Outline

• Misperceptions on security of supply
• The EMR Capacity Mechanism
  – Justification and criticisms
• Long-term future of capacity markets

Who should decide on capacity adequacy?
How to allocate risk and incentivize investment?
Security of supply

- Ambitious RES targets increase intermittency
  - Need flexible peaking reserves
  - Normally comes from old high cost plant = coal
    - Large Combustion Plant Directive 2016 limits coal
    - Integrated Emissions Directive further threat to coal
    - Carbon price floor + hostility to coal => close old coal
  - high EU gas prices and low load factors
    - gas unprofitable, new coal prohibited by EPS

- Future prices now depend on uncertain policies
  - on carbon price, renewables volumes, other supports
  - on policy choices in UK and EU

hard to justify investing in reliable power
What is the problem?

Ofgem’s derated capacity margin

System Operator’s problem

First Capacity Auction delivery

Source: DECC IA
Security of Supply

• Measured by Loss of Load Expectation, LoLE
  – 3 hours per year => Value of Lost Load = £17/kWh
• But spot and balancing prices capped
  – Balancing actions costs will increase to £6/kWh
• Missing money = (£17/-£6/kWh) x 3 hrs/yr = £33/kW yr
=> Pay-as-clear descending clock auction in 2014 for 2018/19
• New build gets 15 yr contract at auction price
  – existing plant: 1 yr contract unless major refurbish
    • must be price taker unless good cause, entrants set price
    • existing plant can delay until later auction (2017)
• DSR auctioned from 2016: 1 yr contracts
Illustrative auction demand curve

- **Price (\(\text{\£}/\text{kW year}\))**
  - Cap: £75/kW year
  - Net CONE: £49/kW year
  - Price taker threshold: £25/kW year

- **Capacity**
  - Minimum: 1.5GW
  - Target: 1.5GW
  - Maximum

- **Source**: DECC IA
What does “Loss of Load” mean?

Market supply

Demand exceeds

Exceeds demand

Supply available in the normal market operation up to Balancing Mechanism

New Balancing Services

Voltage Reduction – up to 500 MW

Maximum Generation – up to 250 MW

Emergency Services from interconnectors – up to 2000 MW (depending on direction and size of flows)

Controlled Disconnections

Actions that would take place during loss of load events

These actions have lower cost/value than £17/kWh

Cost of “energy unserved” = £17/kWh

Figure 12: Combined cost of energy unserved and procured capacity against capacity to procure

Amount to procure = 53.3 GW

But these cost less than £17/kWh

Source: National Grid (2014, p50)
Interconnectors and coupling - status 2014

GB coupled to NWE 4/2/14

Existing

Due 2016-19

SWE coupled to NWE 13/5/14
Interconnectors and capacity markets

- Interconnectors increase security of supply
  - provided they are free to respond to scarcity

  $\Rightarrow$ they should displace **domestic reserve capacity**
  - Poyry estimates 50-80% for GB
  - France imported 9 GW at 2012 Feb stress moment

- EU Third Package aims at **Single Market**
  - Single auction platform for day ahead and intra-day

- But GB is aiming at **autarky** for capacity!

**Reluctance to rely on imports $\Rightarrow$ over-procure**

  $\Rightarrow$ reduce cross-border price differences
  $\Rightarrow$ undermine interconnector investment
Trading with capacity markets

• Day-ahead supply and demand bids to Euphemia
  – Adjustments via intra-day and balancing
• Efficient capacity design drives out inefficient design if no price cap
  – If price reflects scarcity then willing to buy or sell
    • If not then face inefficiencies
  – But DA Euphemia capped at €3,000/MWh
• The key to efficient trade is how to ration at cap

Ensure spot price or allocation is efficient
⇒ hedge with Reliability Options
Optionality

- 2014 auction is for delivery in 2018/19
  - Allows time to build CCGT
- But information about future D & S uncertain
  - Especially DER and DSR

=> retaining flexibility has option value

- If planning and connections secured CCGT can be built in 2 years (2,000 MW Teeside in 27 months)
  - OCGTs can be built even faster

=> procure less now, more later
• Unstable policy environment and uncommercial low-carbon generation make investment risky
• Capacity markets can reduce investment risk
• GB capacity auction seems a good design
• Except that nervous politicians decide quantity

=> Amount procured seems excessive
  – Influenced by bogey of “Loss of Load”?
  – Ignores interconnectors and optionality of waiting

What solutions? What futures?
Problem

• National Grid is System Operator
  – Charged with security of supply

  and advises on capacity volume to procure

  ⇒ Advice to over-procure as consumers pay?

  ⇒ Politicians nervous about “lights going out”

• Would an ISO do better? What role for politicians?

Can we do without central capacity procurement?
Efficient pricing of electricity requires

Prices varying in response to S&D each second
- Australia has 5 minute pricing in real-time market
- Frequency response needed in 1-5 seconds
- Tender auctions may be cheaper than spot markets for some services
- Contracts needed to hedge risk and incentivise responses

Investment needs forward prices for 15-20+ years
- Or ability to predict confidently and hedge

Investment needed is either capital-intensive (low-C) or has low capacity factors for balancing intermittency = risky

How to allocate risk to incentivise and reduce cost
EU Standard Market Design?

- **Central dispatch in voluntary pool**
  - SO manages balancing, dispatch, wind forecasting
  - LMP + capacity payment = LoLP*(VoLL-LMP)
  - Hedged with reliability option (RO)
  => reference prices for CfDs, FTRs, balancing, trading

- **Auction/tender LT contracts for low-C generation**
  - Financed from state investment bank
    - Credible counterparty to LT contract, low interest rate
  - CfDs when controllable, FiTs when not, *or*
  - Capacity availability payment plus energy payment
    - Counterparty receives LMP, pays contract

- **Free entry of fossil generation, can bid for LT RO**
  - To address policy/market failures
Conclusions

• Low-C investment is durable and capital intensive
  – needs **stable credible future prices** to invest
    • and guaranteed contracts for cheap finance
• EU CO$_2$ policy is a messy 27-state compromise
  – neither stable nor credible
=> leave each country to choose its best solution
  – some mix of contracts and capacity markets
  – Ensure that cross-border trade permits efficient pricing
• Gains from cross-border trading higher with RES
  => share reserves, renewables to reduce investment

*Autarky depresses prices, raises cost of RES support*
Security of supply, UK Energy Policy and the Capacity Auction

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http://www.eprg.group.cam.ac.uk
CCGT  Combined cycle gas turbine
CfD  Contract for difference
D & S  Demand and Supply
DER  Distributed Energy Resources
DSR  Demand Side Response
EMR  (UK) Electricity Market Reform
FiT  Feed-in tariff
FTR  Financial Transmission Right
ISO  Independent System Operator
LMP  Locational marginal price or nodal price
LoLE  Loss of Load Expectation = sum of LoLP
LoLP  Loss of Load probability
LT  Long-term
NW E  North west Europe
OCGT  Open cycle gas turbine
RES  Renewable energy supply
RO  Reliability Option
SMD  Standard Market Design (the US model)
SO  System Operator
VOLL  Value of Lost Load