Imperial College
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Security of supply, UK Energy Policy and the Capacity Auction

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

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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?

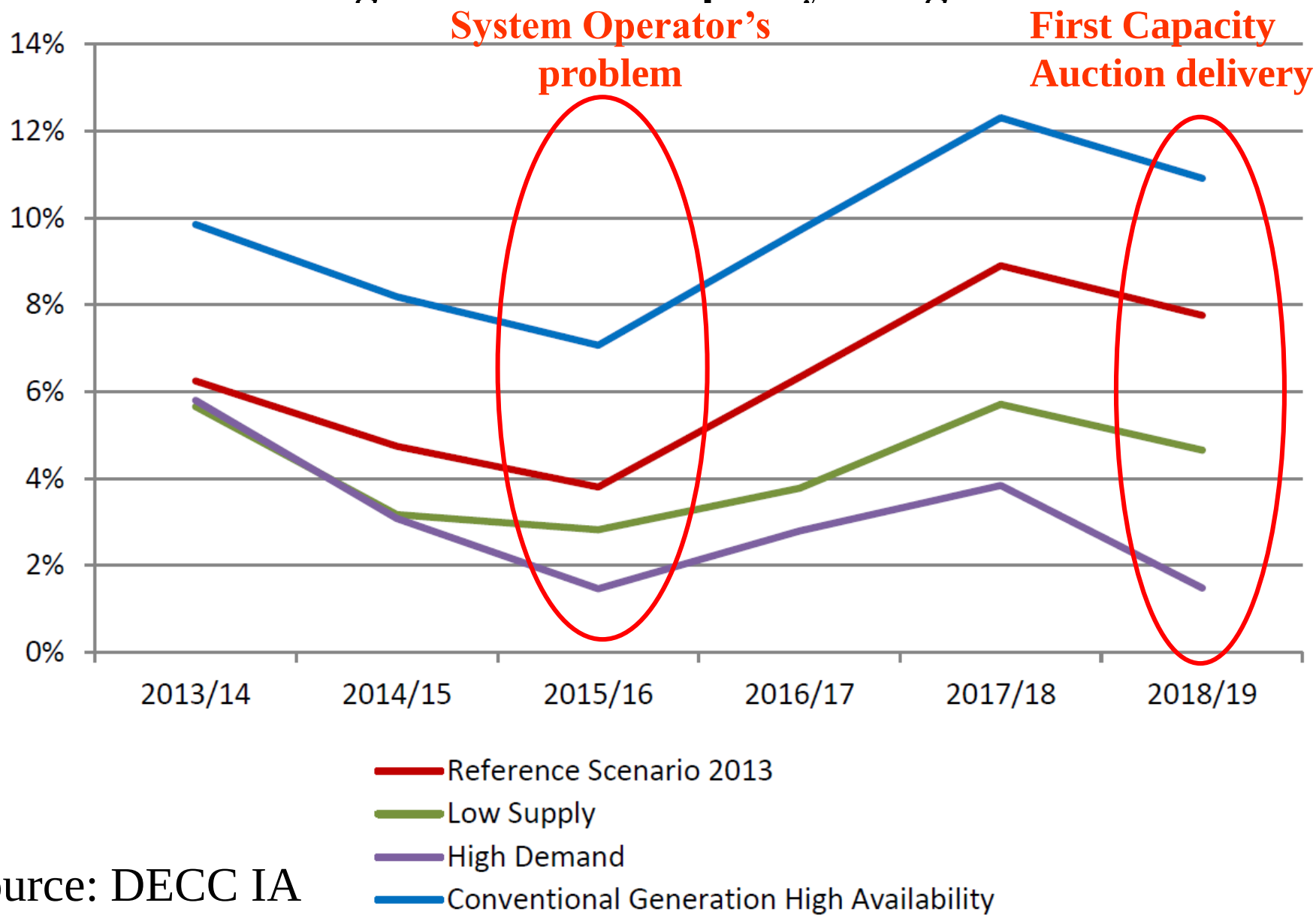
Security of supply

- 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



Source: DECC IA

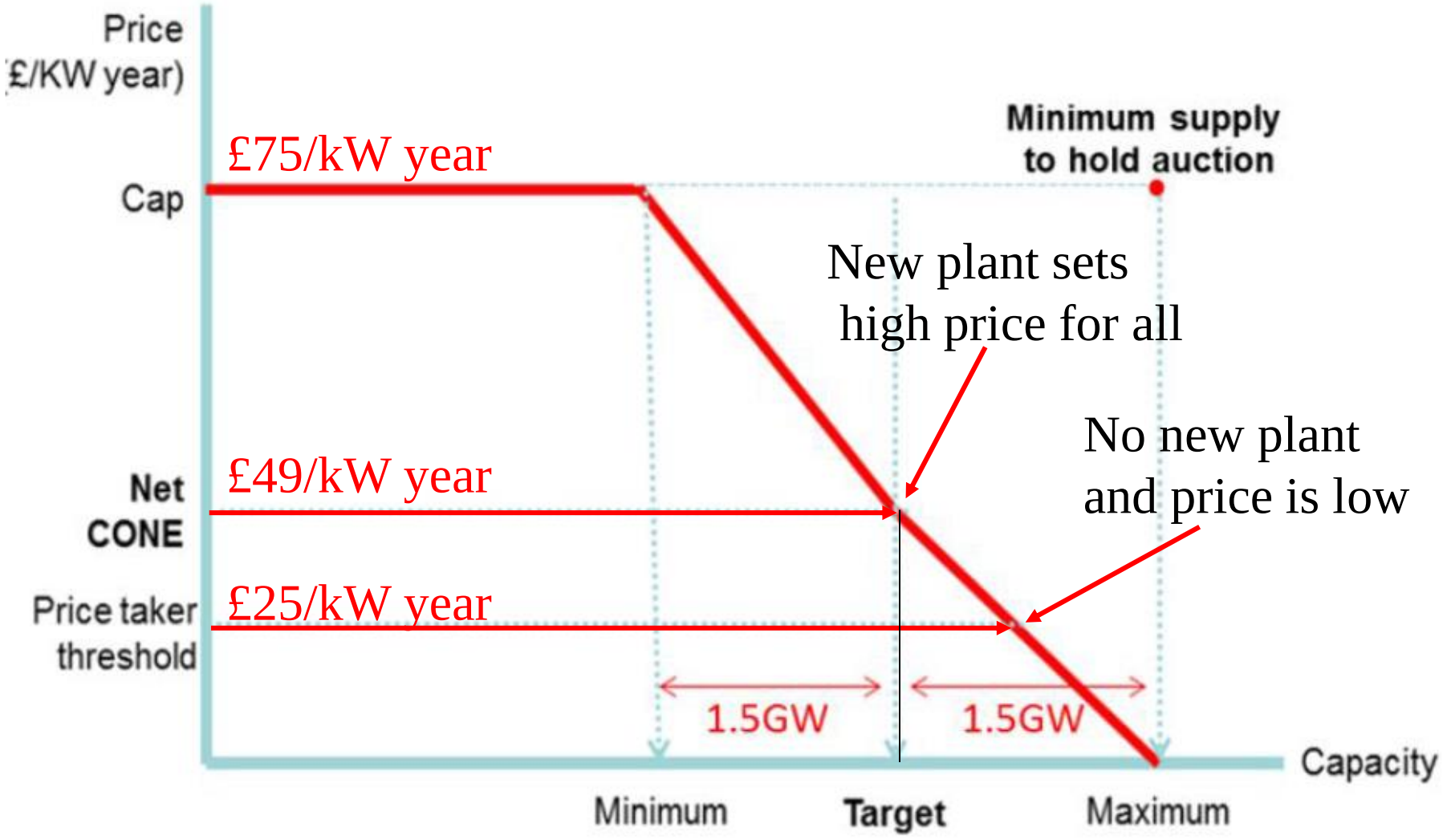
Security of Supply

- 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

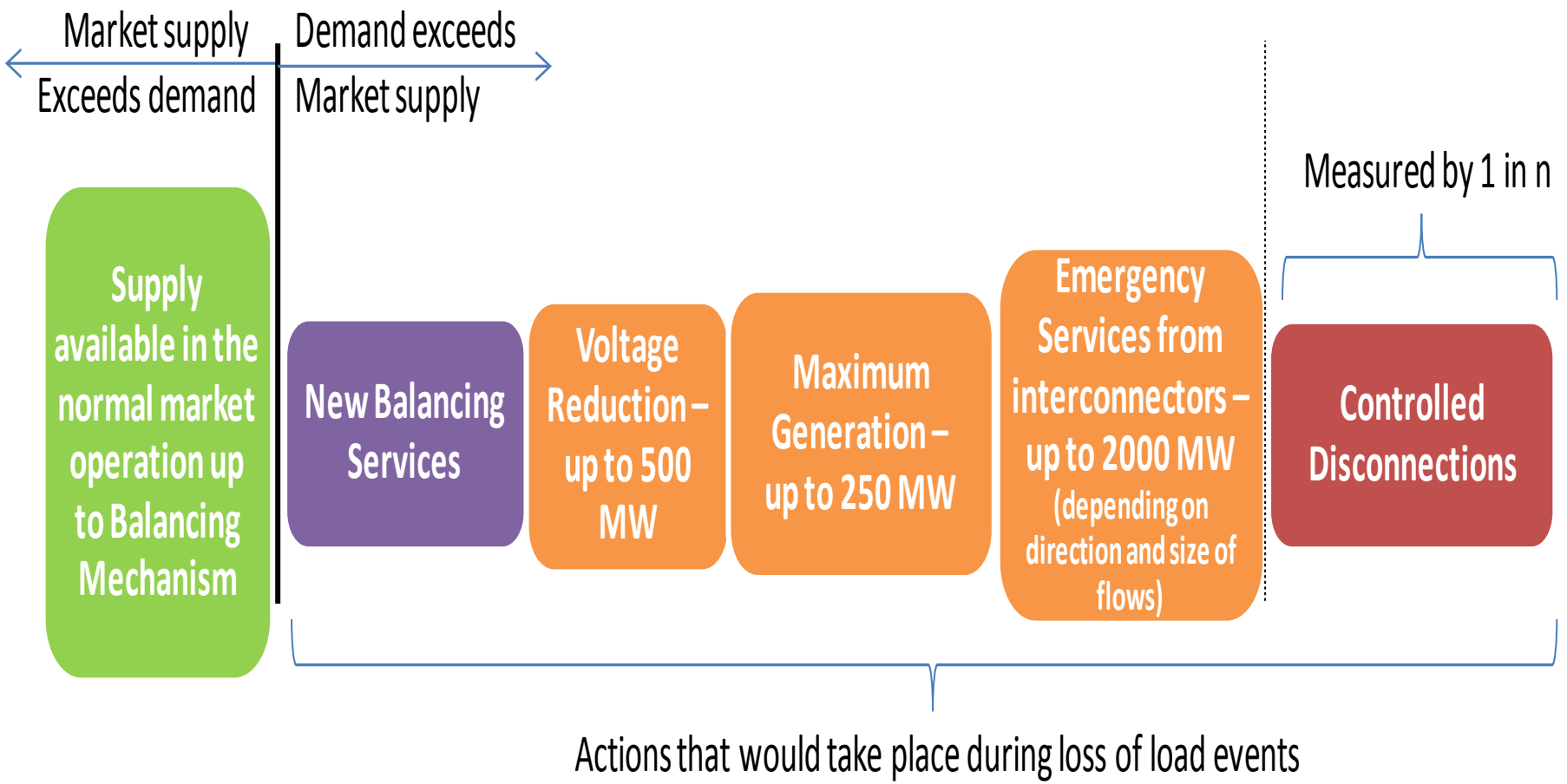
- New build gets 15 yr contract at auction price
  - existing plant: 1 yr contract unless major refurbish
    - must be price taker unless good cause, entrants set price
    - existing plant can delay until later auction (2017)
- DSR auctioned from 2016: 1 yr contracts

Illustrative auction demand curve



Source: DECC IA

What does "Loss of Load" mean?

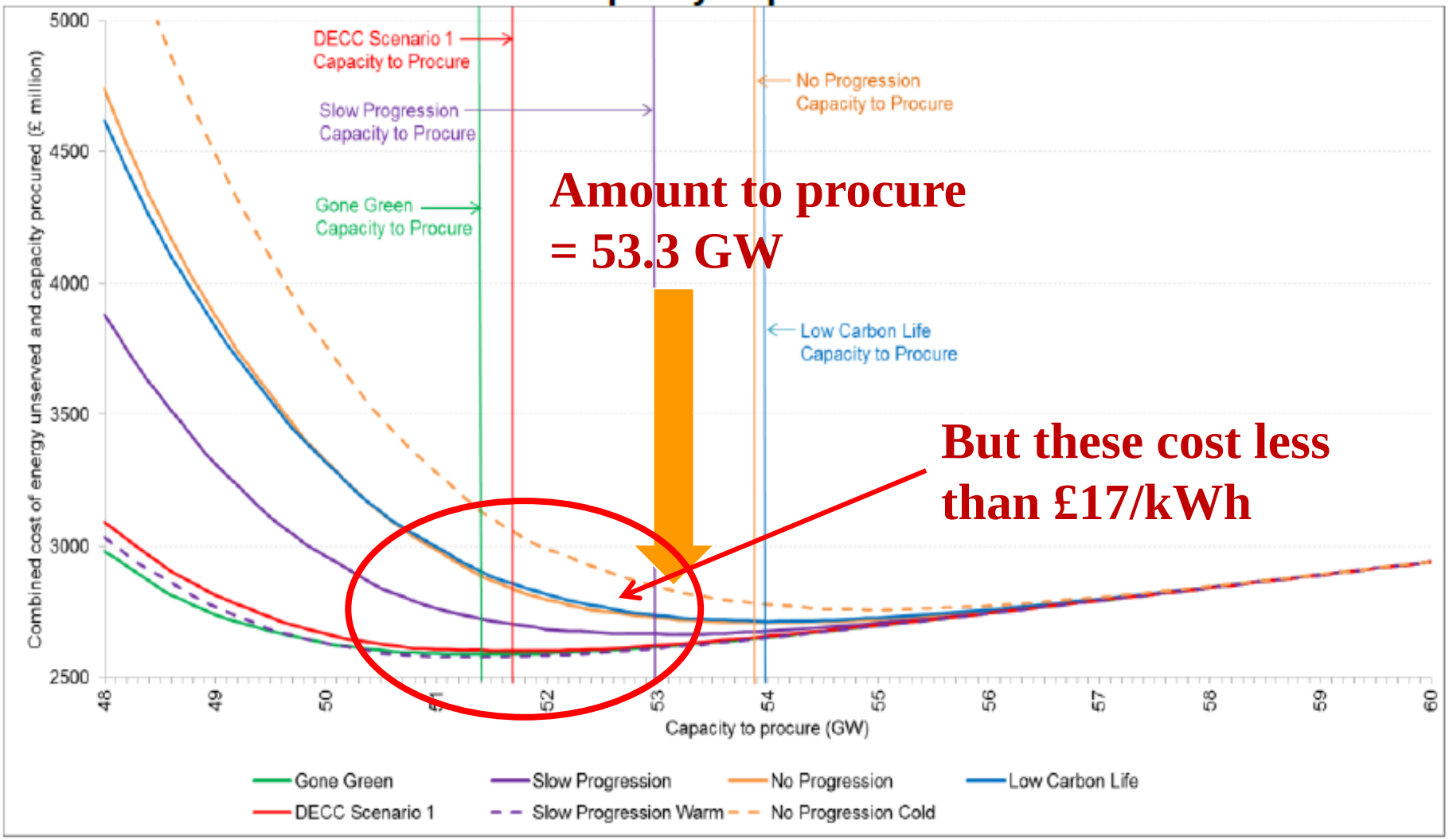


These actions have lower cost/value than £17/kWh

Source: Ofgem (2014) *Capacity Assessment 2014*

Cost of "energy unserved" = £17/kWh

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



Source: National Grid (2014, p50)

Interconnectors and coupling - status 2014

Existing

Due 2016-19

GB coupled to NWE 4/2/14

SWE coupled to NWE 13/5/14

Interconnectors and capacity markets

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

=> 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 => over-procure

⇒ reduce cross-border price differences

⇒ 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

Assessment

- 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 bogy 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?

Theory and reality

- 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

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Acronyms

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