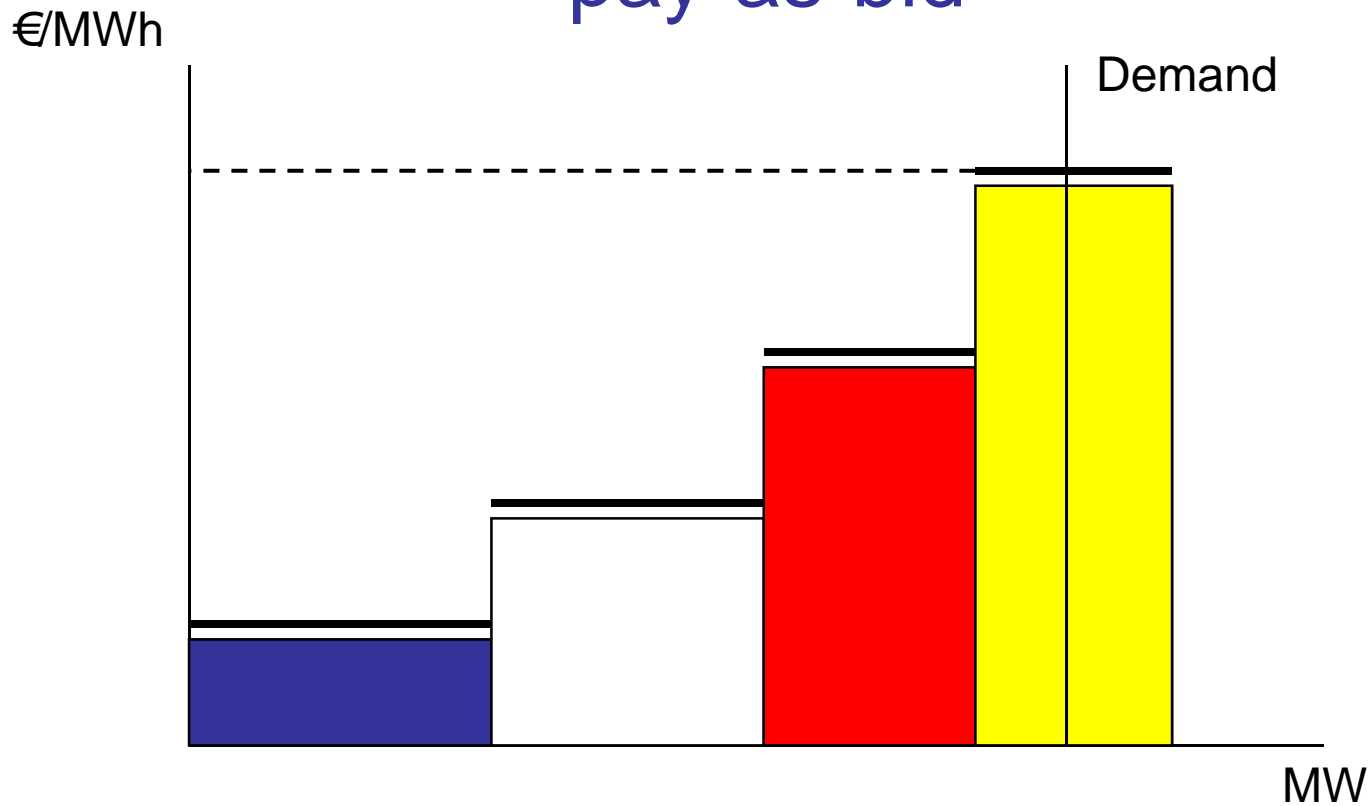
Producing electricity



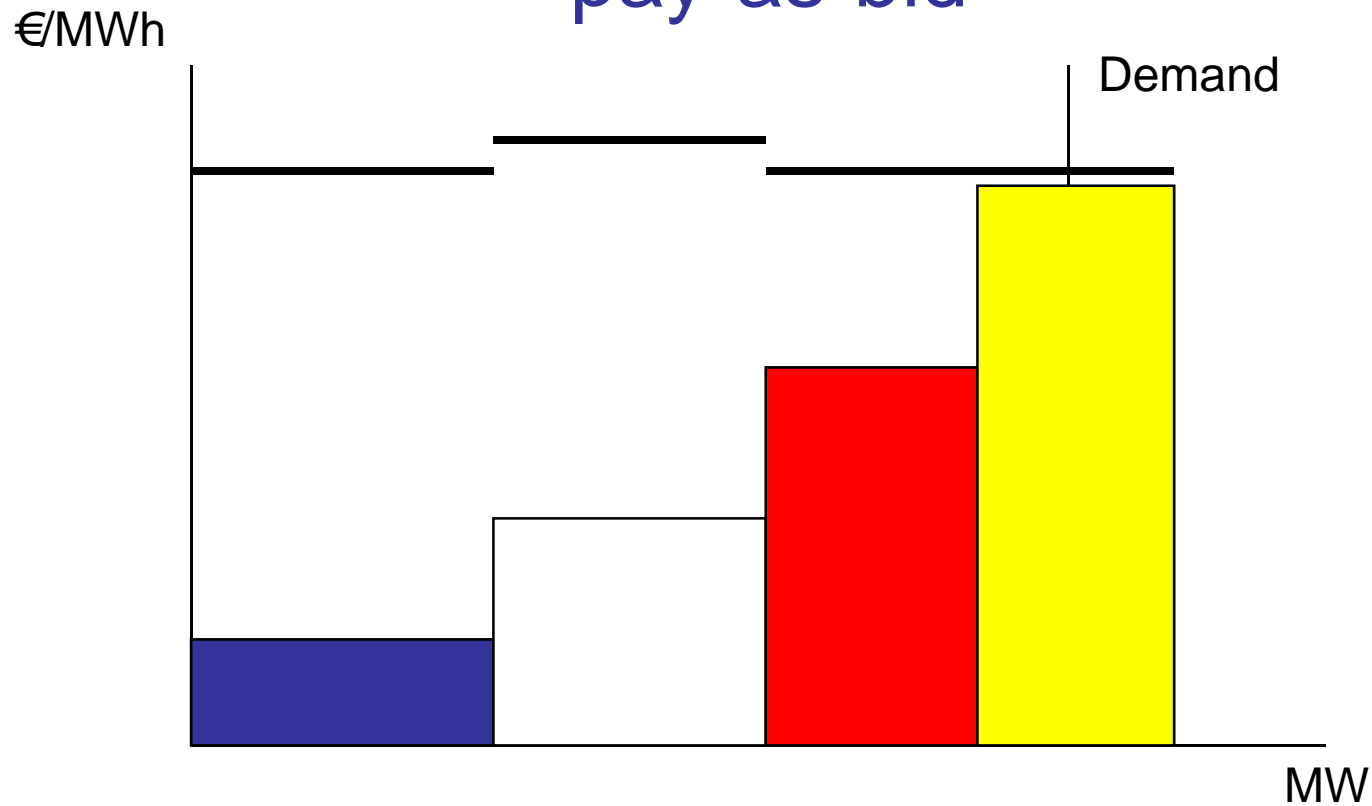
Bidding in an auction “marginal pricing”



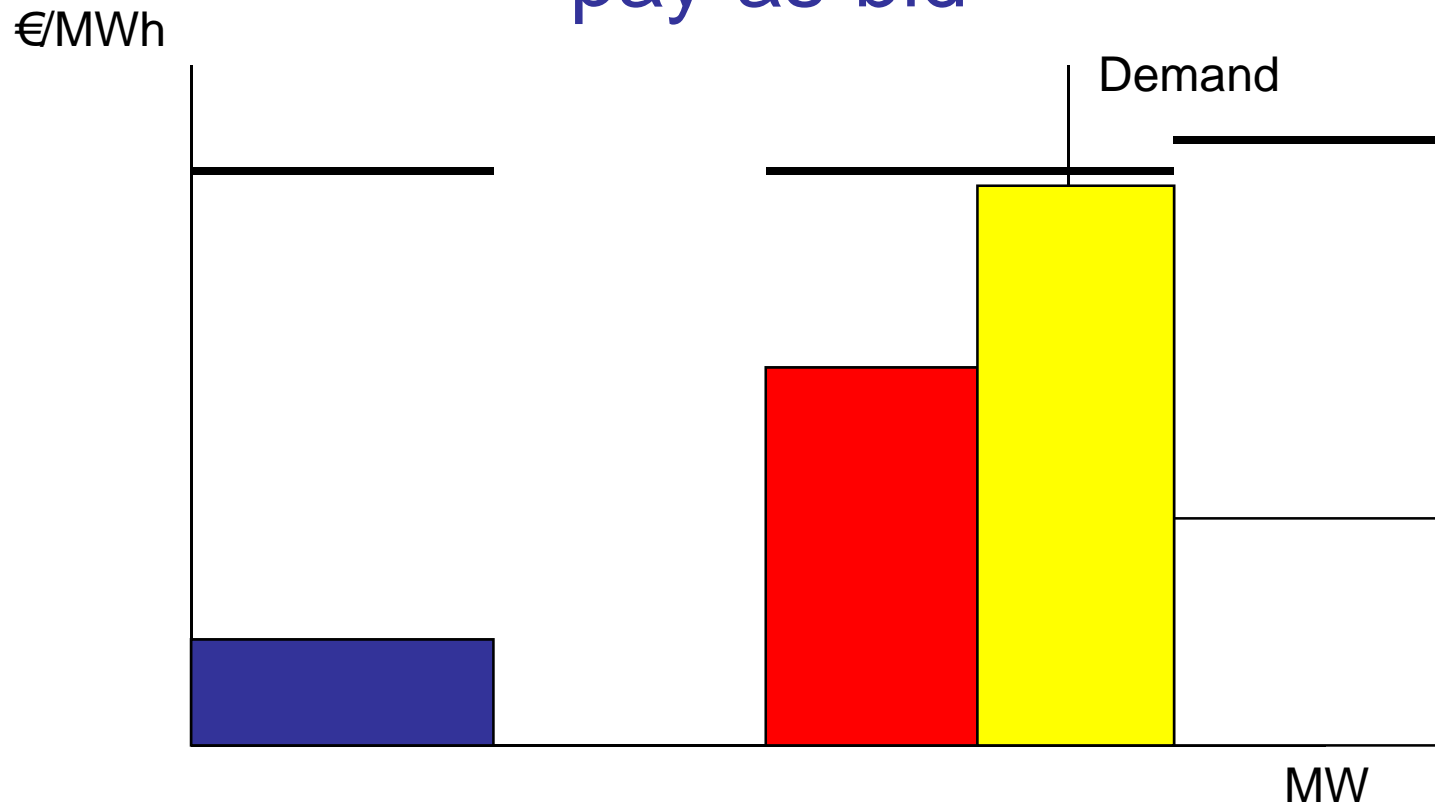
Bidding in an auction “pay-as-bid”



Bidding in an auction “pay-as-bid”



Bidding in an auction “pay-as-bid”



These slides introduce the concept of “economic rent”, given that changes to markets often mean that rents are going to be moved around

Economic Rents

- Low variable-cost generators make a surplus as the market price exceeds their variable costs
- It's hard for the market to get rid of these surpluses
- We may need them to cover fixed costs
- If not, we call them economic rents

Sources of rent



Sources of rent

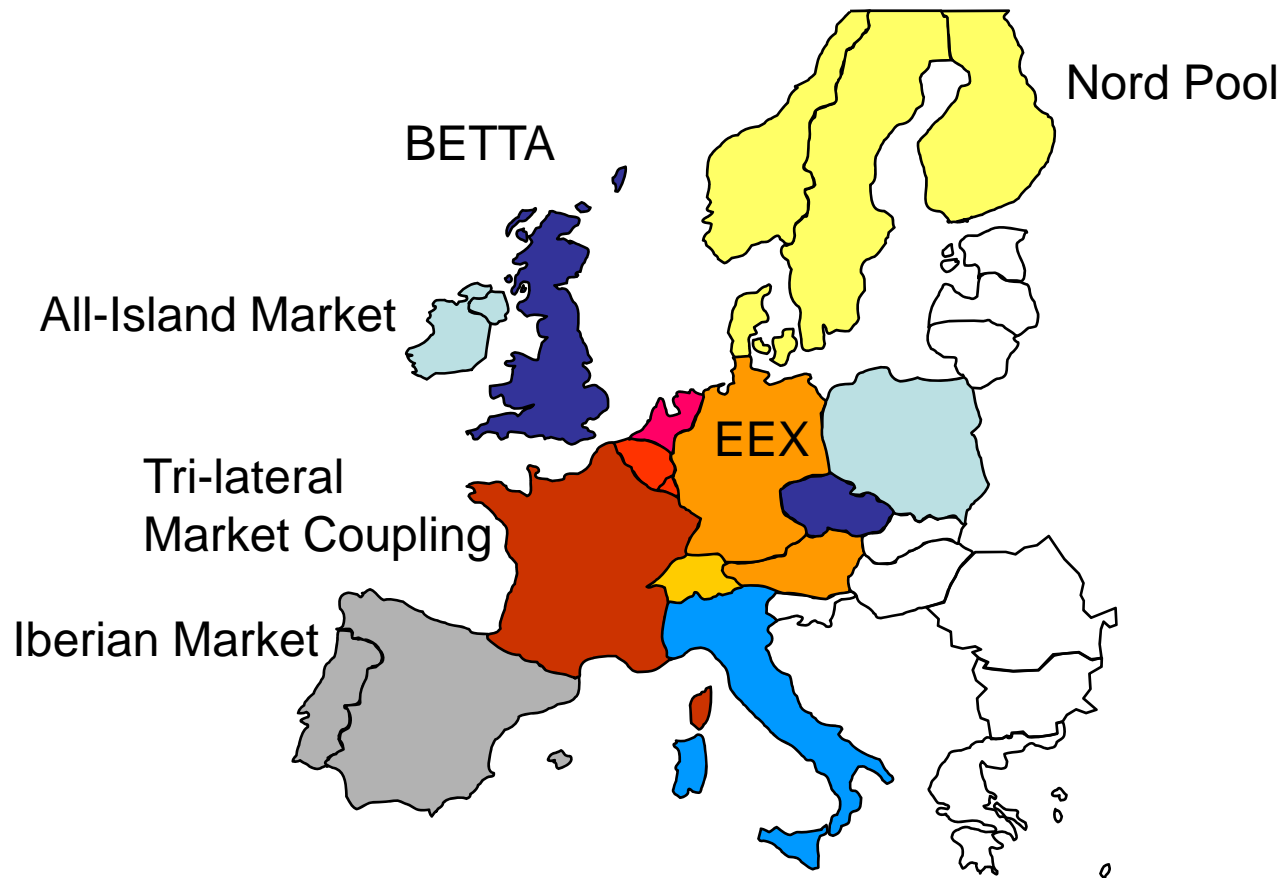


Should we get rid of rent?

- It's hard to change the market rules to eliminate rents
 - The Revenue Equivalence Theorem says that any efficient auction mechanism will lead to the same expected payments
- Even if we did take the rents from the producers, who then gets them?

The next few slides are a quick
description of the current EU markets for
electricity

Europe's electricity markets



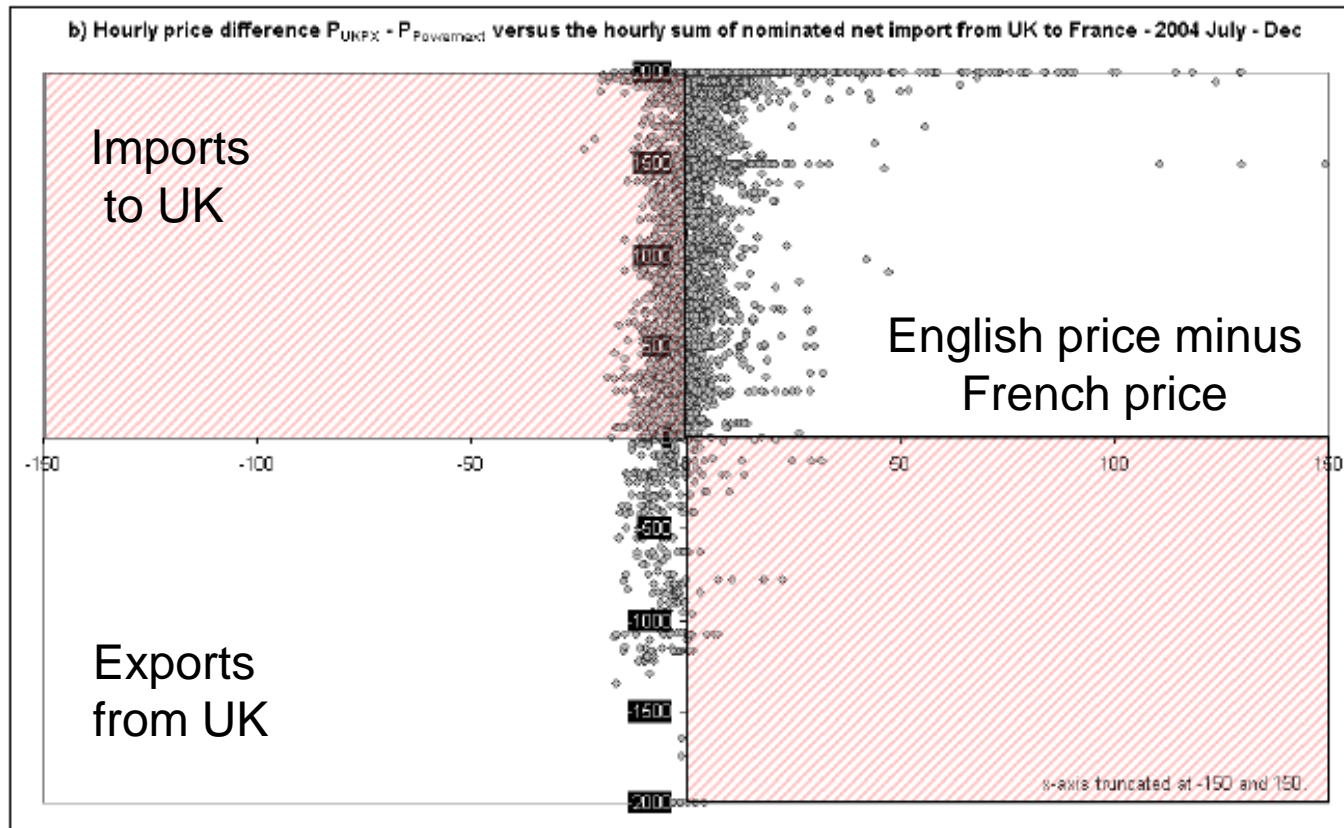
European Markets

- Power Exchanges run markets for energy, mostly voluntary day-ahead auctions
- Forward markets exist to hedge these
 - Financial hedges or physical trades
- Transmission companies acquire ancillary services, resolve constraints (usually by counter-trading) and balance in real time

Dealing with geography

- Most markets have a nationwide-price
 - Norway and Italy the main exceptions
- Market coupling allows two nations to share a price if the border is not congested
- With congestion, different prices signal the best solution
 - Sends power where it is valued most
 - Older ways of allocating capacity may not

Errors in Interconnector use



DG Competition, Energy Sector Inquiry, fig 64



Paying for capacity

- Iberia and the All-Island Market have explicit payments for capacity
- Most system operators buy reserves
- Will energy prices rise when capacity is short?
- Do generators make their money across their portfolio?
- Do integrated electricity firms need to make their money in generation?

What will happen as we move to a
lower-carbon future?



A low-carbon future

- EU Target of 20% renewable energy

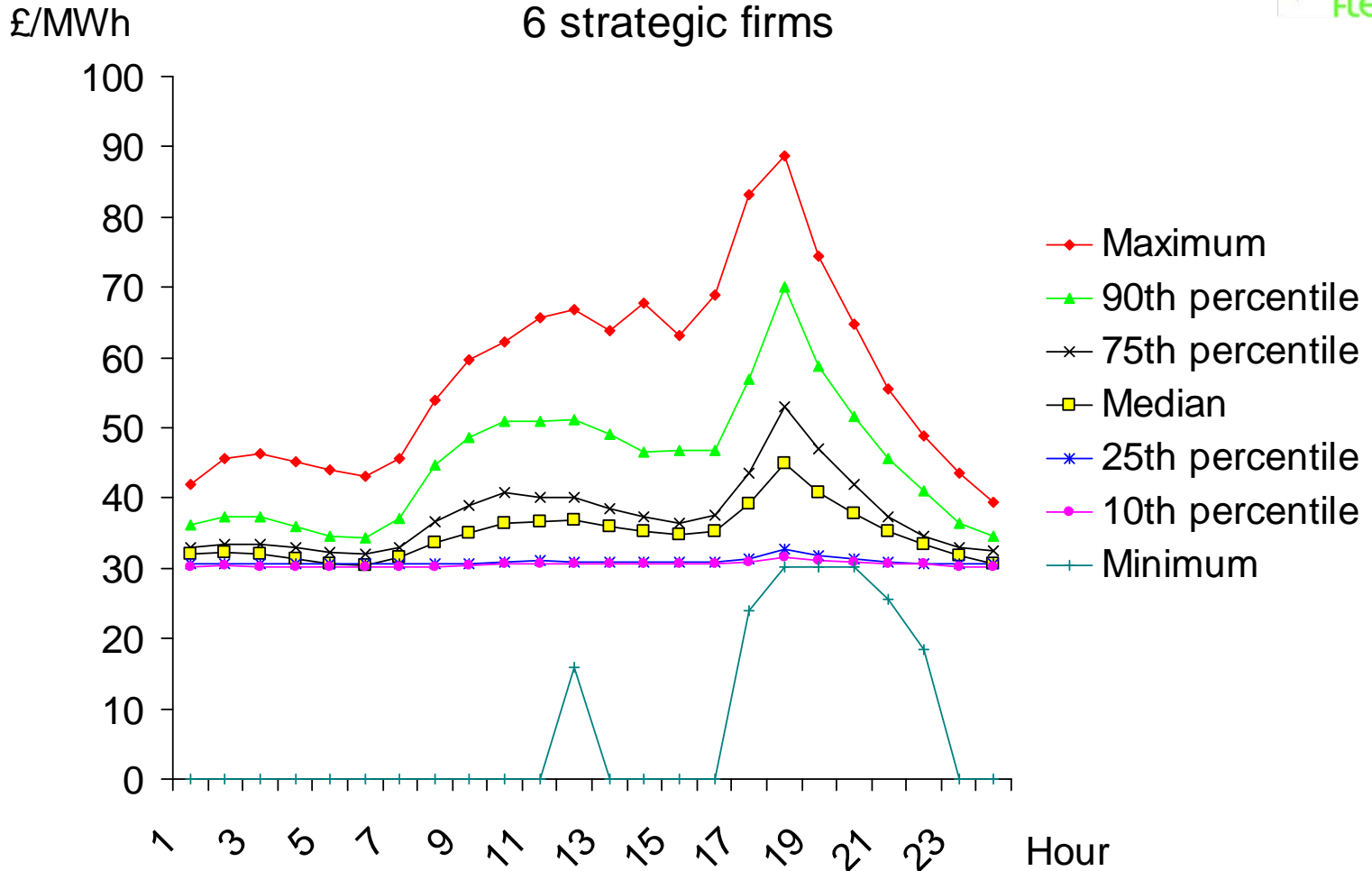
TWh/year	now	2020
Wind Power	60	350
Biomass generation	60	450
Renewable Electricity	440	1250

Poyry, 2008 report to BERR on costs of the 20% target

Implications for the system

- Wind generates when the wind blows
- CHP generates when heat is wanted
- Net load more variable, less predictable
- More short-term reserve needed
- More generation capacity needed
- (Some) more transmission needed

Price variation due to wind - January 6 strategic firms



Simulation of Great Britain in 2020 by R J Green and N Vasilakos, University of Birmingham

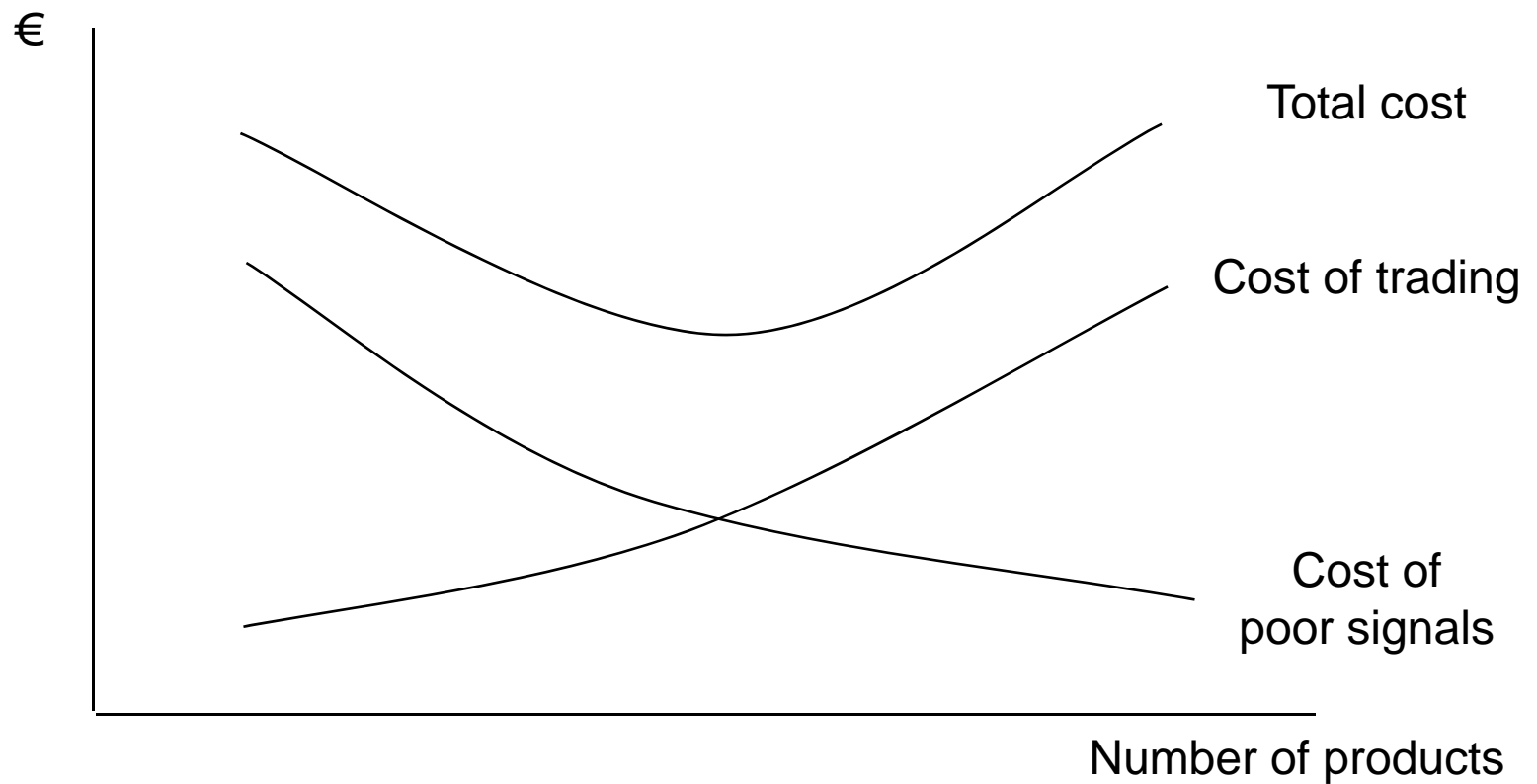
Should we move to zonal prices
within countries?



Bigger or smaller markets?

- There may be times when we can move power from surplus to deficit areas
 - Create a bigger market to make this easier
- There may be times when a smaller area is transmission-constrained with a surplus or deficit
 - Signal this clearly with a local price
- One market can set more than one price!

How many products?



Implications for market design: Geography

- Marginal cost of power becomes more volatile over space and time
- This raises the cost of poor signals
- Implies we need more “products”
 - In other words, smaller price zones

Thin, volatile, markets?

- Some zones may have few generators
 - These *already* have market power
 - A transparent system may reduce it
- Prices may differ between zones
 - Hedging these differences is relatively easy
 - Market participants face equal and opposite risks



“Free” electricity?

- Could the price sometimes drop to zero?
- Is this the right price?
- Can we protect incumbents’ expectations?
- What about the long term?

Do we need something else to pay
for capacity?

Implications for market design: Capacity

- More stations run only for short periods
 - Will they cover their costs from energy and reserve market revenues?
 - Are the risks symmetric?
- Should we have an explicit market for capacity to make sure?

Capacity markets

- Need to run several years in advance
 - Means entrants can bid to build plant
- Need to be price-sensitive
 - Safety value against excessive prices
- Need to take location into account
 - Not all plants are equal, given transmission constraints



Will market integration create winners and losers?

In some cases, particularly in the short run, but we can compensate the latter with appropriate contracts



Market integration

- Bigger markets are usually more efficient
- More choices mean better value
- More pressure to perform
- Better investments in the long run

Impact on prices

- In future, most EU countries will make similar *marginal* investments in generation
- Electricity prices should let this investment recover its costs
- Long-term prices will become more similar
 - Whether or not markets are formally joined

Disruption in the short run?

- Any change to market rules can change prices, creating winners and losers
- This need not be a problem
- Agree long-term contracts that preserve rents but send the right marginal signals
 - Fixed-price, fixed-volume, sales contract

Conclusion

- A low-carbon challenge
- Electricity markets can respond
- We need
 - More accurate price signals
 - New ways to pay for capacity
 - To avoid creating losers unnecessarily

