Is it time for an Independent System Operator for GB electricity?

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Outline

- The Global Picture
- The Transmission Planning Problem
- Options for GB transmission system reform

- Acknowledgements:
- Mallika Chawla and EPSRC Autonomic Power Project
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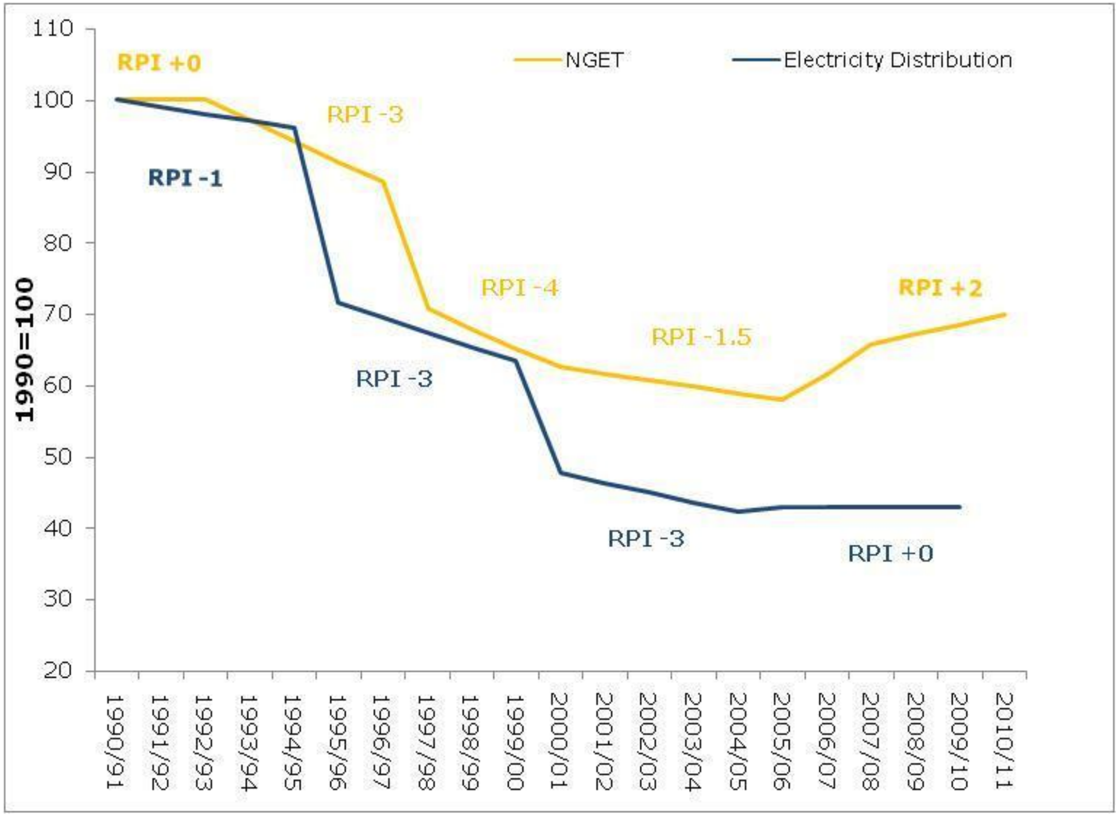
- Imperial-Cambridge ITPR project team
- Ofgem

THE GLOBAL PICTURE OF TRANSMISSION SYSTEM OPERATION

Acknowledgement: GB Transmission system prices/costs

Price control revenue allowance adjustments for electricity networks - 1990 to 2011



NGET = National Grid Electricity Transmission

Source: Ofgem (2009, p. 5)

Different TSO arrangements

- Different transmission system operation arrangements, including system operation.

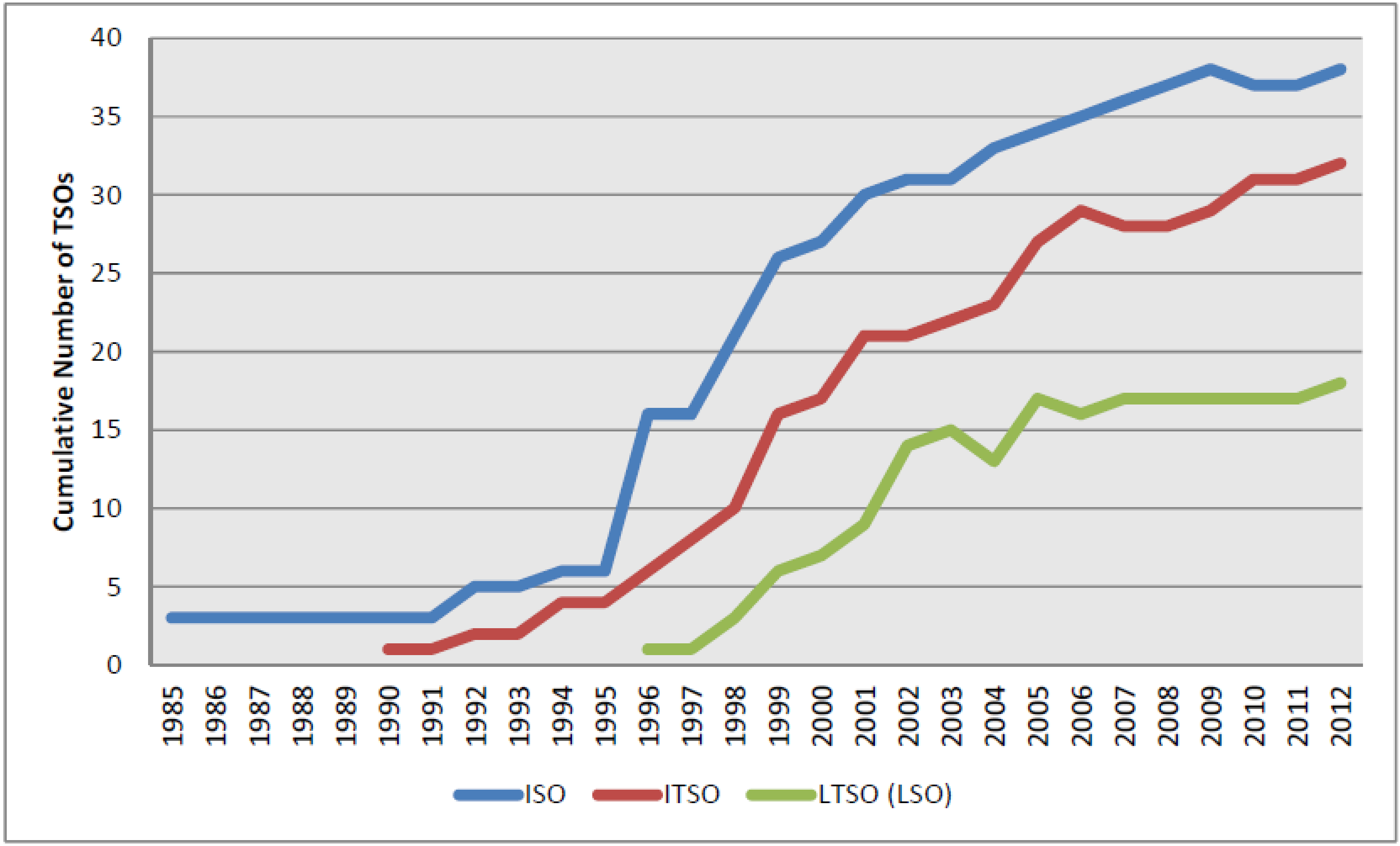
- Vertically integrated utilities (VIU), e.g. TVA.
- Legally unbundled transmission system operator (LTSO), e.g. RTE in France.
- Independent Transmission System Operator (ITSO), eg. NGET in England and Wales.
- Independent System Operator (ISO), e.g. PJM, NGET in Scotland.

Distribution of identified TSOs

Regions	ISO	ITSO	LTSO	VIU	Total no. of TSOs studied	Total no. of Countries studied
Africa	0	2	3	48	53	52
Australasia & Asia	6	7	2	40	55	37
Europe	12	20	7	1	40	38
Middle East	0	1	6	9	16	16
North America	14	1	0	56	71	23
South America	6	1	0	7	14	12
Global	38	32	18	161	249	178

Source: Chawla and Pollitt, 2013, Table 3.

Evolution of TSO arrangements



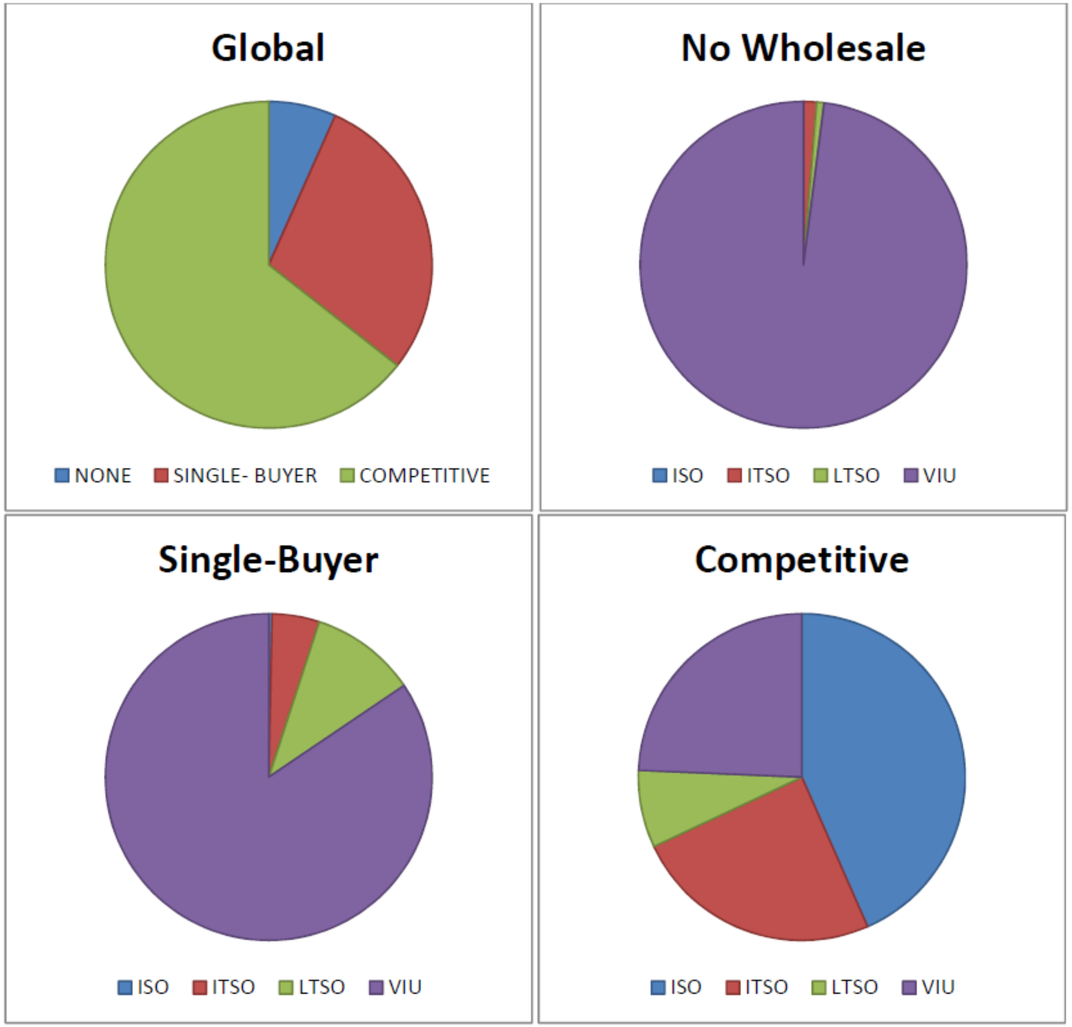
Source: Chawla and Pollitt, 2013, Figure 1.

Year	Countries moving away from the VIU arrangement and adopting the following types of TSO arrangements*		
	LTSO	ITSO	ISO
1985			Chile , Spain
1986			
1987			
1988			
1989			
1990		England and Wales (NGC)	
1991			
1992		Norway	Argentina, Peru
1993			
1994		New Zealand, Colombia	Bolivia
1995			
1996	Portugal	Ukraine, Kazakhstan	Sweden, Guatemala, USA, Ecuador
1997		Finland, Georgia	
1998	Czech Republic, Pakistan (PEPCO)	Netherlands	Australia (AEMO), Canada, Panama
1999	Denmark, Greece, UAE	Austria, Belgium, Slovenia, Jordan, Nicaragua, Germany	El Salvador, Germany, Italy
2000	Northern Ireland (SONI)	Portugal	Romania
2001	Egypt, Jordan	Kyrgyzstan, Philippines, Uganda, Turkey	Mongolia, Singapore, Dominican Republic
2002	Croatia, Bangladesh, Algeria, Zimbabwe, Ireland		Slovakia
2003	Cyprus	India	
2004	Poland, Estonia	Czech Republic	Bosnia and Herzegovina, Cyprus
2005	France, Hungary, Latvia (LSO), Nigeria, Oman	Iceland, Serbia, Italy, Denmark	Armenia, Scotland (NGC)
2006		Albania, Ghana	Ireland
2007	Bulgaria		
2008			Russia
2009	Luxembourg	Switzerland	Philippines, Northern Ireland (SONI)
2010		Spain, Estonia	
2011			
2012	Saudi Arabia	Lithuania	Latvia

Please Note: Off the 249 TSOs studied for this research, by the end of 2012, 88 in total had switched away from the VIU arrangement (as shown above) leaving 161 incumbent utilities as VIU

Source: Chawla and Pollitt, 2013, Table 2.

Distribution of Market structure and TSO arrangement by capacity



Source: Chawla and Pollitt, 2013, Figure 4.

THE TRANSMISSION PLANNING PROBLEM AND ITS SOLUTION

Current and projected transmission RAB in GB (£bn)

	Estimated asset value (£bn)	Expected Investment (£bn)
Onshore	**8.4**	**4 – 7**
Offshore	**2.5**	**8 – 25**
Interconnection	**2**	**8 - 20**

Source: Strbac et al. 2013, Table 1.

We have three transmission planning regimes

- Integrated Transmission Planning and Regulation (ITPR) project at Ofgem.
- Onshore regime – annual locational per MW connection charges, no short term locational signals, transmission companies propose investment plans which are approved by Ofgem.
- Offshore – generators build offshore wind assets and connect them to the shore line then these are auctioned by Ofgem.
- Offhore Interconnectors – merchant links which exploit price arbitrage opportunities between countries.

Can 3 regimes be part of the 'ideal' regime?

- Ideal regime (following Hogan!):
  - ISO manages existing system across entire UK
  - Efficient short term nodal prices (LMPs) in place
  - Individual ITOs responsible for availability of their lines.
  - ISO then evaluates all proposed transmission investments using social cost benefit methodology – including reliability, economic and public policy elements
  - Investments voted on by parties (where revelation of private valuation important as for New York transmission), go ahead if super-majority.
  - Investments tendered competitively for construction and maintenance (subject to max price ceiling).
  - Investments then charged to the beneficiaries.

Three from one?

- Onshore regime can be seen as a response to the meshed nature of the onshore network and integration of TO and SO in a meshed network. There are many small investment and operational improvements to be evaluated in such a system and as such it makes sense for the <u>'ISO' to delegate these decisions to a single integrated ITSO (NGET in England and Wales) to save on transaction costs.</u> (This is essentially what happens with Distribution).

Three from one?

- Offshore we are faced with large discrete investments which are easily separated from the existing networks and where the beneficiaries (offshore wind parks) are clear. <u>The 'ISO' can set up a competitive regime for these investments while not, compromising what is happening onshore,</u> as long as the spur investments do not impact onshore regime.

Three from one?

- Interconnectors are risky and depend on an evaluation of market prices at both ends of the interconnector. This is fundamentally different from a transmission investment driven by physical flows between identifiable generators and suppliers (i.e. annual average flows are misleading guides for interconnector investment). The 'ISO' can delegate this to parties willing to take the risk of building such assets, some of whom will be 'foreign' (in particular overseas TOs).

Three regimes make sense when

- Three regimes make sense when they add up to delegated elements of a sensible market based solution (a.k.a. 'ideal' solution).
- So while sensible market based arrangements are theoretically possible in transmission, in practice <u>transaction costs of separation and contracting and risk mitigation</u> mean that some form of formal coordination, licensed monopoly and regulation is preferable (there are several variants of each).

If we have three regimes

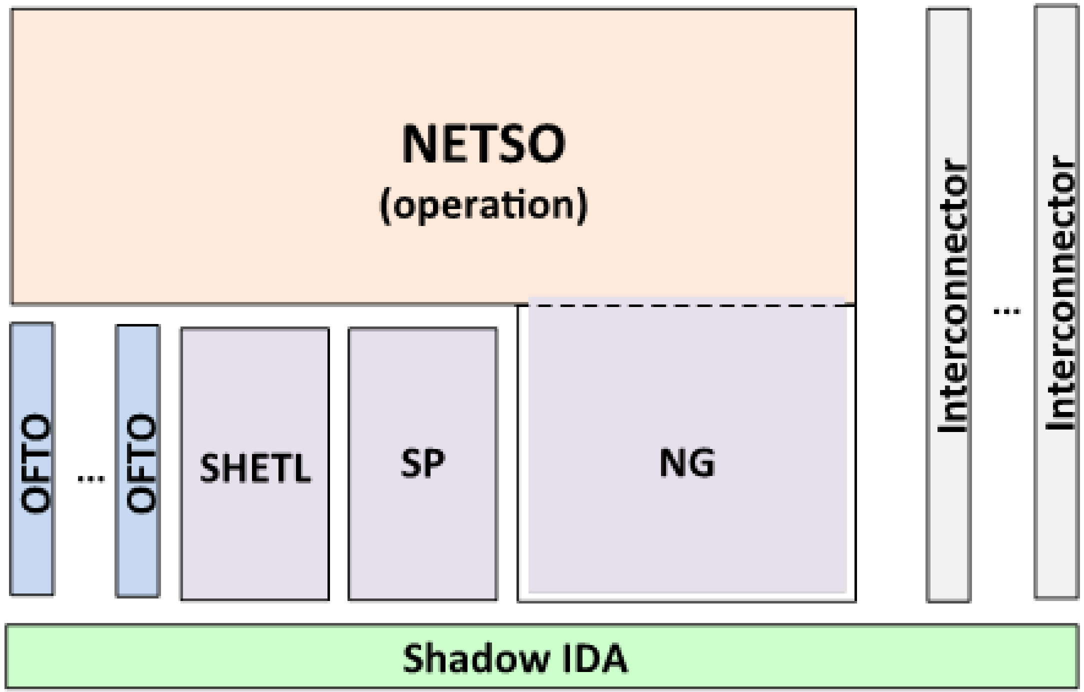
- Three regimes can work if they are clearly defined subsets of a sensible whole.
- This requires the basic model at the heart of the system to make sense, i.e. that all available information is being sensibly exploited (e.g. nodal pricing, investment appraisal).
- It also requires clear addressing of the seams issues that arise, e.g. can't allow subsidy arbitrage and competition between regimes as in Irish wind example.
- Also need to recognise that <u>circumstances may mean that three regimes need to be altered to accommodate emerging realities</u>, e.g. conflict between SO and TO roles of NGET, may give rise to need for 'deep' ISO with planning responsibility.
- <u>The three regimes we currently have are merely a practical response to past realities.</u>

OPTIONS FOR IMPROVEMENT

Options for improvement

- Given the size of the increase in investment, it would be surprising if the current arrangements were the best we could do (a.k.a. optimal).
- Misaligned incentives, lack of coordination, conflicts of interest are big issues.
- Three options developed by Imperial-Cambridge ITPR team:
  - Improved status quo
  - A GB TSO
  - A GB ISO

Option 1: Improved Status Quo

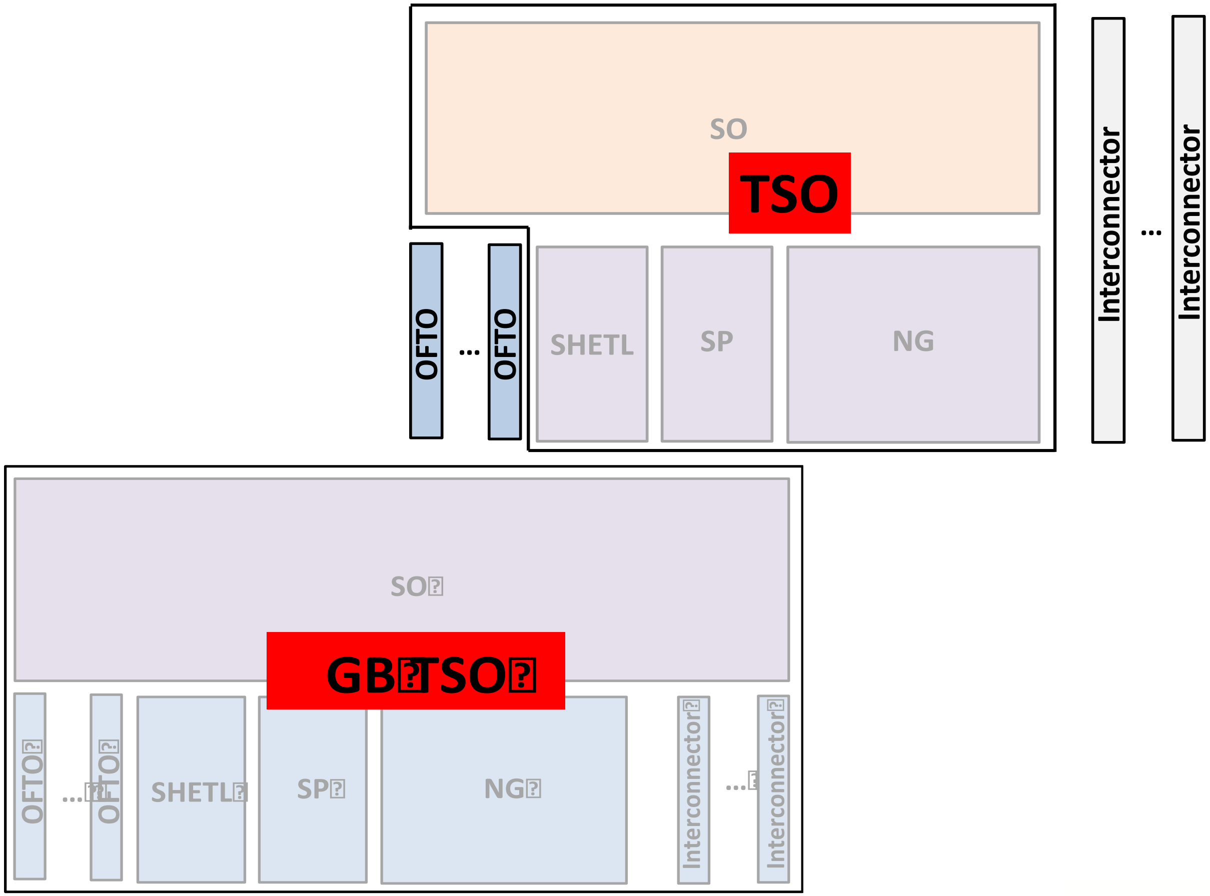


Source: Strbac et al. 2013, Figure 2.

Role of Shadow IDA

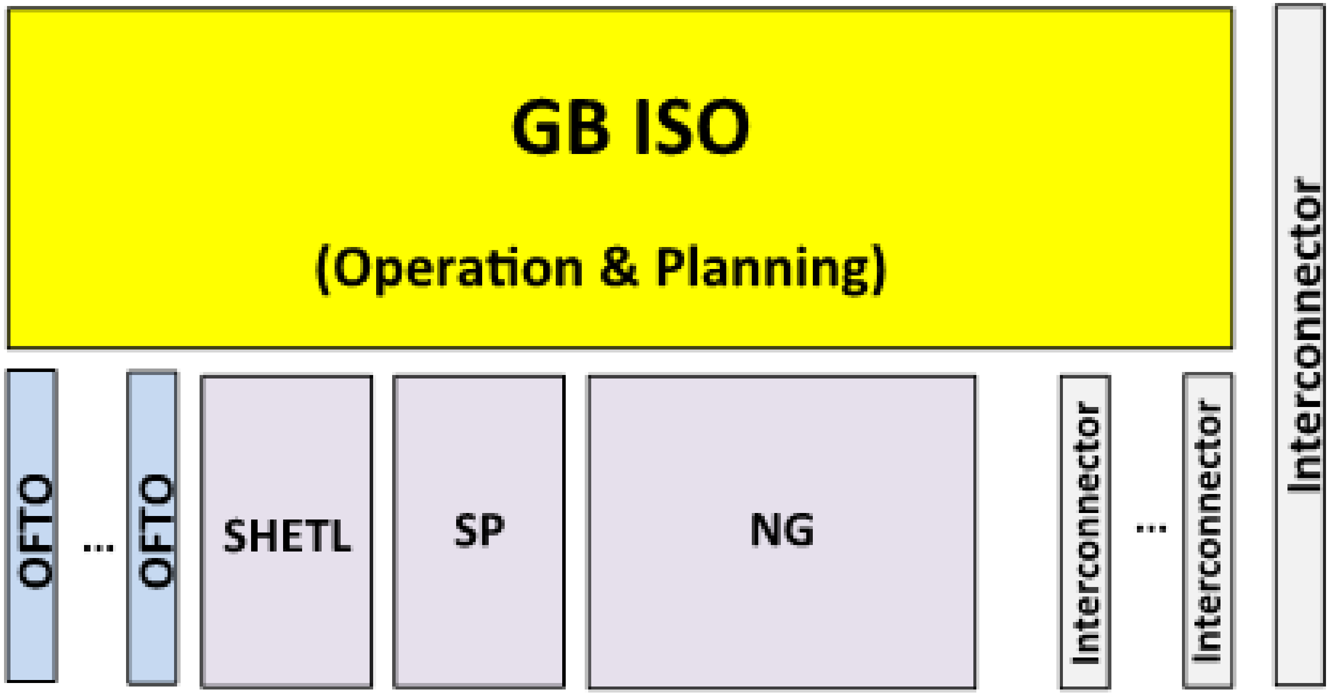
- Scrutinise the onshore TOs' RIIO business plans.
- Make proposals for Strategic Wider Works.
- Establish full information transparency .
- Coordinating and preventing barriers to entry in the onshore and offshore regimes through calling for an open season process when the need arises.
- Determining the efficient capacity of an interconnector for regulated interconnectors.
- Administer the "golden rule" cost-benefit check for merchant interconnectors.
- Support Ofgem/DECC in administering auctions for the cap-and-floor of regulated interconnectors.
- Support Ofgem/DECC in the auction of offshore assets.
- Facilitating the multi-purpose projects (MPP) planning process through a transparent Cost Benefit Analysis methodology.
- Supporting Ofgem in administering auctions for the detailed design and delivery of MPPs.

Option 2: TSO option



Source: Strbac et al. 2013, Figure 3.

Option 3: An ISO for GB?



Source: Strbac et al. 2013, Figure 5.

Role of ISO

- To work to a clear set of rules and grid codes and updated network operation standards;
- Facilitating the transmission planning process through a fully transparent Cost Benefit Analysis (CBA), which would involve stakeholder engagement regarding development of future demand and generation scenarios;
- Scheduling and co-ordinating transmission system outages;
- Offering connection agreements to market participants;
- Administering competitive tenders for the delivery of certain assets;
- Mandating incumbent TOs to undertake transmission investment;
- Co-ordinating with merchant offshore and cross-border project developers, ensuring that these investments are NPV>0;
- Administering BSUoS and TNUoS cost recovery and payments;
- Co-ordinating the development of MPPs and engaging with ENTSO-E and other EU counter-parties for regional network planning ;
- Administering Network Innovation Competitions (NIC);
- Supporting Ofgem/DECC with market design and regulation;
- Administering EMR and in particular the design of CfD contracts and capacity market.

Key strengths and weaknesses of options

	Status Quo+	GB TSO	GB ISO
Key Strengths	• Minimum change focused on improving current regimes • Optionality to reconsider as more evidence emerges	• Theoretically optimum option • Synergies from combining SO and TO functions, particularly in asset operability and flexibility assessment • Integrated design delivery and operation • Low transaction costs • Preferred practice in Europe	• Resolves most current concerns: implements efficient system operation, removes conflicts of interest, provides effective coordination across regimes and within the region • ISO can promote future market design improvements • ISO option with advanced planning and delivery process can potentially lead to more active stakeholder engagement
Key Weaknesses	• Regulation heavy • Key concerns unresolved	• Concepts about the development of PBR • Asset divestments required • Efficient transmission pricing is a pre-requisite • Over-reliance on a single entity	• In the case of a deep ISO, single worldview • Effective governance, grid codes and rules need to guide ISO • SO to TO contracts potentially difficult to define

Source: Strbac et al. 2013, Table 2.

CBA for ISO

Item	Comment
ISO Option Implementation Costs	
Loss of TO/SO Synergies in E&W	A fraction of £50mn/year[7]
Increased ISO/TO transaction costs in E&W	Estimate based on transaction costs between Scottish TOs and NETSO
One-off set up costs of ISO	Est. £100mn[8]
Consultations and code review costs	N/A
Potential ISO operational cost inefficiencies	Multiple of current NETSO annual costs
ISO Option Implementation Benefits	
Benefits of increased co-ordination	Extension of offshore co-ordination study across regimes
Benefits of increased transmission planning and delivery efficiency	CBA based on different assumed levels of reduction in transmission investment costs
Benefits of adopting advanced operational levels	CBA based on different assumed levels of reduction in system operation costs
Reduction in Ofgem costs due to reduced regulatory burden	N/A

Source: Strbac et al. 2013, Table 4.

CONCLUSIONS

Conclusions on Transmission Arrangements

- The creation of NGET as an ownership unbundled ITSO was a great success (Pollitt, 2008).
- Dispersed asset ownership stopped this happening in the US: 'if you want an ITSO, assume an island'.
- However the US situation suggests that an ISO model has much to recommend it (see Pollitt, 2012):
  - avoiding the costs of transmission asset ownership reorganisation
  - facilitating more efficient operation of the transmission system and trading benefits over a wide area.
  - specialising in the IT intensive part of the electricity system and developed sophisticated and efficient real time management algorithms
  - evolving their role in calculating the system wide benefits of future investments and the associated network planning.
- Is it time for a GB ISO? Answer: Sometime, soon?

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