

# UK TRANSMISSION CONGESTION PROBLEM: Causes and solutions

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# Outline

## Congestion issues in the GB electricity market

- Congestion management and congestion costs
- Concerns of market power in the BETTA market and MPLC

## Incentives induced by the balancing mechanism

- Competitive bidding benchmark in presence of constraints and market power

## The best way to address these issues

- Market Power License Condition
- Efficient congestion management system



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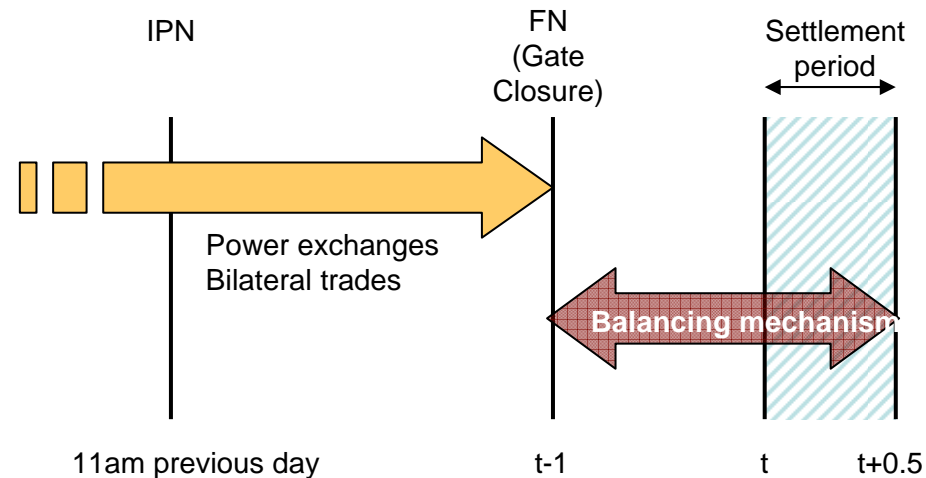
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# Congestion management in the GB



## Re-dispatch approach

- Bilateral trades performed assuming no transmission constraints up to t-1 hr
- Constraints are addressed in the Balancing Mechanism from t-1
- National Grid accepts offers to increase output in import-constrained areas
- National Grid accepts bids to decrease output in export-constrained areas
- Accepted offers/bids receive/pay the value of their bid

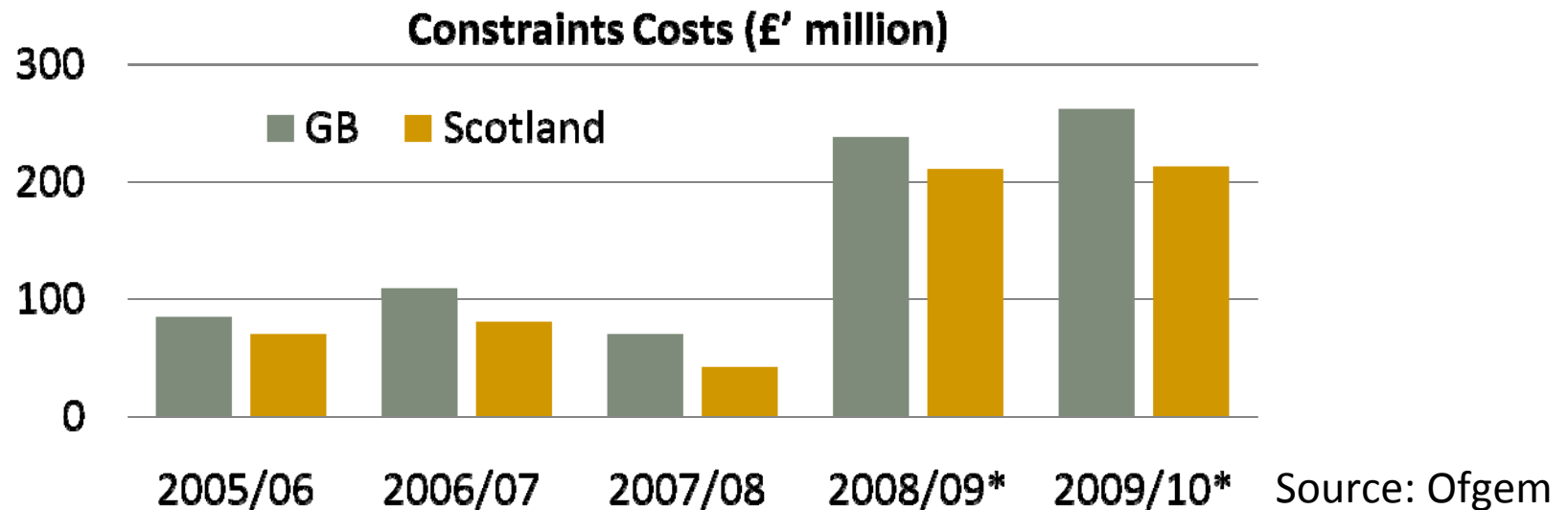
## Recent congestion costs in GB

Most congestion occurs on the Scottish border (Cheviot Boundary)

- Mostly in the direction from Scotland to E&W – export constraint

Constraint costs out of control

- Constraint costs increased over 3 times since 2005
- Constraint costs in 2008/2009 and 2009/2010 unprecedented and unexpected
- Constraint cost forecast for 2008/2009 doubled over a year



# Adverse bidding behaviour during congestion

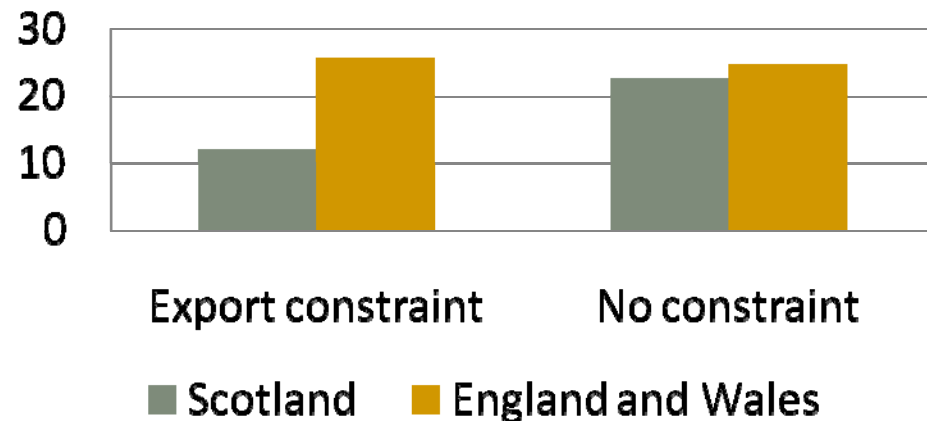
## Export constraints

- Scheduling uneconomic plants in the forward market
- Submitting balancing bids at low or negative prices

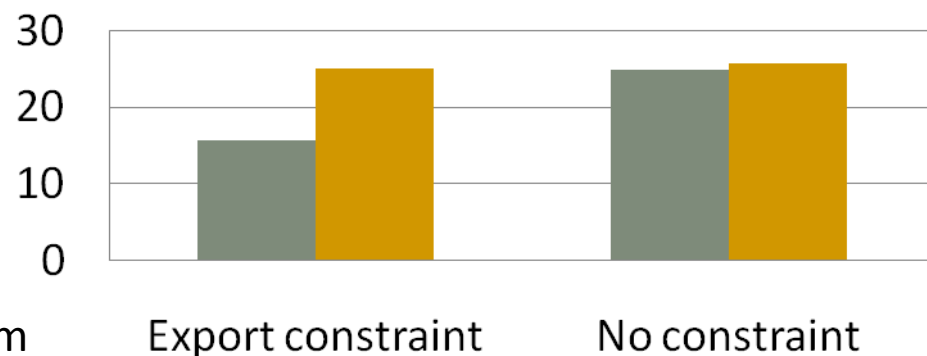
## Import constraints

- Failure to schedule plants in the forward market
- Submitting balancing offers at excessive prices

**Accepted bids, 2005-2008**  
coal units

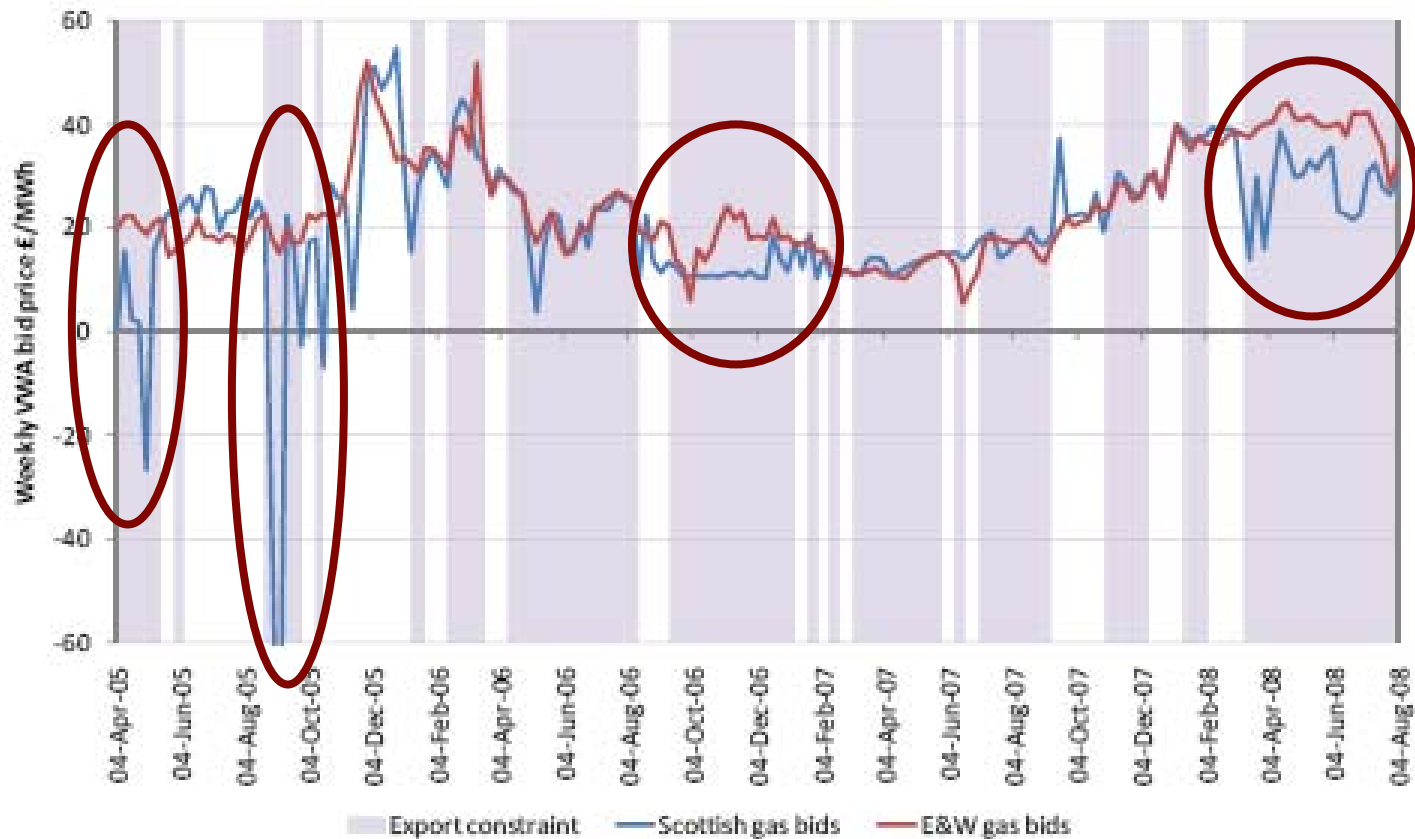


gas units



# Bidding incentives during congestion

Export constraint

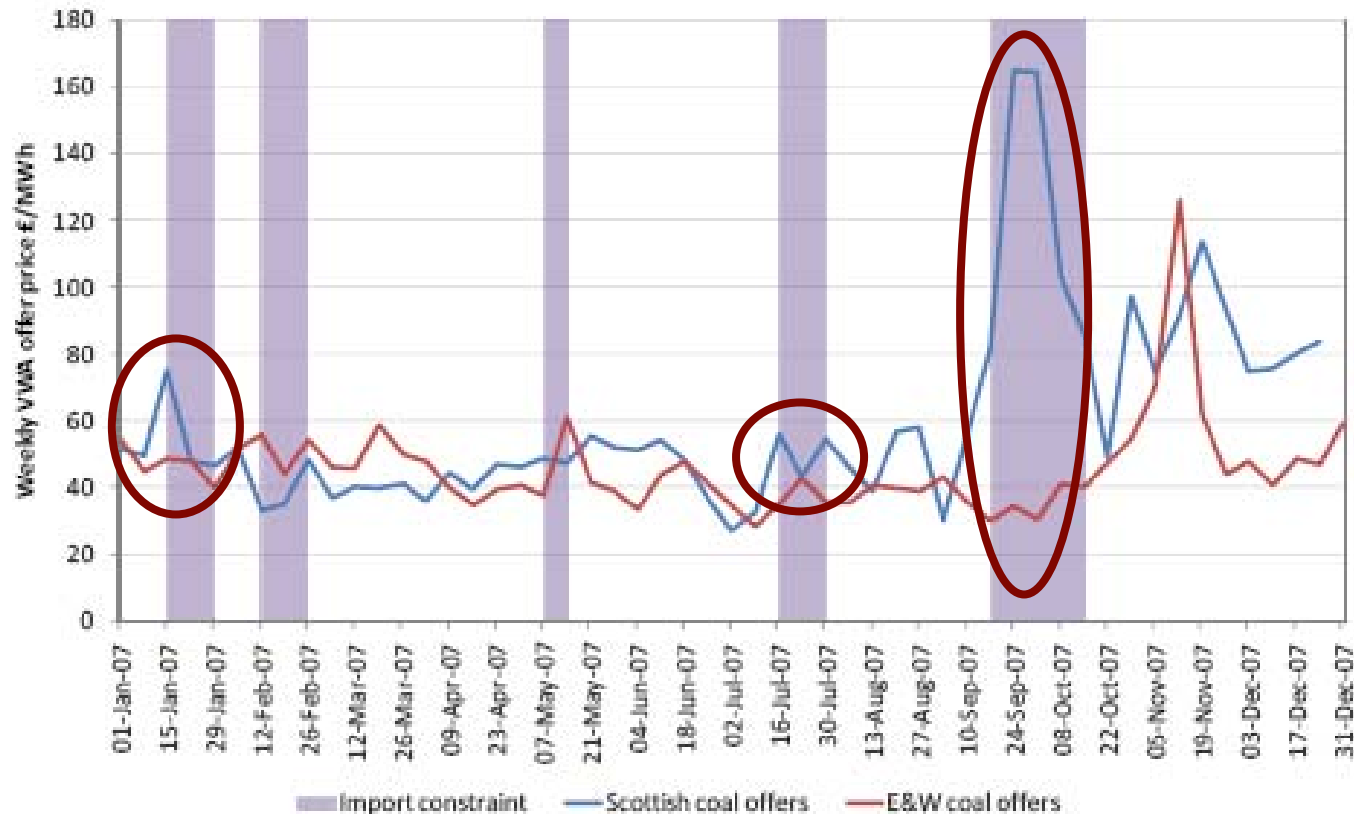


Source: Ofgem

1 February, 2010

# Bidding incentives during congestion

Import constraint



Source: Ofgem





# Market power concerns

Observed bidding behaviour is often interpreted as exercise of market power

- Ofgem ran an investigation of the bidding behaviour in Sep-Oct 2007
  - SP and SSE did not schedule plants in the forward market
  - High offers from these plants were then accepted by NG in the BM
- Ofgem considers introducing a Market Power License Condition on generators
  - Facilitates ex-post investigations of generator's behaviour and sanctions
- Market power exploitation defined by MPLC
  - **Output manipulation.** Scheduling plants “out of the money” in the forward market in export-constrained areas and not scheduling plants “in the money” in import-constrained areas
  - **Exploitative BM bidding.** Submitting unduly high offers or low bids as compared to similar plants on the opposite side of constraint

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# Competitive incentives induced by the BM

When congestion becomes persistent

Re-dispatch mechanism dramatically modifies bidding incentives

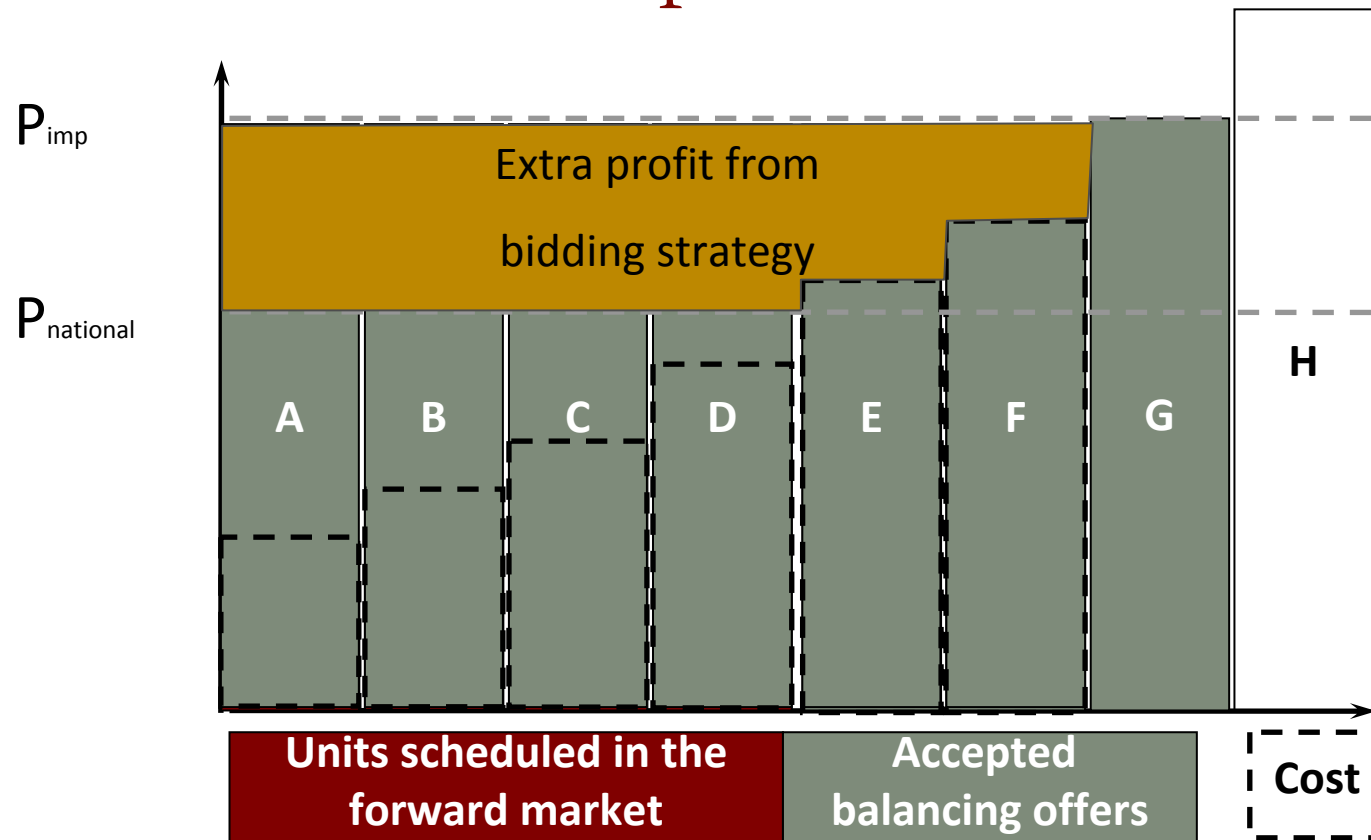
Reasons:

- Arbitrage between two markets that use different transmission models
- Pay-as-bid nature of the Balancing Mechanism

Re-dispatch congestion management sets different competitive bidding benchmarks on opposite sides of the constraint

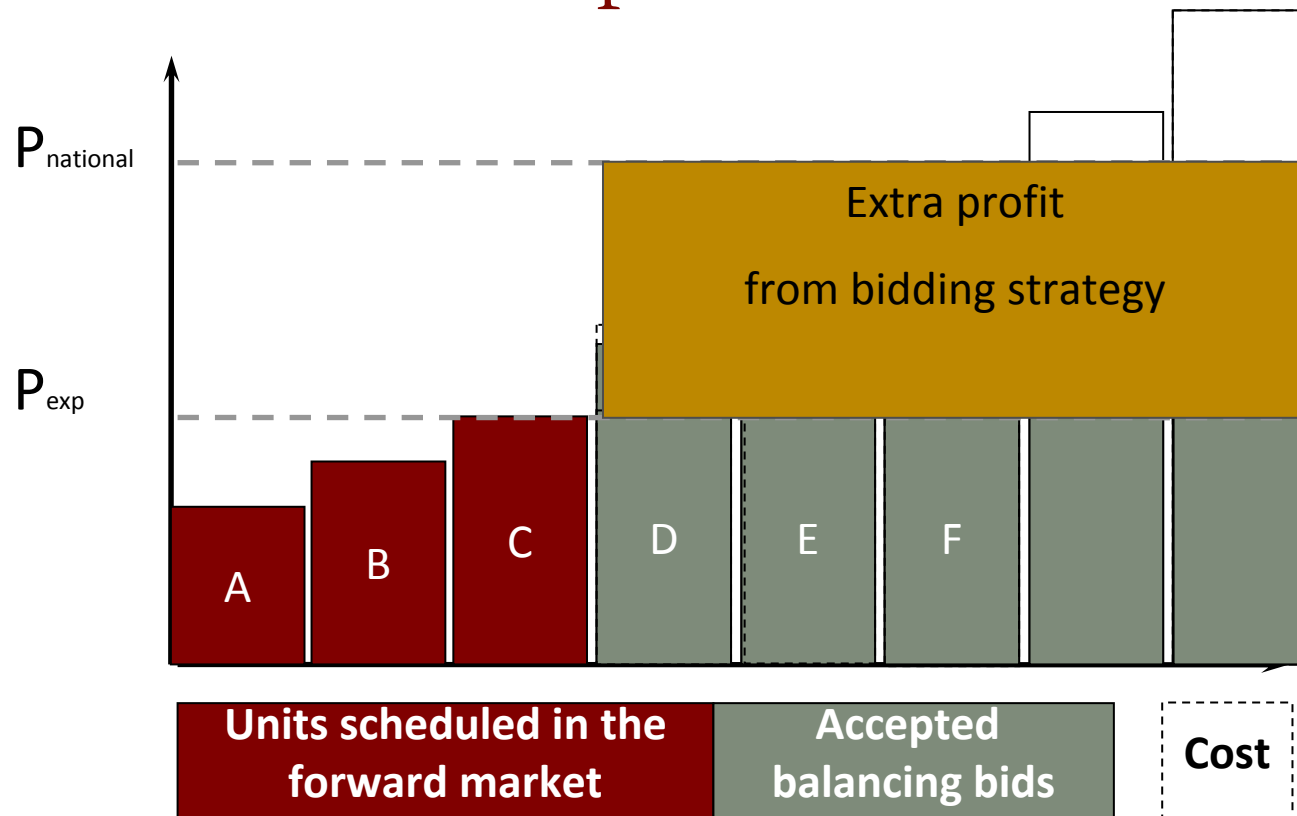
Competitive bidding benchmark in each location is set at the marginal cost of the most expensive running unit in this location after re-dispatch as expected by generators

## Incentives in the import-constrained area



- The cost of the last economic unit running in the import constraint area sets the new competitive bidding benchmark both in the forward market and in the BM for all units in the area with costs below this level

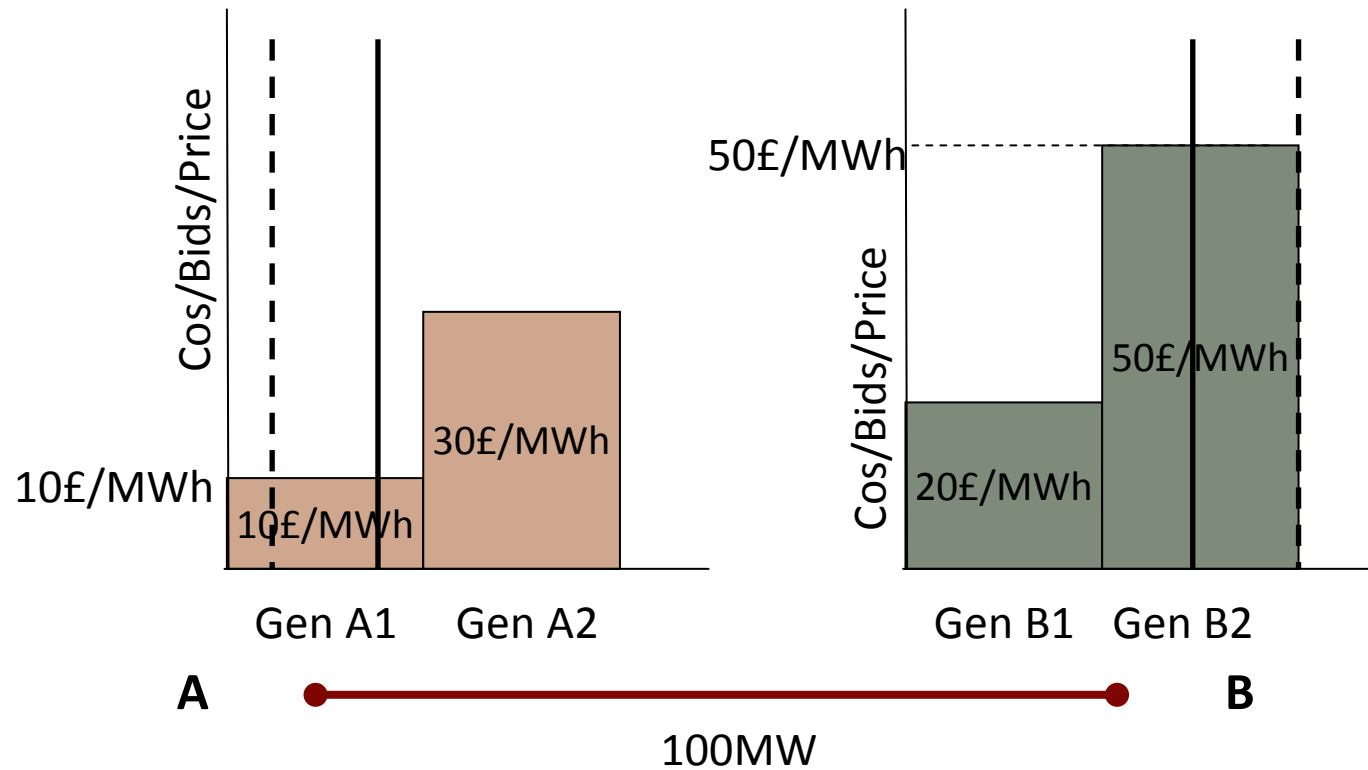
## Incentives in the export-constrained area



- The marginal cost of the last economic unit running in the export constraint area sets the new competitive bidding benchmark both in the forward market and in the BM for all units in the area with costs above that level

# Impact on the market outcome

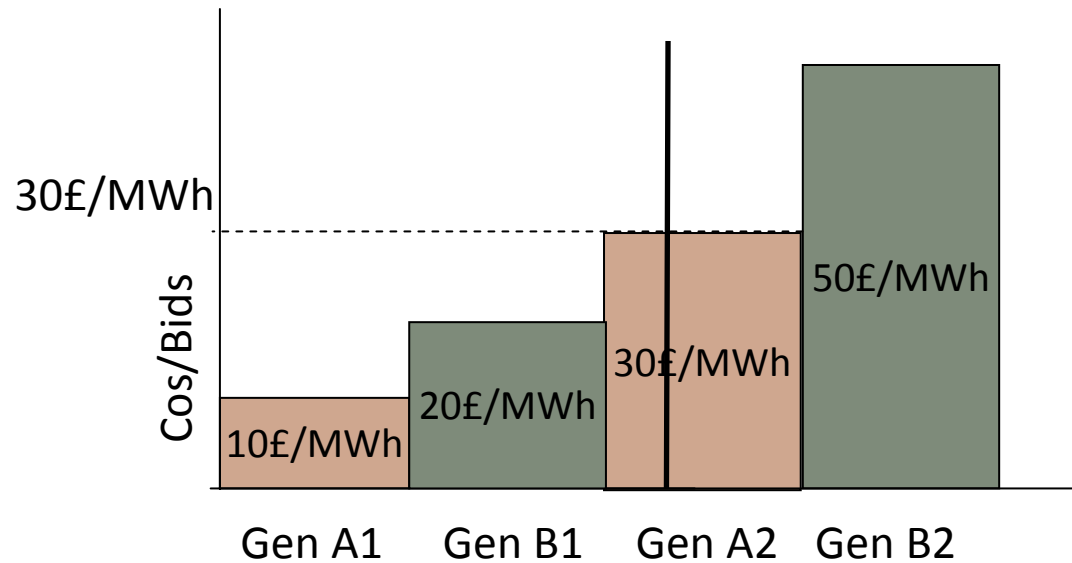
## Cost-minimizing dispatch



- At A, 150MW from Gen A1, marginal cost £10/MWh
- At B, 300MW scheduled, marginal cost £50/MWh

# Impact on the market outcome

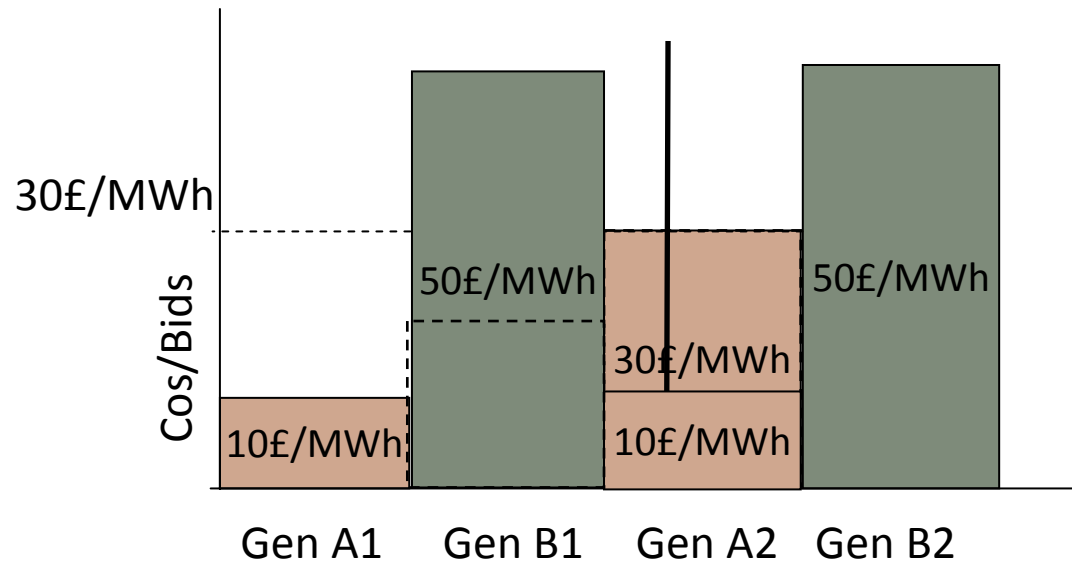
## Cost-based bidding



- Market price 30€/MWh
- Re-dispatch of 100MW from B to A is needed
- The cost of re-dispatch to relieve the constraint is £3000

# Impact on the market outcome

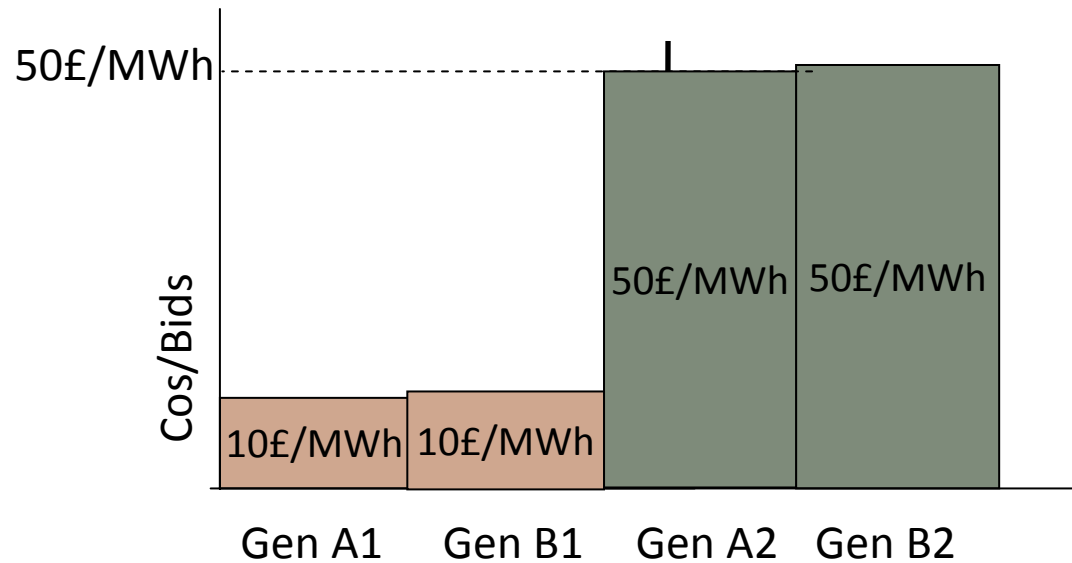
## Induced bidding





# Impact on the market outcome

## Induced bidding

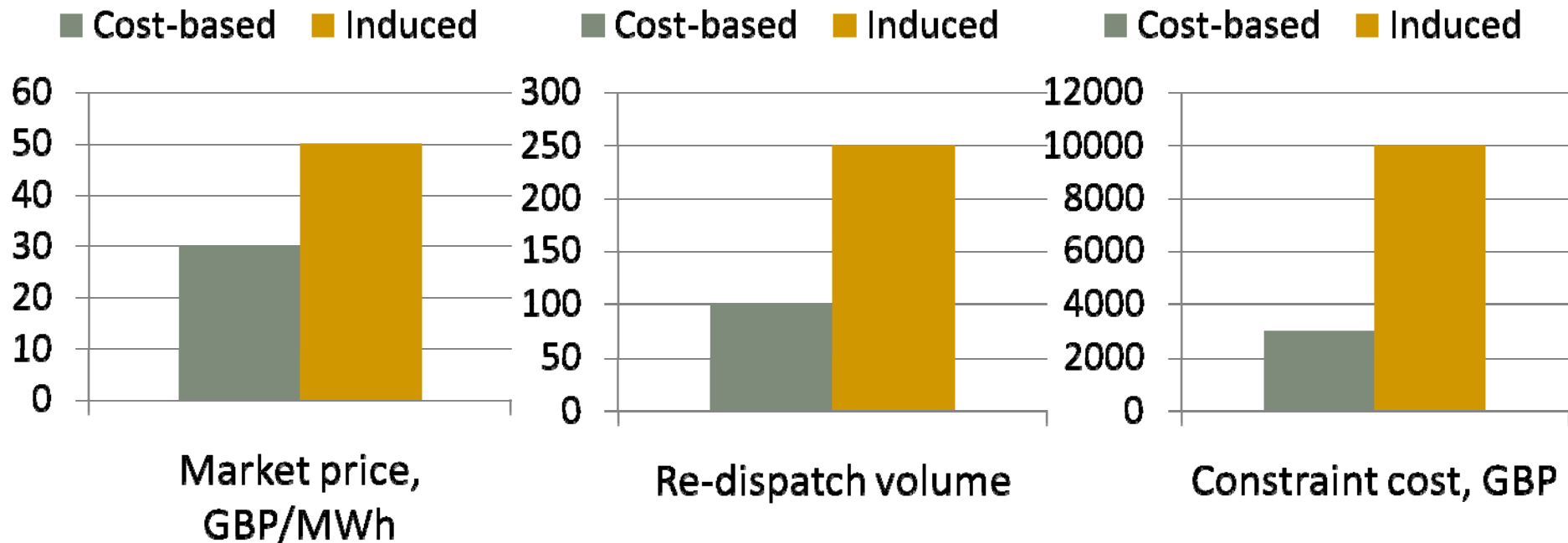


- Market price 50€/MWh
- Re-dispatch of 250MW from B to A is needed
- The cost of re-dispatch to relieve the constraint is £10000

# Impact on the market outcome

## Summary

Incentives followed by generators expecting constraint situation have adverse impacts on market outcome



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# Addressing the issue through MPLC

Limiting this behaviour because it is “market power exploitation” is wrong since this behaviour can be observed in very competitive markets

- Output manipulation (shifts between the forward market and BM) is the result of the arbitrage opportunities created between two markets using different transmission models by consistent congestion
- Exploitative bidding cannot be established based on the bids of comparable plant on the opposite side of constraint.

## Market power

- Is still a real threat and can further exacerbate the situation
- It is difficult to distinguish market power from competitive behaviour in the context of re-dispatch congestion management
- E.g. estimating the correct competitive benchmark in presence of constraints could be difficult:
  - Requires computing locational system marginal costs
  - Generators may have different expectations about it

# Congestion management without adverse bidding incentives

## Markets with locational prices

- Congestion management integrated with market clearing
- In case of congestion different prices are set at different locations, generally lower prices in export-constrained and higher in import-constrained areas

## No adverse incentives

- No arbitrage created by successive markets using different transmission models
- No pay-as-bid payments

## Examples

- Zonal markets: Italy, Nordpool, TLC
- Nodal markets in the US

**Many of the US markets have introduced the nodal system after experiencing problems similar to those in the GB**

# Modifications in the GB market design

## TAR models and locational BSUoS

### Several relevant recent proposals for modification of the GB market design

- **Transmission Access Review.** Some proposals involved auctioning the rights to use available transmission capacity among generators in export-constrained areas
- **Locational BSUoS.** Make generators behind the constraints responsible for the cost of congestion.

### However

- None of the proposals completely remove the arbitrage between the two markets when constraints are expected
- None of the proposals remove the pay-as-bid component
- Very specific to Scottish export constraint, and can be hard to generalize in case if other constraints become important.



## Conclusion

- Re-dispatch congestion approach modifies bidding incentives when congestion becomes consistent.
- These incentives are competitive they, but they still have negative impact on market outcomes
- Since the incentives are competitive, it may not be correct to deal with the issue by MPLC
- May require a major revision of market design towards a form of locational pricing
- Congestion problems like those now in GB have caused many electricity markets to change the market design and introduce locational market