

DSR in the 'all electric' low carbon future

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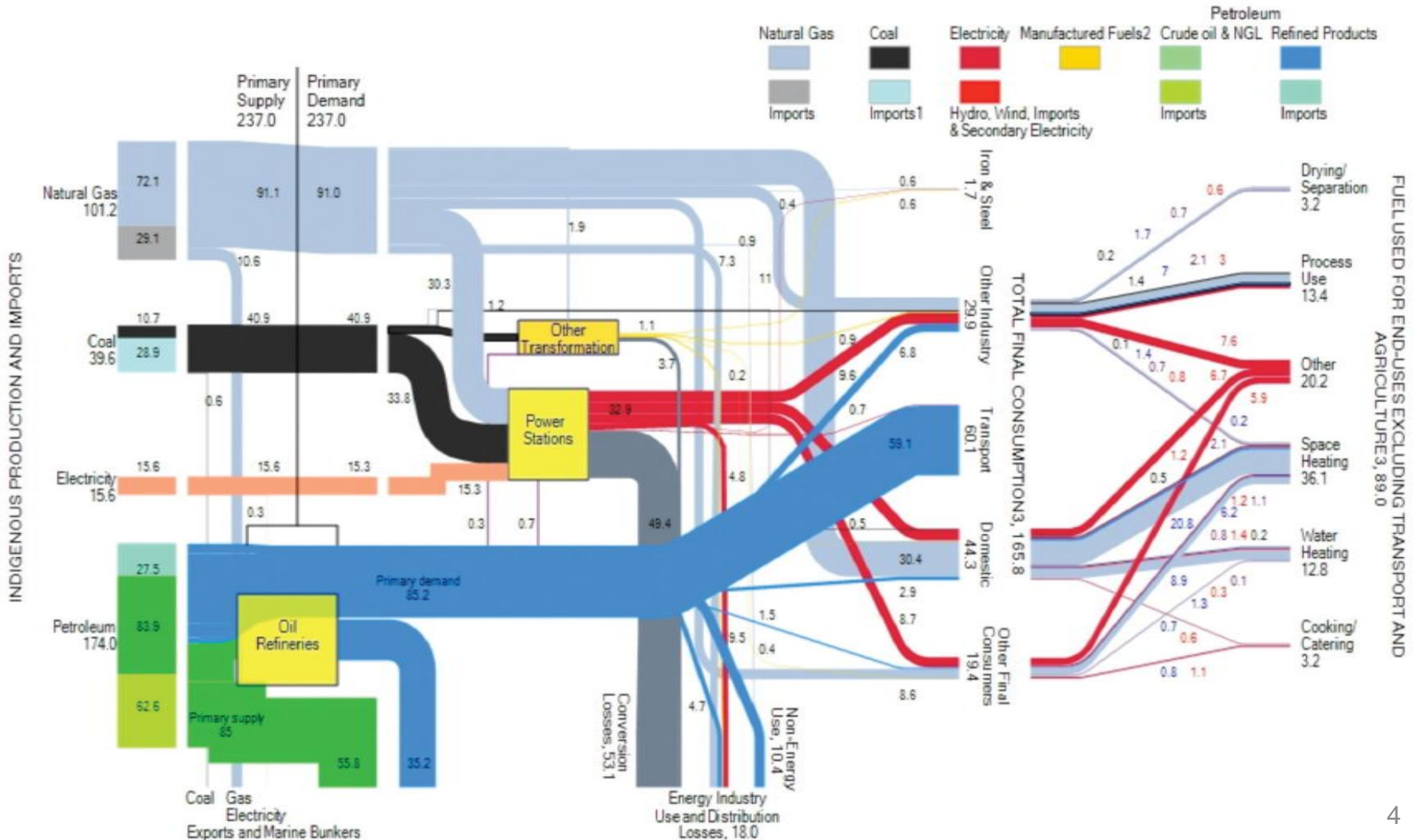
Outline

- The importance of DSR in the ‘all electric’ low carbon future
- What are the obstacles to DSR?
- Incentivising DSR
- A reward/penalty mechanism for DSR

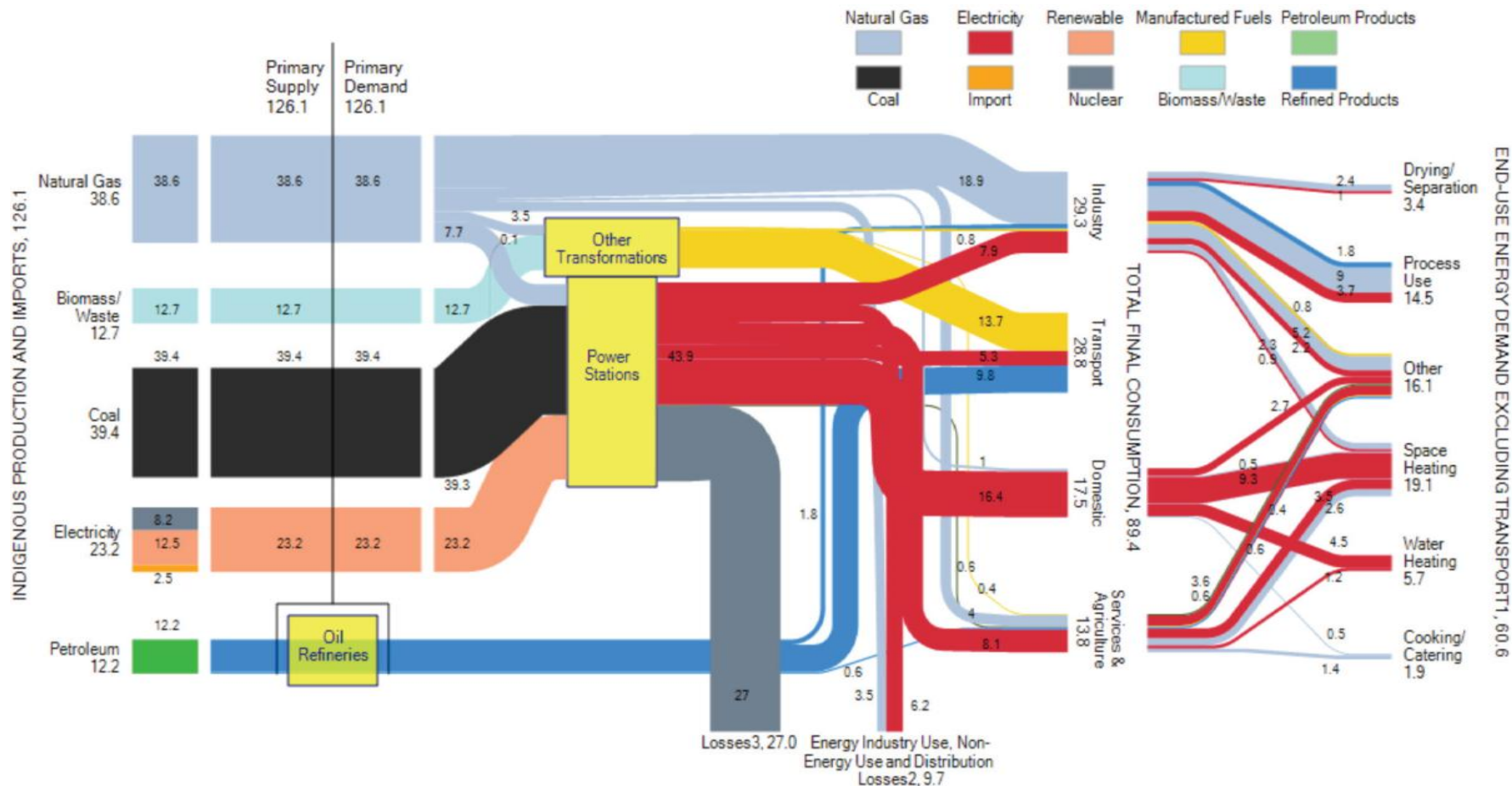
Role of DSR

- The traditional argument for the importance of DSR has been around the economic and environmental benefits of shifting peak loads
- Peak demand in Britain is currently around 60GW (National Grid 2009)
- ‘All electric’ low carbon future means that DSR will be increasingly important

Energy flow diagram of the UK in 2007- adapted from (DECC 2009c)



Energy flow diagram of Committee on Climate Change 33/80 scenario for UK in 2050



Speirs, J., Gross, R., Deshmukh, S., Heptonstall, P., Munuera, L., Leach, M. and J. Torriti (2010) 'Building a roadmap for heat 2050 scenarios and heat delivery in the UK' (London: CHPA)

In the 'all electric' future...

- Heat demand will be largely supplied by electricity
- Air source heat pumps will add significantly to peak electricity demand
- The peak power demand of a domestic heat pump will be around 7kW
- Aggregate effect may be around 1.3kW per home (Hawkes 2010)

Tens of GW of additional peak electricity requirement

What are the obstacles to DSR?



- Technical
 - DSR technologies cost effectiveness
 - Estimating benefits
 - Negative NPV of the most advanced DSR technologies
 - Metering technologies
 - Communication technologies
- Pricing
 - Price structures
 - Price signalling
- Behavioural risks
 - Risk aversion
 - Risk of technological obsolescence
 - Risk of inertial behaviour and unawareness of price-based tariffs

How to incentivise DSR?

Cost Recovery Mechanism

- Allows suppliers to recover the technology and installation costs
- The utility's costs for DSR are usually “expensed,” approved by regulators and sometimes amortised over several years

The economic significance of load shifting is lost

The behavioural learning on the consumer side is very limited

Lost Revenue Adjustment Mechanisms

- Pays suppliers back for the direct losses that they experience due to decreases in electricity sold
- Recovery of all of the revenues that suppliers would have benefited from had they not implemented DSR programs
- If services delivered go down as a result of DSR activities, all other things being equal, rates will go up so that costs may be recovered

All end-users will have to pay for responsiveness

Shared Savings Incentive Mechanisms

- They are designed to provide rewards to utilities based on the effectiveness of socially beneficial DSR
- They can compensate for energy savings associated with DSR by making it possible for the provider to share the consumer net benefits from DSR programs

Difficult to make incentives dependent on objective verification

Situation in the UK

- DSR programs:
 - Time of Use for residential users
 - Interruptible Programs for large industrial users
- Limited number of products available to encourage DSR (Ofgem 2010)
- Smart metering roll-out in UK

Situation in the UK-DSR costs

Technology costs

- ~£60 for residential and 80% SMEs
- ~£260 for 20% SMEs



Planning costs

- Suppliers costs related to changes in their billing systems
- DNO costs for re-designing and building parts of their networks
- Changes to settlement system (Ofgem estimates up to ~£1m)



Installation + Appliance level costs

- Installation costs
- Upgrading to smart appliances
- Retrofitting existing time-flexible appliances with dynamic control (+£5)

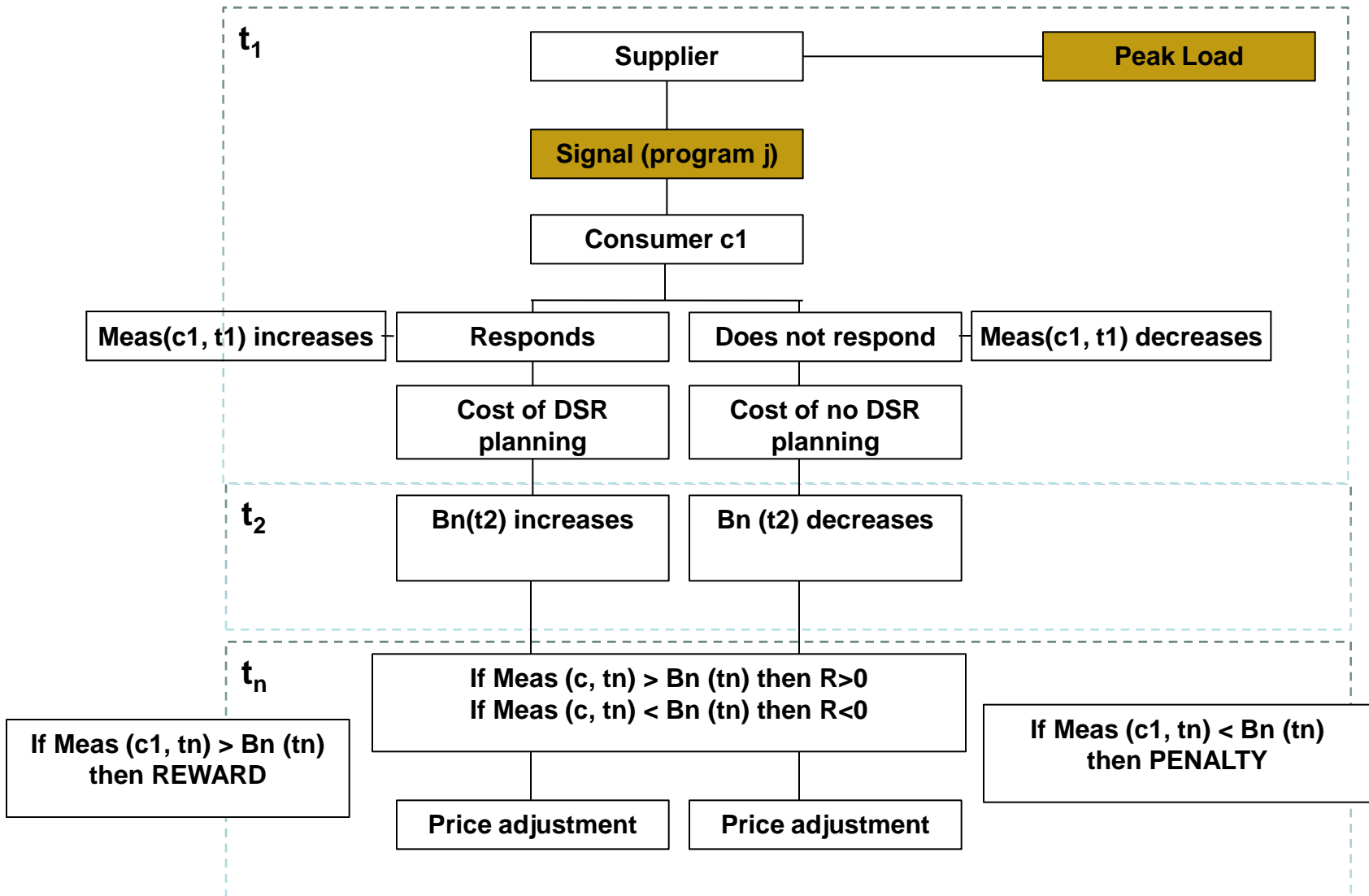


Opportunity costs

- For commercial and industrial users: quantified in terms of productivity loss
- “People do not have time to switch”



Reward/penalty mechanism for DSR



Reward/penalty mechanism for DSR

- Benchmarks are determined according to overall consumers' performance in the previous period:

$$Bn_t = Bn_{t-1} \times (1-\alpha_t)$$

- The level of α (where $0 < \alpha < 1$) for one period is dependent on performance in the previous period:

$$\alpha_t = \max \left[\beta\%; 1 - \left(\frac{Meas_{t-1}}{Bn_{t-1}} \right)^{\frac{1}{t}} \right]$$

$Meas_{t-1}$: Measured consumer responsiveness for previous period

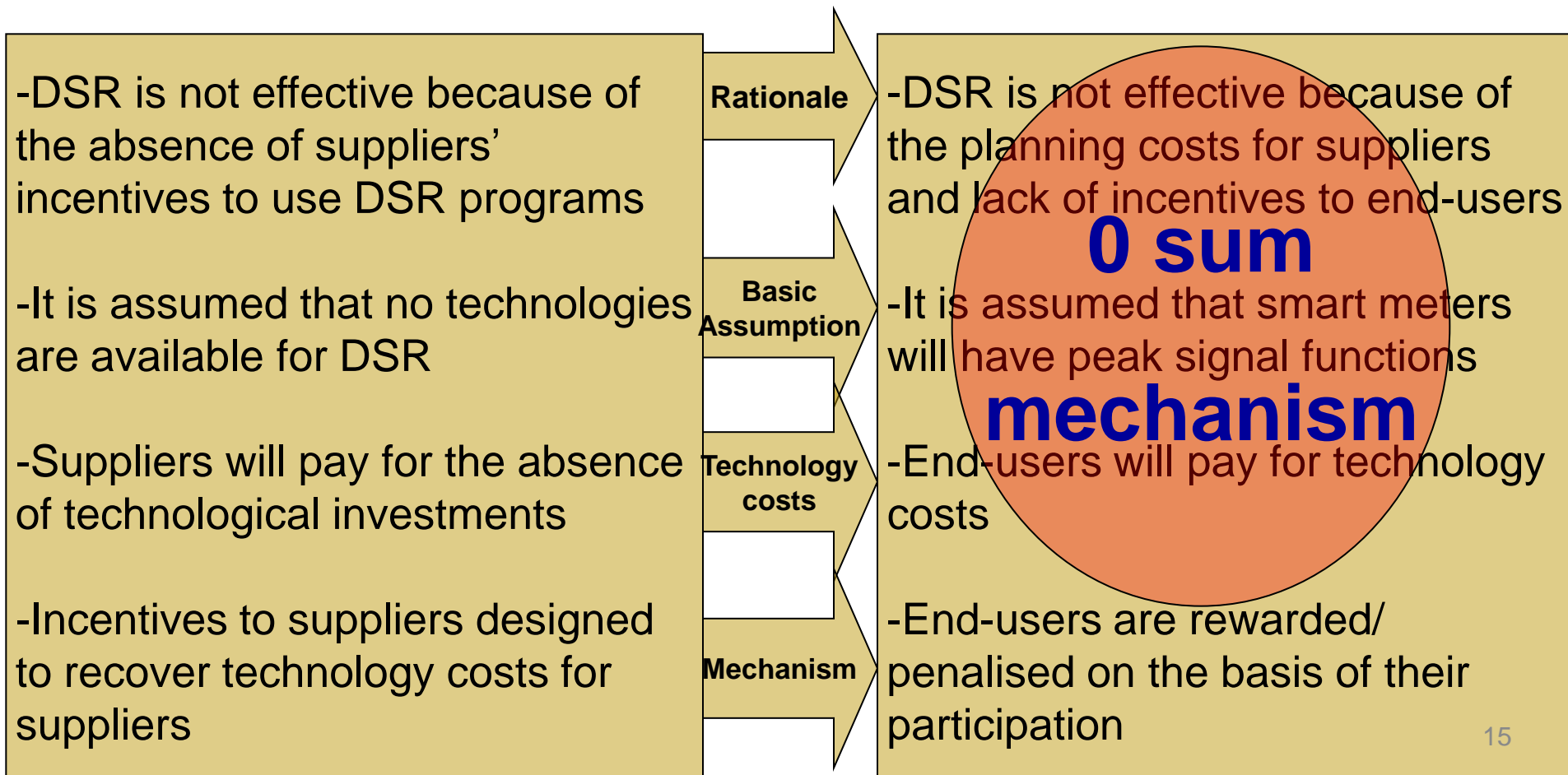
Bn_{t-1} : benchmark previous period

β : minimum number of responses for the period t

Shifting rationale of incentive mechanisms for DSR

Previous economic mechanisms for DSR

Reward/penalty mechanisms for DSR



Conclusions

- The importance of DSR is bound to increase in the 'all electric' low carbon future
- The traditional incentive mechanisms for DSR may not be find optimal application in the UK context
- Thanks to smart metering roll-out, the focus of incentives for DSR can move from recovering suppliers capital costs only to an integrated reward/penalty mechanism