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CENTRE ON REGULATION IN EUROPE

The role of systems operators in network industries

A CERRE study

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10 July 2012



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About the authors

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Prof. Cave has been heavily involved in providing advice on these matters to the UK and other governments and to the European Commission. His independent review of the regulation of social housing for the UK Department of Communities and Local

Government formed the basis for the creation of the new Tenant Services Agency by the Housing and Regeneration Act 2008. Advice in his earlier reviews of spectrum management for the Treasury has been adopted by the Government.

Prof. Martin Cave has recently conducted a review of competition and innovation in the water industry and chaired an expert panel advising the Secretary of State for Transport on the future of airport regulation.

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Guido holds a PhD in economics from Bocconi University, Milan, where he is currently a lecturer of Economics of Regulation in addition to its abovementioned research directorship at IEFE.

Executive summary and key conclusions

- 1) For network infrastructure industries like electricity, natural gas, railways and water supply, system operators (SOs) control access to the network by service providers as well as co-ordinating and, in some cases, carrying out, network extensions.
- 2) SOs can exist:
 - a. Within a single vertically utility with multiple upstream sources and a single retailer distributing the product over a network across a wide geographic area;
 - b. As a fully ownership unbundled network with competing upstream and/or downstream suppliers; and
 - c. As intermediate models with limited upstream and retail competition and with or without network unbundling.

Hence, SOs are the key co-ordinating entity for network infrastructure industries.

- 3) SOs can exist as
 - a. Implicit SOs: company divisions or branches - as in vertically integrated electricity and water supply companies;
 - b. Explicit SOs: as in fully ownership unbundled networks and some intermediate models; and
 - c. Virtual SOs: as in the proposed EU-wide electricity and natural gas models, where area markets and networks are linked by network codes rather than by an explicit SO.
- 4) SOs have existed since the 1840s, if only in implicit form. The compilers of the early railway timetables were the first modern (implicit) SOs. In addition, there was a need for common track gauges across areas and timetables, as well as for

common signalling procedures, common emergency procedures, rail network expansion plans and investments, etc. These arrangements were particularly important for countries (like the UK) with multiple train companies operating on the tracks.

- 5) The development of modern explicit SOs is most associated with developments in the US electricity industry over the last 30 years or so. In particular, the US has, since the 1990s, developed independent system operators in electricity both within and across States. These were originally only functionally separated entities but, since 1996, the main ones (like PJM) have become ownership separated ISOs.
 - a. The US electricity ISOs are responsible for transmission planning but, as they do not own the transmission assets, are not responsible for carrying out the recommended investments. That responsibility rests with the transmission asset owners.
 - b. In England and Wales electricity (and now in most EU member states), system operation has been combined with transmission operation and ownership in an ownership separated entity known as an ITSO – an independent transmission and system operator;
 - c. Among intermediate models, the EU has developed the notion of an ITO – an independent transmission organisation. This is a (strongly) functionally separated but not ownership separated TSO model, which has been adopted in France and a few other EU member states.

A similar classification of SOs into ISOs, ITOs and ITSOs is also relevant for gas, rail and water.

The ISO/ITSO classification is not relevant for virtual SOs whose role is to co-ordinate electricity and gas flows (and trade) across market coupled networks.

- 6) The main functions of SOs can usefully be divided up into:

- a. Short-term: Traffic management, congestion, emergency management and contract execution. Short-term SO functions are usually within-day operations;
 - b. Medium-term: Access to the network, including:
 - i. how best to allocate available network capacity among service providers;
 - ii. how to ensure, particularly when the network itself is investor-owned and self-supporting, that network revenues cover costs; and
 - iii. how to do the above without distorting competition among service providers – and, in particular, preventing the strategic use of the network in favour of the upstream and downstream operations of the network owner;
 - iv. a particular problem within the EU has been the arrangements for the allocation and efficient use of interconnectors between markets and jurisdictions.
- 7) Long-term: Long-term decisions relate to investment.
- a. Decisions about expansion/contraction of network capacity have to be made in a way which benefits end-users and does not distort competition among and between service providers. This involves investment planning which, at least in principle, is a function of all SOs, even the co-operative agencies involved in virtual SOs.
 - b. Investment implementation and financing is a function of ITSOs but not of ISOs. ITSOs can implement and finance network capacity investment without distorting competition among and between service providers.
 - c. ITOs are responsible for financing new capacity investments. However, there remain major concerns as to whether ITOs will, in practice, plan and

implement new investments without favouring the upstream and downstream interests of the companies within which they are based.

- d. The disconnection between network investment planning and responsibility for actually carrying out investments is the critical weakness of ISOs relative to ITSOs. However, there may be no alternative to an ISO (real or virtual) where transmission entities are separately owned - as in almost all multi-area jurisdictions and some single-area jurisdictions.
 - e. The most serious problem with ISOs is on interconnection investment. Incumbent companies (as well as local/national regulators and governments) have a strong economic incentive to resist interconnection investments that widen markets and threaten the commercial viability of their own higher-cost upstream assets (and the associated network assets). This problem is serious with explicit ISOs and likely to be a lot more serious with virtual SOs.
- 8) The relevant economic analysis can be found for each of the three time periods above.
- a. For short-term SO issues, the most relevant framework is that of transaction cost economics.
 - b. For medium-term issues, the most relevant framework is access and competition policy/antitrust economics. Regulation typically plays a major role, not least in providing specialist competition policy analysis for monopoly networks.

The role of auctions and auction theory has been playing a growing role for network capacity allocation in recent years.

- c. For long-term issues, some type of indicative (or co-ordinated) planning approach is probably most appropriate for most network investment. However, this can be difficult to reconcile with commercial interests. This approach is most obviously suited to single area jurisdictions where

industry structure, regulatory coverage and governmental responsibilities are all geographically aligned.

The alternative to a planning approach for network expansion is a market driven “merchant” investment approach. This can be important (e.g. for interconnectors and other links with existing networks). US interstate gas pipeline investments operate on a market-driven competitive basis. In this case, the relevant economics are again those relating to competition/antitrust policy. This approach is most obviously suited to multi-area and interconnection network investments, including gas transit lines.

- 9) Considering the four industries covered in this report and the relative importance of short, medium and long-term issues, our main conclusions are as follows:
- a. Short-term SO functions are most important in electricity. That is because electricity travels at the speed of light; there are no storage possibilities; and transmission networks need to be continuously balanced. Doing this while co-ordinating with upstream competition in generation markets is a complicated, difficult and sensitive process.
 - b. Short-term SO functions are also very important in rail, particularly for highly-meshed and congested rail networks (e.g. around major cities). They are also important for natural gas. However, the slower speed of travel of gas and the storage possibilities (including line-pack) reduce the sensitivity relative to electricity. Short-term SO functions in water supply seem to be relatively unimportant.
 - c. Medium-term SO network capacity allocation functions are important in all four industries, although probably less in water supply. The linkages between upstream markets and network use are most important for electricity and gas. Allocating interconnector capacity has been a major issue in EU gas and also important for electricity but not, as yet, for water.

- d. Long-term investment related SO functions are very important for electricity, gas and water supply – both investment planning and investment implementation. The last of these is much less important for rail since governments almost always play a much greater role in financing railway network investment.
- e. Long-term interconnection investment planning and implementation is a crucial SO-type function, particularly in multi-area/multi-TO owner environments. Achieving sufficient Interconnection investment has been a major problem for US electricity and for both gas and electricity in the EU. It is also an important (and unresolved) issue for SO-arrangements within a water supply industry with upstream competition as has been proposed for water in England.

10) Considering the types of SO and their relevant advantages and disadvantages, our key conclusions are as follows:

- a. Functionally separated ISOs and ITSOs achieve little in terms of promoting efficiency and competition on short, medium or long-term SO functions. It remains to be seen whether the more strongly separated ITO model successfully removes the incentives for anti-competitive behaviour relative to fully (ownership) unbundled ITSOs
- b. Within single-area/single owner jurisdictions, ITSOs dominate ISOs. The key difference is that ITSOs, unlike ISOs, integrate the planning and the implementation of network investment. This has, in practice, proved to be a major weakness with energy ISOs in both the EU and the US. ITSOs also provide the co-ordinating economies of scope that operate within vertically integrated utilities but which do not with ISOs.

There is a countervailing effect in that ITSOs have an incentive to focus on safe investments to be operated by their TO arm. Incentives for more risky transmission capacity investment or investment to meet future likely (but uncertain) demand are weak. However, this can be offset by some

combination of functional separation within ITSOs and regulatory activism, so that ITSOs remain the most recommended option for single-area/single owner jurisdictions.

- c. For multi-area and/or multi-owner jurisdictions ITSOs are not a viable option. Hence, ISOs are the only available explicit choice available – even within the UK electricity sector. Energy sector experience shows that (explicit) ISOs handle well both short and medium-term SO functions. In that case, an ISO but with some additional mechanism(s) adequately to implement network capacity investment programmes looks to be the best option.
- d. The problems over investment in ISOs are most acute with regard to additional interconnector investment. Incumbent utilities with market power within their own area have strong incentives to resist additional interconnector investment – and they frequently do in all network infrastructure industries. This raises the option of mandating interconnector investment if it can be justified by a cost-benefit test for the wider area.
- e. Virtual SOs have proved successful in co-ordinating and managing the Nord Pool electricity market. However, there are many issues involved as to whether that model, based on network codes and guidelines, will transfer well to electricity markets in CWE and elsewhere in the EU. The use of virtual SOs for multi-area gas markets in the EU is, as yet, still very much a work in progress. There is not a clear or convincing market or SO conception for it and current proposals do not look convincing as a working model.

11) Regarding SO Variants by industry, our main conclusions here are as follows:

A Single- ownership/single area conclusions

- a. For electricity and gas, the main single TO ownership/single area options are reasonably well-established and understood. ITSOs dominate other SO models in theory and in practice. They perform better on short, medium and long-term functions – at least providing that the horizontal competition issue over transmission investment incentives is not too severe and can be mitigated in other ways.
- b. For railways, provided a sufficiently large investment financing role for the government, ITSOs have no obvious advantage over ISOs. Indeed, ISOs may have an advantage in the UK where there are proposals for joint ventures between some Network Rail regions and the main corresponding regional train operating company. An ISO independent of Network Rail, handling timetabling and other medium-term issues could well be a promising option. This may also be true in other countries.
- c. For water supply, it seems unlikely that an explicit ISO or ITSO could be justified for all except the largest companies. To justify it requires a significant amount of upstream competition and water trade e.g. in response to water scarcities. ITSOs should dominate ISOs for the standard investment incentive reasons except that company-based ITSOs do not have incentives for building interconnection. A single buyer ISO has proved attractive in Australia but single buyer models have strong incentives to over-invest and are difficult to regulate.

B Multi-ownership/multi area conclusions

- a. For electricity, ISOs are the only option available. In the US, we observe explicit multi-state ISOs – as we now do in Britain and Ireland. For the Nordic countries, we find virtual SOs, organised around well-established country ITSOs and based on network codes. That is the model intended for the planned EU single electricity market. How well it will work remains to be seen. There are clearly major issues yet to be resolved e.g. on whether it should use financial or physical transmission rights, its

consistency with capacity payments and the recurring issue of the adequacy of interconnector capacity and investment.

There is a strong argument in favour of an explicit European electricity market ISO at least for transmission interconnectors.

- b. For natural gas, it seems highly unlikely that the competing US gas “merchant” transport ITSO model will be suitable or acceptable for the EU single gas market. The official proposals are therefore for a virtual ISO based on network codes. The standard problems apply and the model is being planned for introduction during a time at which the underlying long-term (20 year plus) oil-price linked gas contract model is undergoing substantial challenge and change.

On that basis, it is very difficult to judge the likely efficacy of the current multi-area EU gas proposals. However, the absence of any supra-national TSO or substantive supra-national regulatory powers is noticeable and worrying, particularly given national government security of supply concerns. It is difficult to see how the authorities can ensure sufficient transport capacity investment which currently operates on a planning basis – both in general and for interconnectors - unless regulators guarantee a sufficiently generous and protected rate of return. That approach removes a large percentage of investment risk from companies and investors - but places it on consumers.

There are strong arguments in favour of an explicit European gas market ISO at least for cross-country pipelines.

- d. For international railway journeys, an explicit ISO looks attractive but it could be very hard to achieve without segregation of international from domestic lines. It may be easier to achieve in smaller areas (e.g. within Britain, Ireland or Spain and Portugal).

- e. For water supply, regional ITSOs (e.g. based around major rivers or similar water sources look attractive) and segregation of interconnector from within-company pipe networks may be reasonably feasible. In England, there is a lot to be said in favour of regional ITSOs to manage, plan and invest in interconnector and possibly major line network capacity – at least in water-scarce regions. That could also help develop deeper and more liquid upstream markets for water. Given the crucial importance of interconnections, ISOs would be much inferior.

It is unclear whether or how far this model is attractive in the English context, for geographical as opposed to underlying economic reasons. The answer to that will determine whether or not regional ITSOs would be attractive in other contexts.

- 12) The creation of SOs in all four of the industries discussed is closely related to the question of widening the scope of competition, particularly upstream competition. That process, although typically benefitting all consumers, creates winners and losers among the supplying companies. In particular, as the scope of competition is expanded, there are often concerns from the original incumbent supply (and network) companies as regards stranded assets, particularly when increased competition is accompanied by vertical network unbundling to prevent vertical discrimination and foreclosure. However, this is not an SO problem per se and different countries typically respond to it in different ways, sometimes including transitional arrangements, depending on national regulatory regimes and the degree of regulatory protection they offer on existing assets (e.g. regulatory asset base protection). The EU multi-area electricity and gas proposals based on virtual SOs do not seem to give any EU or other multi-national agencies the powers to mandate new interconnection or other network capacity against the wishes of national regulators. This could change were there to be explicit multi-area SOs regulated by a supra-national entity but proposals on these lines would be very different from what has been proposed and very strongly resisted by companies and member states.

13) Finally, it needs to be emphasised that SO choices can only be taken in the context of a market model for the industry in question. Although there are common competition-related and investment issues, they manifest themselves in different ways in different industries and different countries – and in different ways depending on the underlying market model.



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1. Introduction and scope of the report

In this report we consider the role of system operators of various types, including ‘virtual’ system operators, in the electricity, natural gas, railways and water supply industries. In this section, we discuss some general issues about system operators (SOs) – what they are and what they do as well as their historical development over the last 20 years. In subsequent sections we discuss the roles of alternative types of SO, firstly, in single-area jurisdictions – primarily nation states, except for water supply; and, secondly, in multi-area jurisdictions e.g. regional groupings of states or, for water supply, regional water markets.

Our focus is primarily on arrangements that have been agreed or are proposed for the European Union. However, much of the development of SOs has been in the US and, apart from the UK, attempts at creating water markets with independent or integrated SO-type entities have mainly been in Australia. The development of ‘explicit’ SOs as separate institutions, i.e. independent system operators (ISOs), started in US electricity in the 1990s. There has, of course, been a long debate about the role of SO-type institutions in the EU with extensive argument over preferred variants both for electricity and gas. The 3rd Package of 2009 appears to have settled the debate at least for national arrangements, even if a number of countries have not yet transposed it into national legislation¹.

However, the debate has now moved on to the goal of creating an EU-wide single energy market, for which the target date of implementation is 2014. A single European energy market with multi-national arrangements involves major new and difficult issues: technical, economic and political – particularly in gas. For gas, the upheavals involved to existing market arrangements from the 3rd Package are much greater and there are real

¹ As of February 2012, according to EU Energy Commissioner Günther Oettinger, only 13 EU Member States had fully transposed the 3rd Package Directives into national legislation, something that should have been done by March 2011. 7 Member States had partially transposed it and 7 (including the Netherlands) had not transposed it even partially.

questions as to the feasibility, let alone the desirability of the reforms. Russia and other gas exporters to the EU have voiced considerable hostility². Finding effective SO (and SO-type) arrangements are at the heart of this debate.

For railways, system operator functions have existed from at least the 1840s. As railway networks developed, there was a need initially for common track gauges across areas and timetables - as well as for common signalling procedures, common emergency procedures, rail network expansion plans and investments, etc. The nineteenth century compilers of railway timetables were the first modern SO. These operations covered what we would now term SO functions even if they were not given that label then. They were particularly important in countries, like the UK, where there were multiple train companies operating on the tracks.

In recent times within the EU, there have also been three Rail Packages, the first two concerning inter-country freight travel and safety issues and the third covering inter-state passenger travel. However, as yet, they are much less prescriptive than energy in terms of national structure and national SO arrangements.

For water supply, there has been no EU legislation as yet on inter-state water trade nor on SO-type arrangements. Apart from England and Scotland, vertical integration without any explicit SO remains the overwhelmingly dominant - and largely unchallenged - model.

In what follows, we will firstly discuss in more detail the general economic issues behind the SO and variants debate, including competition issues. We will use that framework to amplify and organize the discussion introduced in this section. This will then be followed by analyses of (a) single area SO arrangements and proposals for the four industries and (b) multi-area arrangements and proposals.

² See, for instance, the statement by Gazprom Deputy CEO Alexander Medvedev on 7 February 2012. <http://english.ruvr.ru/2012/02/07/65556046.html>



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2. What do systems operators do, and why?

2.1. What are systems operators?

'Systems operator' is a term which has only recently begun to feature in the debate about the regulation of network industries. But just as M Jourdain had spoken prose for forty years without realising it, so the systems operator function was largely unrecognised in the utility sector for decades, until liberalisation made it necessary to bring it out into the light.

The simplest definition of a system operator is that it controls access to the network by service providers and (possibly) extensions to it.

Note that this definition can readily apply within the context of:

- (i) a single vertically integrated utility with multiple upstream sources and a single retailer distributing the product over a network across a wide geographic area;
- (ii) a fully ownership unbundled network with competing upstream and/or downstream suppliers; and
- (iii) intermediate models with (a) limited upstream and retail competition and with or without network unbundling.

The system operator is thus the key co-ordinating entity. This is set out in Keyworth and Yarrow as follows:³

"Less familiar [than regulation] is the development whereby the distinct service activity of 'co-ordination', supplied to companies in the relevant sectors, has been identified and whereby responsibility for its provision has, subject to regulatory

³ T Keyworth and G Yarrow, Economics of Regulation, Charging and Other Policy Instruments with Particular Reference to Farming, Food and the Agri-Environment, RPI, 2005, p. 29-30.

supervision, been allocated to a specific organisation or part of an organisation (a 'system operator')."

In classic monopoly utilities, where vertical and horizontal integration is complete, including monopoly control of imports and exports, there is still the need for some kind of SO activity. Power from various generators has to be physically delivered over a network to local supply entities and then to retail customers – and similarly for gas, water and train movements. However, one would not expect to see a separate SO entity. Rather one would expect to find one or more divisions or branches of the company undertaking the necessary co-ordination – indeed, in some cases, we will find a number of divisions or branches having responsibility for different SO functions. We call this an '*implicit*' SO. Its importance for the physical and engineering activities of the company is very important, even if its effect on competition and market structure is by definition zero.

At the other extreme, in a fully unbundled system with ownership separation of the network, SO arrangements are crucial in economic as well as physical terms. Indeed, it is the SO arrangements and their integration with the network that is crucial for the effective operation of upstream and/or downstream markets. Here, we have '*explicit*' SOs. At the single area level, this is most obvious where the SO is integrated with the transmission operator into an ITSO – an independent transmission and system operator. However, other variants also exist even if there are competitive upstream and downstream markets including ISOs and ITOs (independent transmission organisations).

The explicit ISO model can be very effective at short-term co-ordination, contract execution and even investment planning. However, some other entity has to make and finance network investment – SOs are asset-light entities that do not fund investment or hold significant physical assets other than in computer control systems and similar. This might be accomplished by a regulator allowing the recovery in access charges of efficiently incurred and approved capital and operating costs

Another possibility is what we term a '*virtual*' SO. Consider the Nordic electricity market, which is the key model for EU regional electricity and gas markets. There is a Nordic electricity trading market (Nord Pool). In addition, each member state has its own

national ITSO which is regulated by its own national regulator. These markets are physically linked by interconnectors. The co-ordination of interconnector access and access to national grids is handled by Grid Codes and inter-transmission company co-operation and not by an explicit SO. This 'virtual' SO model continues for the Nordic electricity and gas markets and appears to be the basis for the EU electricity and gas Target models discussed below.

In the above discussion we have covered cases in which systems operator functions are performed both within the confines of a single network (the 'single area' case) and with service providers making use of two or more networks (the 'multi-area' case). The more complex multi-area case, illustrated by international trade in energy, international train services and water transfers between company service areas eliminates (or at least complicates) a number of structural variants, including an SO combined into an ITSO with one network. We discuss this in more detail later in the paper.

2. 2. What do systems operators do?

In network industries, there is a need for a co-ordination function, which differs both from regulation and the operation of the network, to cope with the significant pecuniary and non-pecuniary externalities which link the now increasingly separated functions of running the network, providing services over it, and protecting end users.⁴

To be more concrete, three key co-ordination problems come to light immediately:

- Traffic management: with energy/trains/water/voice and data communications coming from all directions, there is a short- term traffic management problem, if congestion is to be avoided.
- Access to the network: there is an issue, operating over the medium term (a longer time period than detailed scheduling of access); it has three dimensions of

⁴ In this section, we avoid use of the terms 'upstream' and 'downstream', to accommodate different ways in which monopolistic and competitive segments can be combined in a network industry.

- major consequence for the industry as a whole – how best to allocate available network capacity among service providers; how to ensure where it is necessary, particularly when the network itself is investor-owned and self-supporting, that network revenues cover costs; and how to do the above without distorting competition among service providers.
- Expansion: in the long-term, decisions about expansion/contraction of network capacity have to be made in a way which benefits end users and does not distort competition among service providers.

The SO can be seen as one answer to (in principle) all of these problems. We now set out in general more detail what functions an SO may have to deploy to deal with some or all of these problems.

2. 2. 1. Traffic management, contract execution and transactions costs economics

The nature of the ‘real time’ traffic management problem varies from sector to sector. In electricity, the need continuously to balance the network requires very frequent scheduling and the ability to intervene almost instantaneously. Trains run to a timetable, but are subject to sudden variation in the face of unexpected events and emergencies. Other than in emergencies, gas and water are less subject to the need for immediate intervention because the physical systems are less interwoven and less sensitive as well as the existence of substantial storage capabilities.

Transactions costs economics (TCE) is exactly about this kind of issue. According to Tadelis and Williamson 2012,⁵(“T & D”), TCE deals primarily with adaptation to changes of circumstances in a contractual or other context. ‘Market’ and hierarchy’ differ in how they mediate the exchange between parties and settle disputes. One type of dispute is how to deal with situations in which, because of an unexpected circumstance, two

⁵ S Tadelis and O Williamson, Transaction Cost Economics, 2012, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2020176

service providers vie with one another for a limited amount of network access. This creates problem of taking immediate account of pecuniary and non-pecuniary externalities. A figure in T & D (p. 16), based on vertical integration, can be adapted to show the two alternatives of an adaptive market transaction and hierarchical one based on an authority-endowed interface co-ordinator or SO. This is shown in Figure 1.

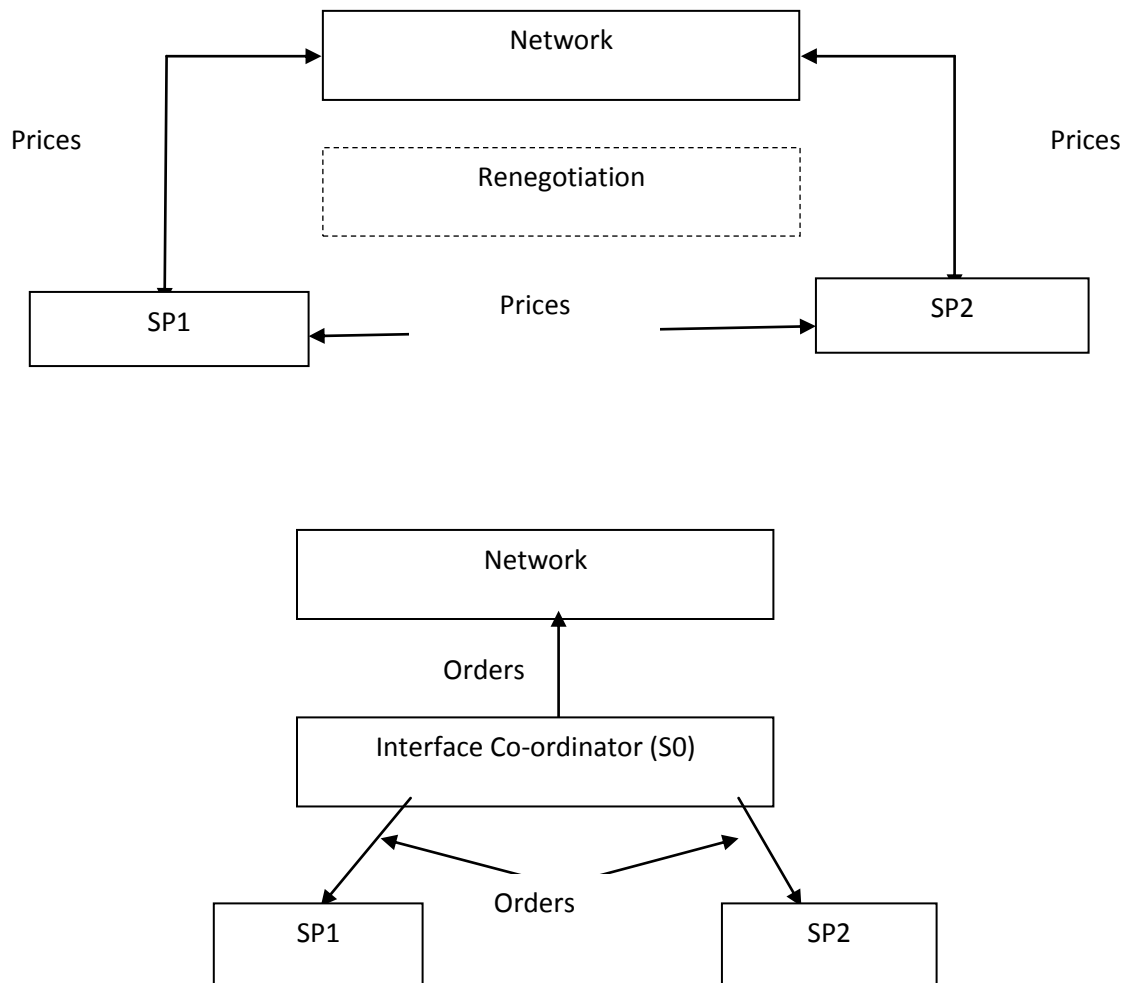


Figure 1. (SP= service provider)

In the upper part of the diagram, the independent actors have to scramble to adapt to the problem by renegotiating quantities and prices, leaving contractual disputes to be settled by the courts. In the lower part of the diagram, a bespoke actor - an 'interface co-ordinator' or SO - is created to which the parties report and from which they receive

administrative direction and control. The powers vested in the SO are a proxy for vertical integration. The SO performs its function without using a 'high-powered' incentive system, because, 'low-powered incentives combined with administrative control is what hierarchy is all about.'⁶

The advantage of hierarchy is linked with asset specificity. When the asset in question is time- specific access to a specific part of a network, with no alternative use, it is doubly specific. This creates close interdependencies among the parties. TCE suggests that if the assets were not specific and outside options were available, then market- mediated transactions relying on orderly bidding responses to changing relative prices would have a greater comparative advantage.

Another notion widely utilised in TCE is that of the incomplete contract. In an SO context, this might be associated with an unforeseen circumstance which is not accounted for in devising the contract. Transactions characterised by higher degrees of exogenous complexity result in endogenously chosen contracts that are more incomplete. A means of dealing with this is to allow the routine tasks to be performed as planned; but, when disturbances occur, decisions are made by the interface –co-ordinator which exercises unified control over production and adaptation. This is one way of dealing with another concept in TCE as developed by Williamson – information impactedness. This situation occurs when one group has more understanding or information about an exchange than the other group. This disadvantage (known or unknown) can make negotiations difficult or increase the risk of the exchange. Once again, this situation is more serious when there are small numbers of exchangers in uncertain, boundedly rational situations where the potential for opportunism exists. An SO can inhibit opportunism in situations of information disadvantage.

The second major function an SO typically performs in this time frame is contract execution. This may require sophisticated measurement and calculation, and it also

⁶ T&D, page 14.

requires the presence in the architecture of the sector of a trusted organisation. As Arrow says,⁷

“There is an element of trust in every transaction; typically, one object of value changes hands before the other does, and there is a confidence that the countervalue will in fact be given up. It is not adequate to argue that there are enforcement mechanisms, such as police and the courts; these are themselves services which are bought and sold...”

An SO can fulfil this function.

2. 2. 2. Access and antitrust

But why have an explicit and independent SO in the first place? Why not allow vertical integration? The explanation for this may be found when we move from ex post adaptation to ex ante regulation of network access.

Two recent literature of the causes and consequences of vertical integration in, mostly, non-network industries reach unexpectedly strong conclusions. According to Lafontaine and Slade (2007),⁸

“We did not have any particular conclusion in mind when we began to collect the evidence. We are therefore somewhat surprised at what the weight of evidence is telling us. It says that in most circumstances, profit maximising vertical integration decisions are efficient, not just from the firms’ but also from the consumers’ point of view. The vast majority of studies support this claim,... even in industries which are highly concentrated..”

⁷ K J Arrow, *Information and Economic Behaviour*, 1973, p. 24.

⁸ F Lafontaine & M Slade (2007). ‘Vertical integration and firm boundaries: the evidence.’ *Journal of Economic Literature*, 45, p. 679.

Joskow (2008) concludes⁹:

“Overall I would argue that there is substantial support in the empirical literature for various efficiency motivations for vertical integration. There is minimal empirical support for anticompetitive foreclosure motivations. This suggests that there is little empirical support for antitrust law’s traditional suspicion of and hostility toward vertical integration and related non-standard vertical contractual relationships except under extreme conditions where firms controlling bottleneck have the incentive and ability to exercise an anticompetitive foreclosure strategy”.

The sad truth seems to be that in network industries ‘firms controlling bottlenecks’ *do seem* ‘to have the incentive and ability to exercise an anti-competitive foreclosure strategy,’ and Joskow himself comes down firmly, in his review of electricity market liberalisation, against the “vertical integration between transmission and generation that creates the incentive and opportunity for exclusionary behaviour.”¹⁰

However, this is the second step. A monopoly network could simply not bother to compete in the services/retail market, and could choose to sell access to the network, probably in a complex, non-linear and discriminatory manner, to maximise its short term profits, and expand (or not) its network capacity to maximise its profits in the longer run.

The obvious solution to this problem is regulation. If it removes most or all excess profits, the network operator will seek to leverage whatever market power it has to build a strong and profitable position in the downstream market. This can be done by either price or non-price discrimination; the former being more direct but also easier to detect.

The conditions for this being profitable are quite likely to be satisfied, so it is natural to look for counter-measures. One such is vigilant enforcement of regulation. Another is

⁹ P Joskow, Vertical integration. American Bar Association. 2008, <http://econ-www.mit.edu/files/1191>

¹⁰ P Joskow, P. (2008). ‘Lessons learned from electricity market liberalisation.’ *The Energy Journal*. 29(2), p. 22.

separation of various kinds. A third is to introduce a separated and disinterested SO to implement the access regime. These options are examined in more detail in section 1 (iii) below.

2. 2. 3. Network expansion and the co-ordination of investment

How can an investment plan for a network be determined? Doing so involves ‘integrating’ the projected demand of all network users. That can be done by addressing end users. But where the location of transmission demand is relevant, it may be necessary to go to the suppliers. This creates an ‘adding up’ problem: the sum of individual suppliers’ projections may not match the overall demand, creating the risk of over-or under-development of the network. A SO, separated from any provider can undertake this task.

This is an issue which raises in a single sector one which decades ago was considered in application to the economy as a whole.¹¹ The theory of indicative planning addresses the question of whether it is impossible to eliminate some forms of market uncertainty in an economy through co-ordination of forecasts.¹² It was recognised that uncertainty about the environment was impossible to eliminate but hoped that the following types of situation might be avoided: a new investment is required. Either all firms invest, or (in the more sophisticated version) all firms conjecture that all others will invest and so none does. In the latter case, ‘an opportunity for all is an opportunity for none.’

The notion of indicative *national* economic planning, after enjoying some apparent successes in the middle of the last century, foundered on the increasing openness of national economies, which made meaningful long term forecasting increasingly difficult.¹³ Yet markets for many network industry outputs are predominantly national, so the

¹¹ A more up-to-date approach to these issues can be found in the more abstract field game theoretical approaches to coordination and cooperation. See S Goyal, *Connections*, 2007, Ch. 4.

¹² J Meade, *The Controlled Economy*, 1971.

¹³ M Cave and P Hare, *Alternative Approaches to Economic Planning*, 1981, Ch. 7.

problem of unforeseeable supplies from outside the national territory is likely to be less damaging to the information content in a forecast.

How might a co-ordinated investment plan be generated? Basically, by two methods, called analytic and synthetic. In the former, the planner forecasts demand, derives where it should be produced and checks the results with the firms involved. This iterative process manages expectations and is intended to generate a consistent plan.

The synthetic route starts from suppliers' expectations or projections. The planner tests these for consistency in the 'adding up' sense and reports back. Again an iterative process ensues, which is intended to lead to a commonly held, published prognosis of the future.

2. 3. A competition policy perspective

This section discusses how the application of competition law may give rise to pressure to develop SOs. The starting point is that some ownership structures give the former monopolist the means and the motive to distort competition and foreclose entry into the competitive service provision segments of the network industry value chain. This has attracted competition authorities to the notion that either the motive should be removed by full ownership separation, or that the means should be removed by separation, better enforcement, or the insertion of an independent SO. Accordingly this section briefly reviews where competition investigations have led, taking the EC's energy market inquiries as an example.

As has already been noted, the issues raised by the energy inquiry have been addressed both by the Commission's use of its competition law enforcement powers, and in the 3rd energy package. But it follows from the discussion which follows that inadequate SO arrangements leave a vertically integrated incumbent in any sector open to charges of abuse of a dominant position.

2. 3. 1. A summary of the theory

We begin with the case of a fully separated network operator. From a competition law point of view, this operator could maximise its profits by acting as a perfect price

discriminator. Even if it were imperfectly price regulated it would still have an incentive to make excess returns and to price discriminate.

A network operator also permitted to be active in the services market would have no reason to take up that opportunity if it could extract the full monopoly profit from its control of the network, unless it were more efficient than its rivals in the service activity. This follows from the proposition that 'you can only make a monopoly profit once'. However, as noted above a network monopolist is likely to be regulated to some degree as to its prices and constrained in the profit it can make there. This will give it an additional incentive to gain power in the service market, for example by applying a margin squeeze and eliminating or weakening its competitors there. However, this is unlikely to escape detection.

Accordingly, it may have to fall back on non-price discrimination, also known more colourfully as 'sabotage'. Such a policy is likely to be profitable if the network operator satisfies the following conditions:¹⁴

- its monopoly activities are regulated to cost;
- the services market is homogeneous;
- the integrated firm is an efficient service provider.

Since some or all of these conditions are likely to be fulfilled, the possibility of non-price discrimination is a real one.

The traditional response is to sharpen enforcement, but this may fail, especially if the conditions for convicting and punishing a transgressor are stiff. Accordingly, attention may turn to some form of separation, which will either remove the motive to discriminate or make it harder to get away with. Only full ownership separation will fully remove the motive. Various forms of separation less than ownership separation, including functional

¹⁴ Beard, T., Kaserman, R.D.I. & Mayo, J.W. (2001) Regulation, vertical integration and sabotage. *Journal of Industrial Economics*, 49(3), 2001, 319-333.

separation may go part of the way – for instance, if they make it easier to establish whether service providers affiliated with the network are being treated in an equivalent manner to those not so affiliated. It may also help to detach the bonuses of network employees from the financial success or otherwise of the service providers, but if the labour markets are not separated, this may not work if a manager might switch from one activity to the other.

One form which the separation could take is hiving off the key tasks of traffic management and capacity allocation to a quasi-independent body, now recognisable as an SO. We now turn to a worked example of a competition authority going through precisely this thought process.

The European Commission's energy market inquiry¹⁵

The energy market inquiry, published in 2007, found many defects in electricity and gas markets in Europe, which can be summarised as follows:¹⁶

- at the wholesale level in particular, market concentration was found to be high.
- an insufficient level of unbundling between network operation on the one side and supply and/or generation activities on the other side resulted in vertical foreclosure preventing potential competitors from entering the market and threatening security of supply.
- insufficient cross-border capacities and different market designs constituted an obstacle to further market integration. Existing network capacities were found to be largely controlled by incumbent companies which supposedly had only slight incentives to expand their network capacity for the benefit of their competitors.

¹⁵ See Communication from the Commission: Inquiry pursuant to Article 17 of Regulation (EC) No 1/2003 into the European gas and electricity sectors (Final Report). {SEC(2006) 1724}

¹⁶ Ulrich Scholz and Stephan Purps, 'The Application of EC Competition Law in the Energy Sector', Journal of European Competition Law & Practice, 2010, Vol. 1, No. 1, pp. 37-51.

- market entry of new competitors was further hampered by information asymmetry between incumbents and market entrants.
- the lack of efficient and transparent price formation was regarded as the key reason why the opening of the energy market had failed to result in benefits for consumers.
- long contract durations, the lack of competitive offers from non-incumbent suppliers and restrictive practices in relation to the operation of supply contracts had resulted in the foreclosure of downstream markets.

The focus here is upon breaches of competition law relevant to the co-ordination function carried out by SOs. The basis conclusion of the inquiry was that each of the three SO activities – ‘traffic management,’ capacity allocation, and ‘network expansion’ – was tainted by discrimination in favour of vertically integrated incumbents.

The instantaneous traffic management abuse is illustrated by the case taken by the Commission against E.ON, the integrated German energy firm.¹⁷ The ‘balancing’ component of that case found that in performance of its necessary balancing function, E.ON as a transmission systems operator favoured its own generation affiliates when purchasing balancing services. It did so by choosing to purchase the form of balancing power which was produced by its generators, rather than one produced by their rivals, thus abusing its dominant position under Article 82 TFEU.

On foot of this finding and another in the wholesale energy market, the Commission accepted binding structural commitments from E.ON. The result, motivated by the balancing case, was a commitment to sell its German electricity transmission network together with the system operator activity to a new owner without generating capacity. The Commission explained that in this case a structural remedy was proportional because an alternative behavioural remedy was impracticable: the activity took place on

¹⁷ Ph. Chauve et al. The E.ON electricity cases: an antitrust decision with structural remedies’, Competition Policy Newsletter, no. 1, 2009, pp. 51-54.

a continuous basis, at any moment of day and night, and creating a monitoring system would be difficult and burdensome.

The capacity allocation issue is illustrated in a variety of cases concerned with refusal to supply transportation capacity to competitors by a number of stratagems carried out by the vertically integrated incumbent, including:

- inadequate capacity management;
- capacity hoarding and degradation;
- long term capacity bookings by the incumbent shipper;
- margin squeeze.

Finally, in relation to network expansion, the energy sector inquiry addressed the issue of strategic underinvestment. This occurs when a network operator deliberately creates a shortage on capacity on the back of which it discriminates in favour of its affiliated service providers. From the networks point of view, the merit of this weapon, compared with foreclosure of existing capacity, is that what is required is not activity but inactivity.

The Commission made it clear in the E.ON decision that underinvestment can be an abuse:¹⁸

“... the mere fact that the current capacities may have been actually used by the essential facility holder for its supply business is not sufficient to exclude an abuse under Article 102 TFEU...

... a dominant essential facility holder is under the obligation to take all possible measures to remove the constraints imposed by the lack of capacity (e.g. by limiting the duration and volume of its own bookings or by expanding its capacities).”

¹⁸ E.ON Decision, para. 40 and fn 46

Its stance in the ENI gas case was stronger. It concluded that, to protect its profits in downstream gas markets, ENI was prepared to forego investments in expanding transport networks which were likely to be profitable on their own terms. As with the E.ON case, a structural commitment was accepted which involved ENI divesting its shareholdings in the relevant transmission networks.¹⁹

It is thus clear that the absence of an independent SO can lead to outcomes in which a network operator might be found to have committed an abuse in respect of each of the time dimensions in which we argue an SO can play a role. Or conversely, the presence of a disinterested SO can prevent abuses in traffic management, remove the motive to foreclose existing network capacity and, by intervening in the network expansion process avoid strategic underinvestment without jeopardising a regulatory arrangement whereby the network operator is allowed to recover efficiently incurred costs.

¹⁹ F. Maier-Rigaud et al. 'Strategic underinvestment and gas network foreclosure – the ENI case', Competition Policy Newsletter, No 1, 2011, pp 18-23.



CENTRE ON REGULATION IN EUROPE

3. SOs in energy - the single area case with one infrastructure owner

3. 1. The Origins and Development of Electricity System Operators

Traditionally, in almost all countries, electricity companies have operated as vertically integrated companies with one or more generating plants supplying final consumers over a network of wires. In the nineteenth century, most electricity utilities were small local entities with only low voltage distribution networks but, by 1920, regional electricity companies had emerged with several generators and covering a wider area. This led to the development of high voltage transmission, owned by the regional power company (as in Germany and the US). The alternative, e.g. as developed in England in the 1920s, was a national company with integrated generation and transmission selling bulk power either to regional distribution and supply companies or as, in post-1945 France, to final consumers directly via franchised distribution companies.

3. 1. 1. Main SO Functions in Electricity

The main SO functions in electricity can be outlined as:

- (a) Short-term: Typically within the day, including scheduling, congestion and balancing procedures, emergency management, etc;
- (b) Medium-term: Contract and network co-ordination issues not involving investment; and
- (c) Long-term: Network planning and investment related issues.

If system operation and transmission are combined in an ITSO, all of these will be the responsibility of the ITSO – but the operational responsibility for and management of the functions are split between the SO and TO parts of the ITSO, as in National Grid in

England and Wales. If, however, transmission and system operation are partially or wholly separated, the functions will need to be assigned to the relevant entity.

We can classify the main tasks for an ITSO as follows²⁰:

- (i) Ensuring the operational security of the system;
- (ii) Maintaining the moment-by-moment and short-term balance between demand and supply;
- (iii) Enhancing the efficient functioning of the relevant markets; and
- (iv) Ensuring and maintaining the adequacy of the transmission system in the long-run.

However, while some of these tasks are clearly SO tasks, others are TO tasks – or could be assigned either to an SO or to a TO (e.g. network expansion planning).

In a vertically integrated infrastructure industry, the various SO tasks may be allocated to different business branches or they may be brought together in a specific division, which would also handle exchanges and sales to and from other vertically integrated companies. They are crucial for the efficient operation of the entity, but, in the absence of substantial competition, they have little or no economic or commercial importance. Such arrangements were common on pre-1990 US electricity pools but exist elsewhere e.g. in current England and Wales water companies. The ITO (independent transmission organisation) option in the EU Energy 3rd Package is a semi-unbundled successor of this approach.

SO functions in electricity are discussed in more detail in Section 3.3 below.

SOs – ISOs and ITSOs - become more explicit with more clearly defined functions as upstream (wholesale) and/or downstream (retail) markets develop. They are the crucial

²⁰ NordREG Report 'A Common Definition of the System Operators's Core Activities' (4/2006). The SO tasks have been reordered and slightly redrafted for the purpose of this paper.

tool in the development and co-ordination of these upstream and downstream markets. As competition develops, so the role of network operation becomes more important, as do the effective performance of SO functions. Indeed, as set out in the previous section, defining and properly allocating SO functions is crucial to ensuring effective competition in upstream markets and preventing network owners from acting anti-competitively to favour their own company's interests.

3.1.2 The Origins of System Operators pre-1990

System operation as a set of functions arrived with regional and national power companies. There had to be procedures to co-ordinate the supply of generation across the network(s) to the geographically disaggregated local supply entities and local customers. This was carried out by 'implicit' system operators. The power company had to organise, among other things: what generators to dispatch when, maintenance schedules, emergency procedures, network (and generation) expansion plans – and interconnection for power exchanges and/or sales with neighbouring companies. These tasks are both crucial and complex given that electricity (a) travels at the speed of light; (b) is non-storable and (c) requires (increasingly meshed) networks that have to be kept in balance moment-by-moment.

Modern 'explicit' system operators only emerged in the 1990s in the US. But, there is a pre-history. From the late 1920s, power pools began to emerge. The first was the Pennsylvania-New Jersey-Maryland (PJM) connection which originated in the late 1920s. By the 1980s, a number of power pools had developed in the US which operated either as "tight" power pools or as "loose" power pools. Early explicit system operators, especially independent system operators (ISOs), developed out of "tight" power pools, which developed in North Eastern States after the Northeast Blackout of 1965.

Tight power pools had centralized dispatch across a unified and highly interconnected control area. However, the unified control area did not have ownership of the transmission systems; transmission ownership remained with the companies who were members of the pool. The pool organized planning on a single basis and had complex rules and procedures. System operation co-ordinated generation dispatch and grid

operations. However, from the start, there were tensions over what network (and generation) investment was made and where it was located. Tight pools also had no explicit, competitive upstream generation markets.

Tight pools dominated in the North East of the US – New York and New England as well as PJM. Most of the rest of the US had pools with varying degrees of “looseness.”

Tight power pools was a major originating factor for the New York ISO which, in its current guise, was established in 1999 as well as the New England and PJM multi-area ISOs which we will discuss in the next chapter. The other US single-area ISOs are Texas and California which have a different origin.

3. 1. 2. The Post-1980 Development of ISOs in the US

The main legal origins of modern ISOs go back to the 1970s. In 1978, the PURPA (Public Utilities Regulatory Policy Act) Federal law was enacted. That law tried to create a market for non-utility power generators (primarily renewables) by mandating electric utilities to buy power from the new producers at an ‘avoided cost’ rate. However, implementation was left to the States. Little new generation was built as a result and much of that was very high cost generation on long-term contracts, most of which are expiring over the next 5-10 years.

During the 1990s the Federal Government and FERC tried to develop wholesale generation markets – and that has meant encouraging explicit system operators. This was very much a top-down initiative with the objective of developing wider generation markets. A major objective throughout in establishing increasingly separate and independent SOs has been to reduce considerably (if not totally eliminate) discrimination by vertically integrated utilities to use their own generation, even if at significantly higher cost.

The starting point was the principle that transmission companies operating under FERC jurisdiction (i.e. companies with inter-State transmission) had to allow other entities to access their transmission lines under the same terms, prices and conditions as they applied to themselves. In consequence, under FERC Order 888, of 1996, vertically

integrated electricity utilities were encouraged (but not mandated) to introduce *functional separation* between generation and transmission and to form ISOs (independent system operators) to manage the transmission network. However, these individual company ISOs seemed to do little to eliminate discrimination in generation or in transmission so that FERC moved to encourage RTOs (Regional Transmission Organisations). Under FERC Directive 2000 of 1999, these were encouraged (but not mandated) to establish *ownership separated* ISOs covering a generation market of sufficient size to be viable as a wholesale trading entity.

The two single area ISOs so created are ERCOT in Texas and CAISO in California. Of these two, ERCOT is particularly interesting in the EU context. Firstly, unlike the rest of the US, Texas has developed extensive retail competition and, by 2007, 60% of industrial consumers and over 35% of residential customers had switched to competing suppliers. More importantly, ERCOT manages an integrated grid covering 75% of the area of Texas and 85% of its load, including scheduling and central dispatch. ERCOT also manages the day-ahead and real-time balancing and ancillary service markets as well as financial settlement. Generation is traded bilaterally (as with NETA in the UK). However, ERCOT is run as a not-for-profit entity with 16 directors drawn from various participating companies, regulatory bodies and others.

Unlike the other US ISOs, the implementation and financing of transmission investments in Texas is internalized within the ERCOT framework so that intra-regional congestion in Texas has been relieved by additional investment. This issue has not been resolved either in New York or in California, where investment co-ordination remains a lot more problematic. However, investment levels in transmission 2005-08 in both NYISO and CAISO have been high relative to ERCOT and other regions in the 2005-08 period²¹.

The other major objective of electricity restructuring in both California and New York was to bring down perceived high retail prices. That has not happened in New York and it

²¹ See Tierney S.F. (2010) 'The New York Independent System Operator: A Ten-Year Review' Analysis Group.

was the attempt to retail price reductions irrespective of cost pressures that was a major factor in the collapse of the 1990s California electricity restructuring.

We will discuss the impact of the US ISO programme in more detail in the next chapter when we discuss regional RTOs. However, there is general agreement on the following, which applies to CAISO and NYISO²²:

- (i) The 1st generation *functionally separated* ISOs were a failure – as recognized by their replacement within 5 years by the 2nd generation ISO/RTOs. In particular, there is agreement that they did not reduce other than trivially discrimination by vertically integrated companies against outside generation.
- (ii) The 2nd generation *ownership separated* ISOs have produced benefits in terms of more efficient management of the transmission grid and improved generator access to wholesale electricity markets, but not any obvious long-term benefits. Transmission investment remains a problem outside ERCOT even in single States where there is much less of a regulatory mismatch.
- (iii) Wholesale power markets have benefited from more efficient dispatch and greater use of low cost generation, but the question as to whether retail consumers have benefited is less clear. It is also unclear, at least outside Texas, how genuinely competitive are generation markets nor how effective is their oversight.

²²

For further information and a fuller discussion of these points see Stern, J. (2011). 'System Operators: Lessons from US and EU Energy Industry Experience and Implications for the England and Wales Water Industry'. City University, CCRP Working Paper No.18. See also GAO, (2008). 'Electricity Restructuring: Report to the Committee on Homeland Security and Governmental Affairs', U.S. Senate, GAO-08-987, Joskow, P.L. (2007), 'Independent System Operators (VI + Access Rules vs. ISO vs. ITO)', Kwoka, J.E. (2010). 'Market Structure, Competition and Regulation in Electricity Market Reforms'. Presentation at World Bank Energy Practice Day and Pollitt, M.G. (2011) 'Lessons from the History of Independent System Operators in the Energy Sector with applications to the Water Sector'.

These issues and other factors have led most electricity economists to prefer ITSOs to ISOs, particularly in single areas.

3. 2. Single Area Electricity SOs in the EU

SO arrangements for electricity in the EU did not surface explicitly until the 2nd Directive in 2003. Mandatory legal unbundling of EU electricity companies was required in the 2nd Electricity Directive of 2003 – but not ownership unbundling which was strongly resisted by a number of countries. The 2003 Directive required, among other things that, at least as a minimum, all Member States:

- establish legal and management unbundling of TSOs and DSOs on top of accounting separation for transmission/transport and distribution system entities – but not necessarily ownership unbundling;
- introduce full retail competition by 2004 for commercial customers and 2007 for households;
- establish regulated TPA (third party access) based on approved and published tariffs set by national regulators for transmission/transport, distribution and some related services;
- impose non-discriminatory obligations to ensure fair access to networks, particularly in gas (e.g. over availability and allocation of firm and interruptible capacity); and
- impose (at least in theory) the same access rules on interconnector transmission lines as for within country transmission.

Hence, the Directives required at least *functionally separated* transmission and distribution networks and network operators with published, cost based tariffs, similar to the first generation US ISOs. Some countries went further and imposed ownership separation of networks i.e. full ITSOs. For electricity, the ITSO countries were: Denmark, Netherlands, Sweden, Spain and the UK, with Italy now moving down that route. France and Germany led the group of countries opposed to ownership-separated ITSOs, along with the Central European countries and Ireland.

There was a review of the 2nd Package of reforms in the DG Competition Energy Review of 2006-07. The Review clearly favoured the ITSO model and heavily criticized the alternative. The main conclusions were as follows:

- (i) *Without ITSOs, wholesale gas and electricity markets remained national with little new entry or incumbent entry into other areas. Generation market concentration levels and market power remained high.*
- (ii) *Functional separation of transmission and system operation had serious weaknesses regarding (a) the functioning of wholesale markets and (b) network investment – particularly network investment that would primarily benefit non-incumbent suppliers. There was clear evidence that non-ownership unbundled SOs favoured their own affiliates and that network investment decisions are taken on the basis of the supply interests of the integrated incumbent.*
- (iii) *Cross-border sales did not impose any significant competitive constraint on incumbent behaviour. Concerning access to primary markets via interconnectors, contract reservations on interconnector capacity plus some physical constraints were frequently used by incumbents to protect their position. However, interconnectors are often physically under-used with significant spare capacity because there are no effective secondary markets or UIOLI (use-it-or-lose-it) constraints. Non-ITSOs had strong incentives not to add to existing interconnector capacity.*
- (iv) *There was a considerable absence of transparency, particularly on network availability and especially on interconnector lines. The Review called for significant additional interconnector capacity and the use of day-ahead auctions managed by TSOs. Generation market transparency was also heavily criticized.*
- (v) *Retail competition was limited in France, Belgium and other similar countries. This was partly (a) because of regulator-set low default supply prices (c.f. the US); and also (b) because of long-term contracts between suppliers and industrial customers on top of long duration gas import generation supply contracts.*

- (vi) *Problems arose with electricity non-ITSOs over market balancing, reserve energy and ancillary services which were often used by incumbent non-ITSOs in an anti-competitive way. Widening overly narrow control areas and harmonizing balancing markets was needed to enable effective upstream competition.*

The unbundling remedies recommended were:

- (i) *Anti-Concentration Measures.* DG Competition identify divestitures to break up generation concentrations. They placed particular emphasis on Virtual Power Plant (VPP) auctions and they have imposed such requirements as conditions for merger approval in several cases (e.g. the Austrian Verbund-EnergieAllianz and EDF-EnBW mergers).
- (ii) *Taking action to promote market integration.* This includes both action to prevent lack of investment and delays in network investment (particularly interconnectors) plus action against long-term take-or-pay power purchase and other contracts. Widening control areas and balancing zones also comes into this category.
- (iii) *Ownership unbundling of networks.* The absence of this is emphasised several times as the major flaw with the 2nd Directive. The findings and associated recommendation led to a concerted (but ultimately unsuccessful) attempt by the Commission to press for full ownership separated ITSOs in the 3rd Package.

It is noticeable that the DG Competition Inquiry did not recommend the US ownership-separated ISO route as a good option. They did consider it but explicitly rejected it as follows: “The independent system operator approach would improve the status quo but

would require more detailed, prescriptive and costly regulation and would be less effective in addressing the disincentives to invest in networks”²³.

However, the recent Ofgem review of UK electricity and gas network regulation²⁴ found that, particularly in electricity, ownership separation has not encouraged new transmission investment by National Grid to meet the demand for additional transmission capacity as much as they and others would like. In addition, Léautier and Thelen’s 2009 study of electricity grid expansion (or, more strictly, reductions in congestion costs) in a number of countries and US states showed that both the degree of unbundling and the strength/effectiveness of transmission incentives are important determinants of reductions in grid congestion costs. (They point out that the relevant investments to relieve congestion included many small upgrade projects as well as major new transmission lines.)

On this test, Léautier and Thelen find that (a) England & Wales and (b) Argentina performed best, combining full grid unbundling with effective transmission incentives. They achieved low and declining congestion cost levels. However, a number of countries with relatively unbundled electricity ITSOs (the Nordic countries and Spain) did worse than some of the main US RTOs because the greater strength of the investment incentives in the latter overcame the design weaknesses of RTOs relative to ITSOs. But, RTO performance was quite varied with only ERCOT, Texas (and, to a lesser extent, the New England RTO) having low and falling congestion costs over the 2000-06 period²⁵.

The DG Competition Inquiry led to the proposals for - and negotiations on - the 3rd Package where the EU Commission and the reformers pushed hard for ownership unbundling of transmission and system operation at national level. However, in the face

²³ DG Energy Inquiry Final Report p. 14.

²⁴ Launched by Ofgem as RPI-X@20 but producing reports under the label of RIIO (Revenue = Incentives + Innovation + Outputs).

²⁵ See Léautier, T-O. and Thelen, V. (2008). ‘Best options for expansion of the power transmission grid’. Energy Policy Blog. and Léautier, T-O. and Thelen, V. (2009). ‘Optimal expansion of the power transmission grid: Why not?’, Journal of Regulatory Economics, Vol. 36, No. 1, pp 127-153.

of implacable opposition from France, Germany and their allies, the Commission and its allies were forced to accept the compromise alternative of ISOs and ITOs²⁶ (the latter with legal but not ownership separation of transmission and system operation) as an alternative to full ownership unbundled ITSOs for member states.

3. 3. System Operator Functions in Electricity

SO functions for electricity across the energy, rail and water industries were briefly outlined at YY above, focusing on the differences between ISOs and ITSOs Rious (2006) defines system operation in electricity as "... the management of the short-run externality (mainly congestion and losses) on a power transmission network to ensure a short-run adequacy between generation and consumption while respecting the network constraints"²⁷. This is a good definition for the short and medium run but omits the long-run issues of network investment planning and implementation.

Pollitt (2011) distinguishes between 'operation of the system' (as set out by Rious) and 'operation of the energy markets'. Pollitt points out that *all* ISOs undertake control of the physical operation of the system for which they are responsible. However, some - but by no means all - ISOs manage the range of generation and related upstream markets involved in a competitive electricity system. Based primarily on US experience, Pollitt defines the minimum functions of a single-area ISO as:

- (i) Transmission Network Tariff Administration and Design;
- (ii) Congestion Management
- (iii) Parallel Path Flow Management
- (iv) Ancillary Service Provision (including pricing and ancillary market co-ordination where such markets exist)
- (v) Operation of non-discriminatory access (including relevant software)
- (vi) Market Monitoring - including geographic sub-markets

²⁶ Independent Transmission Owner

²⁷ See Rious V. (2006), 'An operational and institutional modular analysis of Transmission and System Operator', p.3.



- (vii) Network Planning and Expansion
- (viii) Inter-area Co-ordination²⁸

Pollitt’s list is derived from discussions among electricity economists and engineers and takes US ISO/RTOs as its starting point. It is useful to contrast the list of functions above with the list of electricity SO and TO functions set out by NordREG (the Nordic energy regulators group) in 2006. NordREG were clearly concerned with developing an operational *regulatory* perspective. The NordREG classification is set out below.

The 2006 NordREG report on this topic identifies the following SO activities. We classify these in the Table below by time period. There is clearly a very high level of overlap with the Pollitt list, particularly for short-term functions.

Table [1] System Operator Functions by Time Period

Time Period	Function
Short-Term	Secure short-term (1 hour or less) system operation according to operational agreements and codes
	Maintain demand supply balance within short-term (1 hour)
	Manage disturbances and emergencies by system planning procedures and methods
	Manage shortage situations by agreed action plans including disconnections or equivalent
Medium-Term	Adopt and implement consistent and co-ordinated capacity calculation and allocation procedures as the basis for day-ahead, weekly and monthly system operation
	Adopt and implement common and consistent procedures for congestion management
	Operational planning for network operation for up to 1 year ahead, including maintenance planning and co-ordination
	(Settlement) Set imbalance prices, settlement principles and execute national balance settlement

²⁸ See Pollitt (2011) op cit, pp 8-9.



Long-Term	Define common technical requirements for secure system operation and expansion

Source : NordREG 2006, p. 6-7 (with generalisation for this paper)

NordREG also define TO functions as set out in Table 2 below. Note that some of these are allocated to the SO in other jurisdictions. These are marked with an asterisk.

Table [2] Transmission Operator Functions by Time Period

Time Period	Function
Medium-Term	Ensure the technical compatibility within and between networks
	Maintain the proper functioning of the transmission system by appropriate planning methods and tools
Long-Term	Plan the expansion of the network, including interconnection *
	Carry out network expansion (new investment) in a timely manner

Source: NordREG 2006, p. 6 (with generalisation for this paper)

3. 4. Effectiveness of ISOs Relative to ITSOs in a Single Area

As we will discuss in the next chapter, where control areas have transmission networks with different owners, ISOs dominate ITSOs both in theory and in practice. That mainly affects multi-area jurisdictions (e.g. multi-State ISO/RTOs in the US), but it can affect single jurisdictions e.g. California and New York. It is not a major issue in the EU, at least, not in general for single member states. However, where control areas and jurisdictions have a single transmission network, ITSOs dominate ISOs. This is because, however well ISOs perform on the short and medium-run tasks, they have problems on the long-term functions – the planning and especially the implementation of network investment. Relying on short-run congestion related signals does not provide sufficient revenues for network expansion. However, even in the short-run, ITSOs appear to out-perform ISOs on some co-ordination issues e.g. over the effectiveness of emergency procedures.

The exception to the presumption that ITSOs best fulfil all of the SO and TO functions is where network ownership is not unified even within a single country/jurisdiction. For instance, in the UK, there is a single electricity market for Great Britain (GB – which covers England, Wales and Scotland). This market is regulated by Ofgem. England and Wales have an ITSO – National Grid which combines SO and TO functions but with some degree of functional separation between SO and TO functions (and separate SO and TO incentives). However, Scotland now has an ISO, operated by National Grid but with the Scottish transmission assets not owned by it. Hence, for Great Britain as a whole, there is an ISO.

In addition, Scottish offshore wind-farm transmission links are currently all being built and operated by companies other than National Grid²⁹. They are known as OFTOs – Offshore Transmission Operators and, when built and in operation, will be co-ordinated with the rest of the system via the GB SO. Pollitt (2011) points to the consistent success of other companies competing with National Grid in OFTO auctions as an indicator of potential efficiencies with merchant transmission for standalone facilities within single areas. There may well be similar examples in other EU member states.

In addition, Pollitt argues that ITSOs have an incentive to inflate estimates of investment requirements so that they may not be as superior to ITSOs on investment planning and implementation as argued by most electricity economists. For instance, ITSOs may urge reinforcement investment in low-risk parts of the existing network. That was argued in the context of the Ofgem's recent review of network regulation. It is a horizontal competition issue. However, it is also an issue which can be addressed by a combination of some degree of SO-TO functional separation plus stronger SO incentives. The latter was the option chosen by Ofgem, not least because it avoids the serious investment co-ordination issues with SO-TO ownership separation. Note also that SOs on their own are very asset-light. Hence, incentives on standalone SOs cannot be high-powered without placing undue risk on the company. Functional separation (e.g. management or

²⁹ See Pollitt (2011) op cit, p.38.

business separation) of SOs provides for regulatory transparency and more effective competition oversight while allowing stronger SO as well as TO incentives.

Of course, in the EU context, within single area EU jurisdictions, the choice has not typically been between an ITSO and an ISO but between an ITSO and an ITO. The problem with ITOs is whether or not they avoid the fundamental problem of continued, significant discrimination against non-incumbent generators. Their supporters claim that they do, but ITSO supporters – and most independent observers – claim that they do not. We will consider this further below.

3. 5. Current and Ongoing EU Single Area Issues

There are two sets of currently outstanding single area electricity issues. The first is the choices that EU Member States have made on SOs – and changes in them. The second are the outstanding issues on regulation and other factors that have emerged. We discuss each in turn below.

3. 5. 1. Current EU Member State Choices on Electricity SO and TO Arrangements

When making their 3rd Package choices, most EU member states have opted for electricity ITSOs – the FOU (Full Ownership Unbundling) option. No member state seems so far to have chosen the ISO option. However, as discussed above, Scotland operates within a GB ISO³⁰ and Northern Ireland is an ISO³¹.

Nine member states initially expressed a preference for the ITO option: Austria, Bulgaria, Cyprus, France, Germany, Greece, Latvia, Luxembourg and Slovakia. Of these, several are very small and/or isolated systems. In addition, Germany is increasingly moving into the ITSO/FOU camp with both TenneT and 50Hertz having moved away from an ITO.

³⁰ This is covered by a derogation (Article 9 (9) of 2009/72/EC) under which the arrangements established before September 2009 are exempted if they imply stronger network independence than the independence requirements needed for a qualifying ITO.

³¹ The 3rd Package seems to be creating significant problems for the developing All-Ireland integrated electricity market. It remains to be seen how these will be resolved.

This means that over half of Germany's transmission lines are now within ITSO/FOU ownership.

The remaining Member States seem to be in the ITSO camp or are small/isolated enough to be exempt from the 3rd Package requirements.

3. 5. 2. Outstanding Issues with EU Single-area SOs

The main EU outstanding issues affecting electricity SO arrangements concern multi-area SOs. However, there are some outstanding single area issues.

ITO Independence

The most obvious outstanding issue is with ITOs. The 2009 Directive requires a high degree of internal separation of ITOs within vertically integrated companies and also a high level of regulatory scrutiny of ITOs. There has been an initial test of that regarding the Certification of RTE, the French ITO.

RTE put forward its proposals which were sent to CRE, the French electricity and gas regulator. These proposals were also considered by the EU Commission who published a Commission Opinion on 25 November 2011. The Commission Opinion was critical in a number of respects and requested a significant enhancement of RTE independence relative to the RTE proposals. CRE published its decision on 26 January 2012 required a much enhanced degree of separation than RTE (and EDF) had originally proposed.

The reluctance of the pro-ITSO states and the EU Commission to accept ITOs was always because of the concern that they would be independent on paper but not in fact. Hence, it was argued before the 2009 compromise that discrimination against generation from other companies would continue to be exercised unless SO and TO functions were fully ownership unbundled. We do not have any empirical evidence on this yet. However, the potential competition worries have already been revealed in the RTE Certification example.

National and EU Electricity Regulation

In the US, one of the major problems with ISOs has been with the overlap between (a) Federal regulation by the FERC; and (b) State regulation by individual State Regulatory Commissions. This has caused major problems – more for multi-State RTOs but also with single-State ISOs.

The EU is not a federal entity. However, EU-wide institutions, at least on paper, have increasing coordination functions and/or powers over national competition and regulatory policy as EU guidelines are made more specific and more binding. Member state electricity industry institutions (companies and regulators) are now overseen by ACER. There is also the Florence Group and ENTSO-E who are developing the Target Model template. In addition DG Competition continues to play an active role not least by its case-work over merger approvals and action against cross-national anti-competitive behaviour.

Member state competition agencies and electricity regulators operate both within the EU framework and under the supervision of their own national competition and regulatory agencies – as well as of member state national policy objectives.

What will happen if and when national and EU electricity industry policy objectives conflict is yet to be tested with the new architecture. However, there is clearly the potential for conflict – particularly if we add in new regional electricity companies and regulators. If such conflict arises, it is very likely that it will be in and around SO and TO functions.

Interconnection

Having sufficient inter-country interconnection is crucial for making the Single Electricity Market work. However, both in the US and the EU, finding effective incentives to encourage the building of new electricity has proved extremely difficult. Where ITSOs exist, the disincentives for a single area are weaker as the revenues from the business come exclusively from transmission fees. Nevertheless, providing effective incentives for TSOs and obtaining regulatory approval from all parties can be very difficult.

This is primarily a multi-area issue which we will discuss further in the next Chapter but it is also very important for the efficient operation of SOs, TOs and electricity systems at the national level. For instance, transmission can be stranded as well as generation if generation sources change character and/or location significantly. More importantly, increased levels of SO and TO domestic and transmission investment has become a critical issue for the achievement of the ambitious EU targets for renewable generation. Achieving adequate growth in transmission investment has become a major problem in a number of EU countries as well as in the US, although much of this is due to physical planning hurdles.

3. 6. Gas system operators: introduction

Natural gas and electricity share some technical and economic features. Like electricity, gas is traded as a commodity, it is transported through a network of interconnected pipelines, and uncontrolled service disruptions occur if the injections into and off-takes from the system do not balance. As a consequence the high-level functions of the gas and electricity System Operator have broadly the same nature.

However, gas and electricity differ in major respects. Gas is economically storable on a wide scale and a number of sources of flexibility at the demand and at the supply side are available. Network congestions appear to be less frequent in gas than in electricity.

The requirements that injections and withdrawals be balanced are less critical in gas than electricity. Long distance transportation costs are higher in electricity than gas, so that the transportation range is typically national for electricity and continental for gas. Further, some flexibility in transportation capacity is available for gas, via liquefaction, and not for electricity. Finally the security of supply issues assume for gas, more than electricity, a political dimension, as most of the gas is sourced from non-European countries. These differences impact on how the system operator functions are accomplished and on the relative merits of alternative institutional settings for the system operator activities.

In the first section we present the main gas system operator functions and discuss alternative institutional settings. In the second section we address the issues related to

coordination among neighbouring system operators. The third section reports our concluding remarks.

3. 7. Single area gas systems operator functions

3. 7. 1. Short term functions

The main short term functions of a gas system operator relate to ensuring that injections and withdrawals match in the relevant (typically national) market. The system operator takes actions to increase or decrease injections in and off-takes from the network in order to maintain system pressure within the security limits, in case of:

- imbalances between the total daily injections and withdrawals in the system;
- transmission constraints that make it necessary to reduce net injections at one end of a transmission bottleneck and increase them at the other end;
- within-the-day mismatches of the market participants' injections and withdrawals.

This activity is generally referred to as *balancing*.

Balancing requirements are less strict in gas than in electricity because gas transmission systems have the ability to absorb mismatches between injections and withdrawals within specific timeframes (typically a day or at least several hours). On the contrary electricity networks must be balanced on a continuous basis.

That feature of gas transportation has major implications for the gas market design and for the control area system operator's activities. First, in the gas markets a higher level of product standardisation is typically implemented than in the electricity markets. In particular, in the gas market a seller can honour his delivery commitment by injecting gas at any of the entry points of the network and the buyer can collect the gas at any of the exit-points. On the same line, typically, injections (and withdrawals) with different time patterns are considered identical products, provided the total volume of gas injected (or withdrawn) throughout the day is the same.

Second, gas market participants are granted more flexibility than electricity market participants in balancing their own position during the day-of-delivery. Each market participant can procure additional injections or reductions of injections during the day of delivery in order to balance his position, at the same time as the system operator activates the balancing resources under her control to keep the system balanced. The concurring balancing activity by the system operator and by the market participants – during the time of delivery – usually does not feature in electricity markets. After a certain moment before the time-of-delivery, the so called gate-closure, the electricity system operator is the sole responsible for balancing the system. Any deviations of the market participants' actual injections or withdrawals from the schedules notified before gate closure are regarded as imbalances³². A corollary is that, while in electricity the system operator is typically the counterparty to all the real-time transactions, in the gas market the system operator is just one of the participants in the balancing market.

The flexibility instruments available to the gas system operator (and to the market participants) to perform balancing include changes in the injections/withdrawals in/from gas-storages, modulation of the gas extraction from the production fields, short term trading (including the system operator's buybacks of the transmission rights allocated to the market participants) and interruptible demand. In most systems the flexibility provided by the possibility to change the volume of gas in the pipelines, the line-pack capacity, is exclusively controlled by the system operator, but nothing prevents its allocation to the market participants as storage capacity.

3. 7. 2. Medium term functions

The main system operator functions in the medium-term horizon include:

- assessing the responsibility of each network users to the balancing costs;
- allocating the rights to use the transmission system.

³² The Belgian electricity market is a noticeable exception to this general presumption, as responsible parties are required to balance their net portfolio position. In other terms, as with gas, an electricity supplier is required to adjust injections during the time of delivery in order to follow his clients' actual consumptions.

We also address in this section the option of assigning responsibilities related to gas security of supply to the system operator.

Imbalance settlement

After the day of delivery the system operator assesses each market participant's imbalance, i.e. the difference between the daily injections and withdrawals which the market participant is responsible for. The injections and the withdrawals at large supply points are daily metered. Daily withdrawals at small supply points are estimated. When the metered data on the withdrawals at those points become known, the estimates of the daily consumptions are reconciled with the metering information. The reconciliation process implements some after-the-fact transactions. Market participants that were allocated daily volumes in excess of their metered consumption sell the excess to those that were allocated daily volumes less than the actual consumptions. The price for these transactions usually reflects the average market conditions during the period that is being reconciled.

Allocation of transmission rights

The gas system operators are responsible for defining the content of the transmission rights, assessing the volume of transmission rights that the existing physical capacity supports³³ and running the allocation process.

Gas transmission rights have been traditionally defined as the rights to inject gas at one location and simultaneously withdraw the same volume at another; the *point-to-point* transmission rights. In that context, transmission rights were often defined in terms of access to individually identified pipelines and operate as *physical* transmission rights.

³³ Gas flows are more controllable than electricity's and gas transmission networks are less meshed than electricity. That reduces the complexity, compared to electricity, of mapping the available set of network infrastructure into a set of feasible transmission rights, to allocate to the market.

Within the framework of the Third-package, Europe is moving from the point-to-point to the *entry-exit* model, where large balancing zones are identified by the system operator and the rights to inject and to withdraw gas in each entry or exit point of the balancing zone are allocated independently.

The size of the balancing zones is a matter for discussion. The relevant trade-off, in this respect, is between gas market liquidity and congestion management costs. Larger zones, *ceteris paribus*, facilitate trading, since all injections in the zone are considered substitutable, and therefore compete, to meet the demand in the zone. However, larger zones may result in greater congestion management costs since market transactions within the zone are not subject to any network-related constraints; the corresponding flows are then more likely to violate some intra-zonal network constraints, requiring the system operator to implement (costly) balancing actions.

Long term transmission rights are necessary in the gas industry to support long-term supply contracts. The proposal for a capacity allocation mechanism by the ENTSOG, the European Network of Gas System Operators, allows for yearly rights allocated via auctions up to 15 years forward³⁴.

The allocation mechanism being implemented in Europe is based on auctions, run simultaneously by the European system operators for capacity at all the entry and exit points of the European network.

Finally, the system operators enforce the *use-it-or-lose-it* provisions that generally apply to transmission rights. If a market participant does not use the transmission rights that he was allocated, under certain conditions the unused capacity is reallocated by the system operator to other users.

³⁴ ENTSOG, Network Code on Capacity Allocation Mechanisms. An ENTSOG Network Code for ACER review and Comitology Procedure (CAP-210-12), downloadable from: <http://www.entsog.eu/publications/index.html>



Gas security of supply

The introduction of policy measures to ensure gas security of supply is being extensively discussed in Europe. Alternative measures require a different involvement by the system operator.

Efficient pricing in scarcity situations is crucial to provide incentives to ensure that enough gas to meet demand be available at all times. Therefore the pricing-rules operating during scarcity situations attract much regulatory attention. At times of scarcity the supply of gas is inflexible. On the demand side some consumers are supplied under interruptible contracts or have the capabilities to modify their withdrawals in response to high spot price. However, if the gas shortage is so severe that also part of the price-inflexible demand – typically the smaller consumers’ – needs to be curtailed, the price for gas needs to be administratively set (ideally at a level reflecting the value of gas for the curtailed consumers). When scarcity pricing is implemented the system operator is responsible for triggering the administrative pricing regime, by “declaring” the scarcity condition.

Further policies specifically aiming at gas security of supply are based on placing on the market participants obligations such as holding specified amount of gas in storage. The system operator’s responsibilities in that context range from monitoring compliance to procuring the missing gas, in case a party fails to comply with the obligation. In some proposals the strategic gas obligation would be based directly on the system operator³⁵.

3. 7. 3. Long term functions

The main long-term responsibility of the national gas system operators relate to the development of the gas transmission network. The content of the system operators’ activity vary depending on the institutional framework governing network development.

³⁵ Ofgem, Initial Consultation - Gas Security of Supply Significant Code Review, January 2011 (Reference number 02/11), downloadable from: <http://www.ofgem.gov.uk/Markets/WhIMkts/CompandEff/GasSCR/>.

Two broad approaches are available. In the first approach, the US model – often referred to as *merchant* transport capacity model³⁶, the development of the transmission capacity is driven by the market. Market investors decide and fund the investments in transmission assets. They appropriate the value of their transmission assets by selling the corresponding transmission rights. The distinguishing feature of the merchant model is that the network owners bear the commercial risk of the investment, i.e. the risk of not being able to sell the transmission capacity at prices high enough to provide the expected return on capital. This risk is typically hedged by backing the transmission investment with the sale of long-term transmission rights – *financial* transmission rights.

In the merchant approach the system operator acts mainly as a facilitator, collecting and publishing the information that can be relevant for the investment decision, such as the forecasted demand and supply balances in the different areas. In addition the system operator supervises the *open season* process, in which project plans are published and assessed in order to coordinate the merchant investment decisions.

Competition plays an important role in the merchant approach. In the short run, if multiple network paths connect the same pair of locations, the owners of the alternative transmission paths compete for the demand for transportation services. In the longer run the threat of additional transmission capacity being built exercises competitive pressure on the transmission prices. Hence, no tariff regulation features in the merchant approach. This is the US model for inter-state (multi-area) pipelines.

The alternative approach to network development is based on an incentive-driven planning approach monitored and enforced by national regulators. In a pure planning approach, the system operator and the Regulator take, on behalf of the consumers, the network investment decisions. This is the EU model which seems quite well-suited to

³⁶ The use of the term 'merchant' pipelines for gas can create confusion. In gas industry terminology, a 'merchant' activities involve buying and selling gas. But, in the US, interstate pipelines operate under contract carriage and are forbidden from buying or selling gas. In what follows, we use the term 'merchant' determined investment as the opposite of national 'planned' investment.

national, single-area gas markets but is a lot more problematic in the multi-area case as we discuss below.

Placing substantial risk on the transmission owner is not consistent with this approach, as the decision to invest is taken by the Regulator, directly or in the form of approval of the system operator's proposals. In case the investors were required to bear the commercial risk of the network upgrades decided by a third party – all the more if excess capacity situations are more likely to occur – attracting capital could be impossible or extremely expensive for the Regulator and, ultimately, for the consumers, since the market would attach a high risk premium to the projects. Hence, regulator approved network capacity investment must have asset base (RAB/RAV) protection for the model to be viable at a reasonable cost of capital.

For that reason, typically, it is *consumers* who effectively bear the commercial risk of these investments, insofar as the gas network transmission tariffs are set and adjusted to allow the providers of capital to receive the required rate of return.

In that context, then, the room for competition among transmission service providers in a single area planning context appears to be very limited, as shifting the demand for transmission services from one route to another would, *ceteris paribus*, neither reduce the system's total cost nor change materially the profits of the transmission owner.³⁷ Consistently, tariff regulation of transmission services is a standard feature of the EU member states planning approach, which is focused on national gas ITSOs or ITOs.

However, it is also the case that the EU Europe appears to be evolving gradually towards a hybrid model for the gas network development, largely based on planning but with some quasi-merchant and merchant elements (e.g. for interconnectors). Directive 73/09 grants central-planner prerogatives to the system operators (under the control of the Regulator). In this respect Art 14.4 is unambiguous: *Each independent system*

³⁷ This assessment does not appear to be universally shared. See for example Ascari S., (2011) 'An American model for the EU gas market?' RSCAS 2011/39, EUI working papers, downloadable from http://cadmus.eui.eu/bitstream/handle/1814/18056/RSCAS_2011_39.pdf, section 3, point (a).

*operator shall be responsible for [...] operating, maintaining and developing the transmission system, as well as for ensuring the long-term ability of the system to meet reasonable demand through investment planning*³⁸.

However, it is expected that market participants will increasingly be involved in the network investment decision-making process³⁹. Art. 22.4 of the Directive 73/09 allows Regulators, when consulting the then year network development plans, to require “Persons or undertakings claiming to be potential system users” to “substantiate such claims”. Despite its vagueness, that provision appears to be compatible with placing the risk of the network developments on the parties stating an interest in that capacity. In a possible implementation, the system operator would ask market participants to take long term binding commitments to purchase the additional transmission services made available by the network upgrade. The investment in the network upgrade would then be carried out if (and only if) the commitments offered by the market participants are enough to cover the cost of the upgrade⁴⁰. This is clearly a lot more straightforward for within-area network investments than for those which straddle boundaries. They only require agreement between the national TSO and the national regulator.

Further, the third-party-access exemption regime for new gas infrastructures is maintained in the Third-package (Art. 36 of Directive 73/09) so that, under certain conditions, merchant network investments exempted from the open access regime are allowed. This option will be likely most appealing for the (highly idiosyncratic) network investments connecting Europe and the remote production sites. However, some of these merchant routes might extend well inside Europe.

³⁸ The central role of planning in the European energy infrastructure development is confirmed in the infrastructure package. See Proposal for a regulation of the European Parliament and of the Council on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC, COM(2011) 658 final.

³⁹ Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC.

⁴⁰ This approach is discussed in CERRE’s research report: Investments on transport infrastructures for natural gas and electricity, 2011, downloadable from <http://www.cerre.eu/investments-transport-infrastructures-natural-gas-and-electricity>.

In conclusion, some elements of pipeline and LNG competition might feature within the broad planning environment that seems to be developing in Europe.

In this hybrid environment the system operators' planning activity can be expected to become increasingly complex. SOs must assess the opportunity of the investment based on their expectation of the demand and supply of transmission services over the lifetime of the new infrastructure, as well as coordinate the regulated and the merchant investment activity.

The system operators' planning process is made even more complicated by the requirement that their investment decisions address also security of supply issues and promote competition.

Since both objectives ultimately require that a good deal of spare (excess) transmission capacity be realised, the marginal value for the market participants of additional transmission capacity will be relatively modest. As a consequence, system operators will unlikely be able to extract from the would-be network users long term commitments sufficient to cover a large share of the new capacity. That means that a large part of the investment risk will be placed on the consumers.

As we will discuss in the next section, these issues are much more complex in the multi-area setting for gas (where there are no proposals for any explicit SO arrangements) than in the single-area setting, where explicit unbundled TSOs are mandatory.

3. 8. The ISO/ITSO discussion in the gas industry

The independence of the system operator is universally recognised as a necessary condition for the successful liberalization of the electricity and gas industries. Discrimination in network access and delays in network upgrades can hinder competition in the wholesale as well in the retail markets. However, the situation in EU gas markets is changing quite rapidly in this regard as gas companies sell off their transportation networks – as Eon and Thyssengas have done and others may well do in the near future.

The discriminatory practices in the gas industry specifically discussed by the 2007 EU energy sector inquiry⁴¹ include:

- Parent company restrictions on transmission entity investment;
- Trading names, brands and logos shared between transport and supply companies;
- Shared use of facilities between transport entity and other parts of the business with regulators not sufficiently resourced to be able properly police information separation;
- Bundled rather than separate contracts for gas transport and gas supply;
- More favourable conditions to the incumbent company's supply arm over nominating transport capacity requirements – and on other aspects of network access;
- Preferential treatment to “associated” supply companies regarding access to available firm capacity on transit routes;
- Requirements for advance payments for capacity from independent shippers but not from “associated” supply companies;
- Major elements of discrimination against independent shippers over transit line capacity availability.

The alternative organisational models of the system operator activities implemented in different markets differ in three dimensions. First, with respect to the prerogatives of the system operator, in some implementations the system operator controls a wide range of activities, including in particular scheduling the transmission assets' maintenance, allocating transmission capacity and planning the network development. The alternative model is based on a lighter system operator, which is basically responsible only for the real-time balancing of the transmission system.

⁴¹ DG Competition report on Energy Sector Inquiry, European Commission, Brussels, 2007, pp. 59-61 and 70-77.

Second, alternative system operator models differ in the degree of unbundling from the supply (and possibly retail) activity. At one extreme, full ownership separation of the system operator from the gas market participants. The alternative approach is based on some form of ring-fencing of the system operator activities from the market activities of the vertically integrated owner.

Finally, alternative system operator models differ on the integration between the system operator and the transmission network operator. One option is that the system operator be also the owner of the transmission network – an ITSO; alternatively the system operator and the transmission operator are separate entities – an ISO arrangement. There is also the compromise ITO arrangement with a largely but not ownership separated TSO as discussed above for electricity.

In section 3. 2-4, we have discussed alternative system operator models in the electricity industry. We recall next the main areas of consensus in the discussion on the optimal model in the electricity industry and discuss to what extent the same assessments hold for gas. First, ownership unbundling between the system operator and the generation (and retail) business appears to be more effective than lighter forms of unbundling in ensuring the system operator's independence.

Second, governing through contracts all the detailed aspects of the day-by-day interaction between the system operator and the transmission operator may be complicated and entail high transaction costs. The system operator's and the transmission owners' incentives to maintain and develop the system may be difficult to align via contracts. The issues are exacerbated in case the transmission owner has interests in the supply business, which may create a conflict of interest on the transmission capacity expansion. This holds all the more if the transmission operator enjoys incumbent advantages in implementing the network upgrades, compared to the would-be entrants in the transmission business.

We notice incidentally that no fully satisfactory regulatory incentive-schemes for unbundled system operator and transmission operators have been yet implemented,

capable of dealing effectively with the trade-off between network investments and system operation costs.

Finally, the separation between the system operator and the transmission owner may facilitate setting-up a single European system operator, in case merging the national transmission assets was politically unfeasible⁴². Consider for example that reverting to independent national system operators from a single – basically asset-less – European system operator would be easier than splitting a pan-European transmission company.

Some of the features that determine the relative merits of alternative system operator models in electricity are perhaps less important in the gas industry. First, since the network effects are less complex, discriminatory practices by the system operator are easier to detect in the gas industry. For example, the gas system operator would find it more difficult to refer to complex network effects and poorly auditable security constraints to discriminate against some network users by selectively under-estimating the transmission capacity at specific locations.

Second, the trade-off between network investment and system operation costs appears to be weaker for gas, because congestions are less frequent and balancing requirements lower than for electricity.

Finally, coordination with the upstream activity in network planning is perhaps more complex in gas than in electricity. The gas flows across the transmission network are a by-product of the wholesale market outcome, which is very difficult to predict given the world-wide dimension and the very diverse drivers of the dynamics of the gas market.

In Europe several member states have selected ownership unbundling of the (integrated) system and transmission operators (i.e. (ITSO/FOU status). These are: Belgium, Denmark, Estonia, Hungary, Italy, Lithuania, Portugal, Romania, Spain, and the

⁴² On this line, for example, Levêque, F., Glachant, J-M., Saguan, M. and De Muizon, G. 'Comparing electricity transmission arrangements', 2008, downloadable from http://www.grijm.net/documents/marcelo/200807_Final_version_-_report_for_Endesa.pdf

U.K. The other countries have opted for functionally unbundled system operators (ITOs). Germany now has its two major gas network companies (Thyssengas and Eon) operating or to be operated as ITSOs. Ireland, Netherlands and Sweden currently operate gas ISOs⁴³

Little empirical evidence is available on the relative performance of alternative system operator models in the gas industry. In Europe, the 2007 energy sector inquiry by the European commission has stressed that vertical integration of transmission and supply interests leads to conflicts of interest which may adversely affect investments. In Italy Belgium and Germany, where the gas system operators were not ownership unbundled from the incumbent gas company, under-investments in network upgrades have been attributed to the lack of independence of the system operator. However, it is difficult to separate the impact on the system operator's behaviour of the governance structure from that of the (lack of) regulatory supervision⁴⁴. However, as discussed in the first section of the paper, DG Competition has taken enforcement action several times (e.g. in Italy and Germany) against anti-competitive behaviour by gas companies over access to and investment restrictions in unbundled gas companies.

⁴³ This classification is based on helpful information from Katja Yafimova of OIES and Pollitt (2011).

⁴⁴ In all cases the European Commission has brought action against the incumbent integrated operators.



CENTRE ON REGULATION IN EUROPE

4. SOs in energy - the multi-area case with several infrastructure owners

4.1. Electricity: US Multi-Area ISOs

We discussed single area US ISOs in the previous chapter⁴⁵. However, most attention has been given to the multi-State ISOs (better known as RTOs – Regional Transmission Organisations).

The best known (and much the largest) RTO is PJM which originated in the Pennsylvania, New Jersey and Maryland pool but now covers those States plus all or parts of 8 other States, stretching as far west as Illinois and as far south as North Carolina. PJM manages the high voltage grid and the wholesale electricity markets in this area and generally co-ordinates the movement of wholesale electricity. Its historical peak capacity is 167,000 MW. The other multi-area RTOs are the New England ISO, MISO (the Mid-Western RTO) and SPP (a Southern Power Pool). MISO and, even more, SPP have less development of wholesale and ancillary services, etc markets. Most of these RTOs (not SPP) have adopted nodal rather than zonal pricing for congestion management and are moving towards that for the handling of losses; most also operate financial transmission right markets⁴⁶.

These multi-State ISOs were developed in their current guise under FERC Directive 2000 of 1999. They are ownership unbundled entities but the ownership of the transmission assets remains with the previous utilities and, hence, can be very fragmented. Indeed transmission investment – particularly interconnector investment - is very problematic since State Regulatory Commissions have to authorize the investments as well as the FERC. This is a major contrast with US natural gas where only the FERC

⁴⁵ There are no multi-State SOs in Canada, but there are three single- State SOs in Alberta, New Brunswick and Ontario. They are rather less developed than their US equivalents.

⁴⁶ For a full and clear description, see Pollitt (2011) op cit, particularly Tables 3 and 7.

is involved in the regulation of inter-State gas pipelines, a system that seems to work much better⁴⁷.

There has been much discussion of the performance of the RTOs but no formal official evaluation. The closest to that is a 2008 GAO (Government Accounting Office) Study for the US Senate⁴⁸. However, there have also been a number of other academic, consultancy and lobbyist studies which attempt to provide some kind of evaluation. In terms of the impact of the SOs per se, this is difficult as the development of the SO functions was accompanied by the development of wider and deeper generation markets and other factors, so that it is difficult to establish how far the changes were due to the RTO development per se and how much to other factors⁴⁹. The GAO 2008 Report and the main academic studies (by Joskow, Kwoka and Triebs et al) are discussed at some length in Stern (2011)⁵⁰.

The consensus of the studies mentioned above is that there have been significant short and medium-term benefits in terms of wholesale market (generation) competition, not least because the generation markets in the larger RTOs include a number of generators using different fuel types. There have been other short and medium-term benefits but, as regards long-term issues, transmission investment – which remains at a low level – is highly problematic. For the US as a whole, the NERC 2010 Long-Term Reliability Assessment shows very low rates of achieved transmission investment (under 2% per year in 2008-09 – and, on average, since 2000 if not earlier). The NERC Assessment cites transmission investment as a major problem: “... transmission permitting and siting

⁴⁷ See Joskow, P.L. (2009), 'Deregulation', <http://econ-www.mit.edu/files/3875>, pp. 28-33.

⁴⁸ 'Electricity Restructuring': A GAO (Government Accountability Office) Report to the US Senate Committee on Homeland Security and Governmental Affairs, September 2008.

⁴⁹ Joskow, P.L. (2005), 'Markets for Power in the United States: an Interim Assessment', CEEPR Working Paper 05-12 tries to use econometric modelling to untangle the effects but, in his paper, he urges caution about the precision of the estimates because of data and other problems.

⁵⁰ See Joskow (2007) and Kwoka (2010) op cit. See also Triebs, T.P., Pollitt, M.G. and Kwoka, J.E., (2010), 'The Direct Costs and Benefits of US Electricity Divestitures'. EPRG Working Paper 1024.

is considered one of the highest risks facing the [US] electricity industry over the next ten years”⁵¹.

For consumers and policy makers, it was hoped that RTOs would bring lower retail prices but, on average, electricity retail prices are higher in RTO than in other areas, which has attracted a lot of criticism. That, however, seems likely to be mainly a consequence of the fuel mix of generation in different US regions. Joskow (2007) suggests that, controlling for other factors, RTOs may have reduced retail electricity by a small amount – he suggests by around 5-10%, but this is disputed.

As regards ISOs unbundling and the ITSO alternative, Joskow is clearly in the ITSO camp. His main reservations about RTOs are that they suffer from:

- (i) the absence of vertical integration with transmission functions leading to adverse effects on maintenance and investment planning plus cumbersome interconnection; and
- (ii) difficulties over devising effective performance incentives – even problems in ensuring hard budget constraints; and that
- (iii) ISO responsibilities tend to expand over time to deal with these inefficiencies – particularly as regards transmission investment – so that “TOs become passive owners of regulated assets that march to the ISOs’ orders.”⁵²

Kwoka has defended vertical integration against ISOs because of concerns that ISOs lead to a loss of economies of scope. However, he sees ITSOs as the natural successor to the vertically integrated utilities by providing the central integration necessary for electricity systems and markets. While ITSOs can replace the co-ordinating role of the

⁵¹ See NERC (North American Electric Reliability Corporation) ‘2010 Long-Term Reliability Assessment’. www.nerc.com

⁵² See Joskow (2007) op cit, Slide 22

vertically integrated utilities, RTOs cannot - and that is why he is highly sceptical of them. From this perspective, RTOs give the worst of both worlds since they:

- (i) lose the benefits of generation-distribution/supply integration;
- (ii) *but without* achieving the benefits of a strong transmission company that is responsible, firstly, for co-ordinating generation markets for power (including dispatch); and, secondly, for transmission management, planning and investment⁵³.

Most recently, Triebs et al (2010) look at US power utilities over the period 1994-2006. Using panel data methods, they found significant short-run and medium-term benefits. They found that there were significant cost savings from external wholesale market power sourcing so that these and other efficiency gains outweighed the losses from economies of scope⁵⁴. These net gains grew over time along with gains from other induced organizational and/or technological changes. Generation efficiency unequivocally increased as a result of divestment, so that the costs of generated power and the prices of bought-in power clearly fell as a result of instituting RTOs with competitive generation markets.

In consequence, Triebs et al estimated significant net benefits from US electricity utility divestiture at the sector level, with a net gain of around 5.5% of total costs after 10 years. But, among individual power companies, there were gainers and losers. It was unclear how far the firm-level variation is due to company/management characteristics and how far to regulatory variations between States.

⁵³ See Kwoka (2010) op cit.

⁵⁴ It is generally agreed that he identified losses on economies of scope relate primarily to nuclear power and its integration with local supply in unbundled companies. There is no evidence of significant losses of economies of scope other than from the nuclear link.

A particular problem with the US RTOs is governance. This is a problem in both single-area and multi-area jurisdictions but much more severe in the latter. This issue is most fully set out in Pollitt (2011)⁵⁵.

The main problems are as follows:

- (i) ISOs, unlike ITSOs are very asset-light. That means it is difficult to impose incentives on them with any significant downside risk.
- (ii) All successful ISOs have been not-for-profit organizations. This is necessary to retain the independence of the board, which typically involves members without any financial interest in the companies belonging to or significantly affected by the ISO decisions. However, that again makes it difficult to provide effective financial incentives for cost containment or greater efficiency⁵⁶.

The combination of the factors above has led Joskow and others to suggest that multi-State RTOs are as much regulatory institutions as commercial ones. Pollitt summarises the problem as follows: “The ISO remains a complex entity producing a large number of outputs for which it would be difficult to design a comprehensive set of performance metrics which could form the basis of an external evaluation of its performance”⁵⁷. Indeed.

It may be that the problems with multi-area ISOs are less in other industries, but, the problems with US ISOs may well help explain why, firstly, the UK and then the EU (a) opted for ITSOs as the preferred model for single area ISOs; and, secondly, why the EU is proposing a ‘virtual’ ISO over an actual one as the basis for multi-area market areas in the EU Single Electricity Market.

⁵⁵ See Triebs et al (2010) op cit, Pollitt (2011) op cit, pp 18-25.

⁵⁶ Both for profit ISOs and management contract ISOs have been tried (in the Mid-West and Alberta respectively) but both failed. See Pollitt, op cit p.19

⁵⁷ Pollitt (2011) op cit, p.25.

4.2. Multi-area SOs in the EU

The 2006-7 DG Competition Report showed that the incumbent, mainly vertically integrated power companies not only dominated national power markets, but also – at least outside Scandinavia- prevented any significant international competition. Among the problems identified were:

- Levels of cross-border power trade were low;
- Interconnection capacity was limited and several main interconnectors were regularly congested;
- The short-run methods of allocating interconnector capacity were typically very opaque – auctions were the exception rather than the norm;
- Wholesale power prices in neighbouring markets showed significant differences and there was evidence of power companies using their market power to maintain prices significantly above those of the marginal called generators e.g. by withholding capacity⁵⁸.

There have been some significant changes since 2006-07 e.g. the adoption of congestion management guidelines and the increased use of more transparent methods of allocating interconnector capacity. However, the main initiative has been movements towards and the adoption of the Target Electricity Model which is intended to be in place by 2015.

The EU Target Model is largely based on the Nord Pool electricity model⁵⁹. In consequence, this section will first outline the key characteristics of the Nordic approach before discussing the implications for the Target Model as the basis for the Single Electricity Market.

⁵⁸ See DG Competition Energy Sector Inquiry Final Report, January 2007. The report contains a great deal of data to support its findings. The data cover the period from 2002-06.

⁵⁹ For gas as well as electricity as set out in the next section.

In terms of SOs, the key feature both of the Nordic approach and the Target Model is that they are both “virtual” SO models i.e. they use an SO-type approach but without an explicit SO.

This model is built around market coupling⁶⁰ of all countries in a region but with inter-country SO and TO linkages being handled by a series of network and related codes. The market coupling arises via trade through a regional wholesale power market across an interconnected transmission grid owned by national grid companies. The intention is that the EU Single Electricity Market is then made up of a set of inter-connected regional markets - hopefully supporting significant inter-country and inter-regional wholesale power trade levels.

4. 2. 1. Nord Pool

Nord Pool is the Nordic Power Exchange which covers Norway, Sweden, Denmark and Finland. It is currently operated by NASDAQ OMX Commodities Europe. Its origins are in a 1971 when Norwegian generators formed a national power pool. In 1992, Statnett, the separated Norwegian national transmission company, was established as the Norwegian TSO and the Power Pool was incorporated into it. This expanded into a Norwegian-Swedish power exchange in 1996 which, over the next 5 years, expanded to cover Finland and Denmark. Nord Pool is 50% owned by Statnett and 50% owned by Svenska Kraftnätt (the Swedish grid company)⁶¹.

Nord Pool operates as the market for Nordel, which is the Nordic association for electricity co-operation, founded in 1963. Nordel’s primary objective now is to create and maintain the conditions necessary for an effective Nordic electricity market. It has done this since the mid-1990s by issuing a set of By-Laws. These By-Laws and, now a

⁶⁰ Nord Pool uses market splitting, which has the same outcome but is procedurally different. See Booz & Company, with D. Newbery and G Strbac (2011), ‘Physical and Financial Capacity Rights for Cross-Border Trade’, R01071.

⁶¹ For a good introduction to Nord Pool and its history, see Economic Commission for Africa (2004), ‘Assessment of Power-pooling Arrangements in Africa’. See also NordREG Report (2006) op cit.

comprehensive Grid Code, provide the basis for Nordel to operate as an organization for co-operation by the Nordic TSOs.

In terms of regulation, each of the Nordic member countries maintains its own national regulatory agency. There is no Nordic electricity regulator and no Nordic SO or TSO. Each of the national TSOs now operates as an ownership unbundled ITSO. On regulation, NordREG operates as a co-operative organization of Nordic energy regulators.

Some key points are worth making about Nord Pool as a model for the rest of the EU:

- (i) Electricity co-operation among the Nordic states goes back almost 50 years with the inter-state market going back over 15 years. Nord Pool arrangements have evolved over a long period of time between relatively small but well-developed and institutionally strong countries with a long history of joint activities;
- (ii) The Nordic power systems all operate with ownership unbundled ITSOs which own and operate Nord Pool; and
- (iii) The countries also have generation systems which are highly diversified by fuel use across member countries – but not within countries. Norway, in particular, is heavily dependent on hydro generation, while Denmark has large-scale gas and renewable (wind) generation. Hence, there are substantial gains from trade within the Nord Pool area.

Nord Pool is generally taken to be a very successful power exchange, supporting independent operators as well as the major power companies. It operates spot markets, forward markets, (including CfDs⁶²) and OTC⁶³ bilateral markets. The spot market serves as a grid congestion management tool and it integrates the different regional markets.

⁶² Contracts for differences between area prices and the Nordic system price. CfDs are important in market based generation systems as they provide a perfect hedge.

⁶³ Over the Counter

Nord Pool is a highly liquid set of markets with a turnover many times annual demand. These factors have led it to be the model on which other power exchanges have been based e.g. in France and Germany. In addition, even though there are inter-country interconnection congestion issues, the Nord Pool was given large amounts of praise and little criticism in the 2006-07 DG Competition Energy Inquiry.

Other key features of Nord Pool are that, because of network configuration and geography, loop flows are not a major issue. Nord Pool is a much less meshed network than most EU transmission networks and this eases the estimates of day-ahead Available Transfer Capacity across the interconnectors. Nord Pool's day-ahead prices are established by an *implicit* auction process under which wholesale electricity purchasers bid jointly for energy and transmission capacity, including cross-border transmission. This, in turn, avoids inconsistencies that could arise if there were separate generation and transmission markets. It also minimizes adverse flows over the interconnector and ensures that power flows from low price to high price areas⁶⁴. It is worth noting that most of these characteristics – including implicit auctions – have been carried through into the Target Model Project.

However, successful Nord Pool has been, does this mean that it – let alone other EU regions – can operate successfully in the long-term without an explicit SO of some kind?

For Nord Pool, this (and related issues) was addressed in the 2006 NordREG report. That report pointed out a number of legal and other problems with the existing regime e.g. on dispute resolution procedures. It also recommended further evaluation of:

- (i) whether further developments could be handled within the Grid Code or required fuller specification of national laws and regulations; and
- (ii) whether a legally binding Nordic agreement might be needed – which, in effect would create a Nordic electricity regulator. This would almost certainly be mirrored in a Nordic ISO or merged ITSO.

⁶⁴ See Booz et al (2011) op cit, p.72.

The Report also pointed out that the core activities of the Nordic ITSOs are quite similar, which makes co-ordination easier. So far, though, Nord Pool remains without a Nordic SO or multi-state regulator.

Like the US RTOs, Nord Pool has clearly been very successful in handling the short and medium-term issues of a multi-area electricity system. However, at least in theory, it has a similar problem to the US RTOs over inter-connection investment. These may be planned by Nord Pool but they have to be implemented by the national ITSOs who operate subject to national regulators. Given the geography and the long (and generally very successful) history of Nordic co-operation this may not be too much of a problem for Nord Pool. But, at least in theory, the ‘virtual’ ISO model is likely to have as big if not a bigger problem of transmission investment implementation as the US RTOs.

In any integrated non-ITSO SO system, there is often (understandable) resistance to authorize many of the benefits of any single-area transmission investment primarily go to consumers in other areas while the costs do not. This is most obvious with interconnector investments but it also affects other within-area transmission investments. Booz et al (2011) point to the likely need for substantial additional TEN (Trans European Network) programme funding to support interconnection investment, which is often resisted by national TSOs.⁶⁵ So far, this has apparently not been a significant issue for Nord Pool and its ‘virtual’ SO, but it may become one – and it is much more likely to be a significant issue for the Electricity Target Model, as and when it is implemented across the EU.

4. 3. The EU Target Electricity Model: Regional Virtual SOs

The 2006-07 DG Competition Inquiry registered major concerns with the operation of electricity markets both at national level and on inter-market relationships and trading, as outlined above. That was reflected in major price differentials on wholesale power prices between neighbouring countries. The strong recommendation for single country ITSOs

⁶⁵ See Booz et al, op cit, p. 19. See also Newbery, D. (2012) ‘Are current power markets proof-checked for the 2020 challenges?’ Eurelectric Conference, January 2012, Brussels.

(not ISOs) was one consequence, but, perhaps more importantly, developing effective cross-border trade was the other main feature. In the short-term, the focus was on developing more transparent access to inter-connectors and more market transparency but the main focus soon switched to the development of the Electricity Target Model, developed by the Florence Forum since 2008⁶⁶.

The Florence Forum brings together a range of industry stakeholders but has no legal status. Hence, the Target Model "... is a non-binding high level description of the market including some aspirations which may not necessarily be achievable"⁶⁷. This is very different from the US Standard Model for RTOs which does have legal status and which is regulated by the FERC. There is no EU-wide legally binding specification for an SO or SO-type arrangements and no EU-wide regulatory agency for the proposed regional or EU-wide arrangements.

Besides the Florence Forum process, there have been important developments instituted by electricity companies and their governments. In 2006, the markets of Belgium, France and Netherlands were interconnected; and, in 2007, the governments, regulators, power exchanges, TSOs and electricity associations of those countries - plus Germany and Luxembourg - signed a Memorandum of Understanding for the implementation of market coupling between their respective electricity markets. This created the Central Western European Market Coupling (CWE). The CWE was launched in November 2010 and, in 2011, this was linked to the Nord Pool area, firstly by market coupling between Germany and Denmark and then by connection to Norway via NorNed.

The importance of these initiatives is shown by the very substantial degree of price convergence since the CWE was established. Since CWE has been in operation, wholesale prices have converged in *all* CWE countries 68% of the time⁶⁸.

⁶⁶ Its official name is the European Electricity Forum.

⁶⁷ See Booz et al, op cit, p.20.

⁶⁸ See Booz et al, op cit, p.25-26.

Besides CWE, there are similar markets for (i) Portugal and Spain (ii) Italy and Slovenia and (iii) the Czech and Slovak Republics. They also have the Target Model as the basis for their operation and, presumably, the intention is to link them with the CWE market to give a Single European Electricity Market by 2014/15.⁶⁹

There is no question that Nord Pool is the model for the Project Target Model. Among the features they share are:

- (i) 'Virtual' rather than explicit ISOs or ITSO in the CWE or other regions;
- (ii) No supra-national regulatory agency;
- (iii) Regional PBX's and market coupling, with implicit transmission auctions, to provide short and medium term co-ordination;
- (iv) Rules for operation set out by Network Codes issued by ENTSO-E and approved by ACER after extensive discussions at the Florence Forum, with CEER and others;
- (v) Investment co-ordination by national companies and national regulators. TO (and rather smaller SO) investment approved and financed by national ITSOs and ITOs.

The key question on whether or not this can be achieved is whether the Nord Pool model can readily be transferred. There are some major technical issues⁷⁰ but there are also some major regulatory and governance issues. We will discuss most of those below, particularly the vexed issue of interconnection investment.

⁶⁹ There are also the issues of how to link in Great Britain as well as the Irish Single Market. The issue of Ireland and small island states like Cyprus and Malta probably raise more difficulties but are not central for an EU-wide market in Continental Europe. We ignore these issues in what follows.

⁷⁰ For instance, whether to adopt financial transmission rights (FTRs) plus nodal pricing as used in PJM and other US ISOs for congestion management and redispatch, or to retain physical transfer rights (PTRs) which currently dominate EU transmission. Booz et al (2011) was commissioned to discuss this and it recommended FTRs.

However, there is one political economy point worth making here. An obvious contrast of the Project Target process with the development of Nord Pool is the much larger range of agencies involved in discussing and agreeing the architecture and the Codes. That is worrying. A major reason for the failure of the California electricity reform of the late 1990s was that the process involved a wide range of parties, all of whose interests had to be represented in the final model. That compromise model was seriously flawed and proved unsustainable not least because of the multiple parties with whom agreement had to be reached and the consequential complexity of the negotiations – as well as of the chosen model.

4.4. Uncertainties and Outstanding SO-related Issues with the Project Target Multi-Area Electricity Model

On what follows, we assume that the EU achieves regional electricity markets as envisaged by the Target Project Model across the EU by around 2014-15. We assume that these will develop with interconnecting linkages between regions – as has happened with Nord Pool and CWE. The questions arise as to how successful these are likely to be and what problems might arise. SO arrangements are at the core of this and we focus on them.

The Comments below are divided into short/medium term issues and long-term effects and we discuss each in turn in what follows.

The issues for the EU Target Model and SOs are the same as in other multi-area settings where SO arrangements have come under scrutiny:

- (i) Whether the Target Model framework provides effective and fair competition between sellers, unaffected by foreclosure or other anti-competitive behavior by network and market operators;
- (ii) Whether the Target Model results in efficient, low cost procedures with sufficient co-ordination to maintain the performance of wholesale markets in the face of congestion and other network issues; and

- (iii) Whether the system provides adequate incentives for transmission investment within and between regional markets.

These issues are, of course, inter-related. For instance, more efficient interconnection usage (e.g. via greater transmission-link trading transparency) should allow greater utilization of it and reduce the need for constructing more interconnection capacity⁷¹. More directly, the December 2011 Florence Forum Conclusions records the following: “ENTSO-E asked for regulatory guidance *on (i) the trade-off between maximizing interconnection capacity, (ii) providing firmness for long-term capacity allocation and (iii) system reliability*”⁷². This trade-off reflects the concern that charging for interconnection capacity at the short-run economically efficient price is not likely to provide sufficient revenue to finance major new – and lumpy – interconnection investments.

These examples provide an important instance of short-medium allocation and pricing issues affecting long-term investment concerns and there are others.

We will try to follow these through but will primarily focus on the two separate areas.

4. 4. 1. Short and Medium-term Issues with the Project Target Model

Successful multi-area electricity trading frameworks, like the US RTO/SO examples and Nord Pool, typically perform well in terms of the issues relevant under this remit. If well-designed and managed, they improve generation market efficiency and costs, improve transmission network utilization and efficiency and ease the problems of congestion management. They also, in general, provide an effective balance between co-ordination and co-operation in the way in which generation and other markets interact with the complicated co-operative engineering arrangements needed to keep the system working physically and delivering electricity to a wide range of customers.

⁷¹ See Booz et al, op cit, p.20.

⁷² Our emphasis and added numbers. Source: European Electricity Forum, 5-6 December 2011. Published Conclusions, p.3.

Can we expect the same of the Project Target Model as rolled out across the EU? There is no reason why this shouldn't happen but there are some concerns. These include the following:

- (i) *Will a 'virtual' ISO model provide sufficient inter-TSO co-ordination between members of regional groupings, not least in emergencies?*

We note that, within CWE, we now also have the Coreso grouping of transmission operators (from France, Italy, Belgium, UK and a German transmission company) who have a small team of engineers based in Brussels monitoring transmission networks and power flows to protect against blackouts. However, there is very little literature available on Coreso and its effectiveness. It is even less clear how Coreso fits into Project Target or links into ACER, the Florence Forum Process, etc⁷³.

- (ii) *Will a Nord Pool-type model work as well in the rest of Europe as in the relatively unmeshed transmission networks of the Scandinavian countries?*
- (iii) *Will a Nord Pool-type model work as well when it has to combine national and sub-national ITSOs and one or more ITO, as in the CWE market?*
- (iv) *How well will the Nord Pool-type model and its 'virtual' SO arrangements cope with substantial (and growing) volumes of intermittent renewable generation?*
- (v) *Will there be a need for transitional (or even permanent) compensation arrangements as trade flows develop?*

⁷³ The Coreso website (www.coreso.eu) provides little information and its activities appear not to figure in the discussions at the Florence Forum or in other reports or documents on the development of EU electricity arrangements.

Unless there is considerable inter-country complementarity between types of generation within regional power markets, some power companies, consumers and member states will gain significantly from more regional market trade and others will lose. How will this be handled within Project Target and will there be pressures for temporary if not permanent compensation arrangements involving national TSOs and the regional markets?

(vi) *Will the new arrangements be able to accommodate capacity payments?*

The existing European power exchanges (including Nord Pool) are all energy-only markets, without capacity payments. Given the growth of intermittent wind generation and other factors, the UK is proposing to reintroduce capacity payments under its EMR project. Can capacity payments readily be reconciled with the Project Target Model and its (non-) SO framework?

(This last issue raises particular problems if some countries in a regional market adopt capacity payments but other do not.)

There are, of course, many other issues that the Project Target model will have to address, but these seem to be the most obvious SO-related concerns.

4.4.2. Long-Term Investment Related Issue with the Project Target Model: The Critical Issue of Transmission Interconnection

Achieving an adequate level of transmission investment – particularly in interconnection – is the Achilles Heel of electricity ISOs. ITSOs resolve the problem by internalizing the externalities, albeit at a cost of weak pressures on TOS for innovation and cost efficiency. However, for all non-ITSO SOs, actuating adequate investment has been and remains a problem. It is the key weakness in US ISO/RTOs. This is true in general and it is worse in multi-area ISOs than in single area, not least because of multi-regulator problems.

The problem in multi-area jurisdictions is that there may well be no alternative to an ISO arrangement. It is very hard, typically impossible, to put together an ITSO in a single jurisdiction where transmission network ownership is fragmented. In a multi-area jurisdiction, ISOs (real or ‘virtual’) may be the only sustainable solution. Indeed, ISO/RTOs were adopted for electricity in the US precisely because this was the only viable way of organizing networks and liberalized generation markets without major ownership changes for networks. Such ownership changes were probably not possible and would certainly have been massively resisted.

The EU Target Model recognizes this issue but is less willing to confront it. Neither power companies nor national governments are willing to install explicit multi-area SOs. That leaves an even bigger problem in how to raise the long-recognised very low rate of inter-connector transmission investment which is essential to make the regional and EU-wide electricity markets function effectively and efficiently. Instead, there is the hope that inter-country co-ordination (including national regulatory co-ordination), augmented by catalyst funds from the EU will sufficiently support interconnector and other necessary transmission investment.

Having national ITSOs as the most common national SO choice may help, but reliance on ‘virtual’ regional SOs to handle this issue satisfactorily seems to be a triumph of hope over experience. It has manifestly failed in the US RTOs, so why should it be expected to succeed in the EU where governments and others may well act to protect national markets and where there is a weaker multi-area market design and regulatory background? ACER is far from an equivalent of the FERC in terms of specified powers and duties.

A key issue is that increased inter-connection which removes bottlenecks creates losers as well as winners. Transmission companies and protected generators lose revenues where new bottleneck-relieving transmission investment increases the scope and effectiveness of competition – particularly between jurisdictions (e.g. EU member states).



That can result in higher prices to own-country consumers from higher exports as a result of additional, congestion-relieving interconnection⁷⁴. For this and other reasons, that is why significant additions to interconnection – and the SO-type institutions that might create them – have so far been heavily and consistently resisted.

One of the underlying issues is that congestion payments are insufficient to fund new interconnections and that the main beneficiaries may not be the TSOs (or countries) funding the investments.

It is difficult to see how the ‘virtual’ SOs are likely to change this via the incentives available to them, which is why there are calls for giving powers to regulators (or the Commission) to mandate interconnector investment. This has not yet been openly proposed by policy makers for electricity, but Walter Boltz, Vice-President of CEER has come close to advocating it for gas⁷⁵.

The points above have been made in much of the academic analysis and resulting suggestions on how to deal with this critical issue, including SO suggestions.

Booz et al point out that major additional cross-border investment will be needed to accommodate renewable generation expansion plans and that the resulting intermittency causes problems for TSOs since it is unpredictable how much will be delivered until close to dispatch⁷⁶. They suggest that these and the other factors above imply a strong need for EU funding of interconnection via the Trans-European Networks (TEN) Program. But, it also implies a requirement on national regulators and ITSOs to approve and finance the next Ten Year Network Plan that ENTSO-E is to draw up following its preparation of the Network Codes. Newbery (2012) – a participant in the Booz study – points out in several places the need for more transmission investment, particularly on interconnection and how national TSOs and regulators are failing to deliver it, but leaves

⁷⁴ See Booz et al, op cit, p.19.

⁷⁵ See K Beckman, ‘It’s finally coming: the great European gas market transformation’, European Energy Review, 5 April 2012.

⁷⁶ See Booz et al, op cit. who cite ROADMAP 2050: A PRACTICAL GUIDE TO A PROSPEROUS LOW-CARBON EUROPE, www.roadmap.2050.eu

open how this might best be handled. No commentator appears confident that significantly more TEN funding will be available for funding significantly more electricity (or gas) transmission/transport interconnection capacity.

More directly, there have been explicit calls for an EU-wide ISO. Lévêque, Glachant et al (2008) recommend ITSOs for single area electricity markets for all the reasons discussed in the previous chapter. However, for multi-area systems, they recommend ISOs where cross-border externalities and cross-border competition are important relative to national network investment and reducing transmission costs. They point to the benefits of regional market operation and network integration from ISOs where separate transmission companies continue so that price cap regulation for the network is not possible. These are broadly the circumstances for which the Target Model was designed.

This line of argument is continued in Glachant and Khalfallah (2011) which clearly advocates an EU-ISO to co-ordinate network operation and investment planning in a transparent way, independent of local interest groups. This EU-ISO would be supported by various methods of encouraging cross-border co-operation and investment planning, including a very much larger TEN program fund and obligations on national regulators. This is a package that would allocate much more power from national to EU level. Whether or not it is achievable, it does not suggest great confidence in the potential for Nord Pool-type 'virtual' SOs to deliver the increased interconnection investment and multi-area SO co-ordination necessary for an efficient and effective EU Single Electricity Market. However, multi-area ISOs (or an EU-ISO) would still face the governance and related issues discussed by Pollitt and others and discussed earlier.

As a final word, it is worth emphasizing that the comments above are not a judgment as to whether or not the Project Target model will "succeed" or "fail" (whatever success of failure means in this context). Rather, they suggest that we should not have high expectations that the Project Target 'virtual' ISO will bring major benefits or an early or major development towards an effective and efficient EU Single Electricity Market. We draw this conclusion, on the basis of experience elsewhere, on the balance between market-making and market impeding incentives and extensive experience with ISOs

elsewhere, particularly in the US where they have been grappling with essentially the same issues for almost 30 years and with, at best, very mixed success.

4. 5. Multi-area gas SOs

4. 5. 1. Introduction

Since 2010, the EU has embarked on an exercise to develop an EU-wide gas market to operate alongside the EU-wide electricity market. Like the EU-wide electricity market, this would involve trade between regional hubs. There have consequently been some official proposals towards a Project Target Gas Model. These proposals have attracted much comment and criticism – and a number of variants have been proposed to the official ACER/CEER version.

Like the proposed EU-wide electricity Project Target model, the Project Target gas model has no proposals for an explicit SO other than national SOs, which under the 3rd Package have to be ITSOs, ITOs or ISOs. Hence, inter-country gas trade and interconnection development are the responsibility of national SOs working together jointly under the supervision of ACER, CEER and the Commission. Network development formally remains the responsibility of national TSOs and national regulators, with EU co-ordination and guidance.

Whether or not these virtual SO arrangements will create an effective EU-wide gas market is much debated. The key questions are whether they are strong enough:

- a. to prevent national gas companies from acting in restraint of competition in the short-to-medium term (e.g. in the ways described in the DG Competition Energy Inquiry); and
- b. to foster enough interconnection investment to enable a wider market.

Critics of the plans have expressed significant doubts on each of these.

In addition to the pure SO-related issues, there is the question of the design of the gas markets within which the SO arrangements – however virtual – have to work. In what

follows, we do not (and cannot) provide any detailed analysis of the proposed design of the new EU-wide gas market. However, we do consider these issues to the extent that they bear on the SO issues. We do make recommendations on SOs but, on the wider market design issues, we do not offer any recommendations. Instead, we raise some questions that we think are important (and as yet unresolved) as well as raising SO or SO-related concerns.

4. 5. 2. The Context for an EU-wide Gas Market

The initiative for an EU-wide gas market is taking place within a very different context than electricity. Gas supply is primarily a commodity business where the economic basis for the trade in the basic commodity is changing considerably. Hence, the current EU gas industry focus is on the transition away from oil-price linked take-or-pay contracts. In addition, network separation is increasingly being achieved by gas companies selling their gas transportation networks e.g. Eon selling its gas transport assets to Macquarie. The combination of this means that the EU gas market liberalisation proposals seem, as yet, rather less central to the future of the businesses of many or most of the national incumbent gas companies than the electricity proposals are to the equivalent electricity companies.

Gas multi-area markets and networks are very different from those in electricity. Gas buyers and sellers typically contract bilaterally with long-term contracts- 20-25 year contracts in the EU as against the 2-5 year or shorter contracts in the UK and US. The latter also have a series of associated short-term forward and other gas trading markets which are beginning to develop significantly in north-west Europe but not elsewhere. The less instantaneously critical balancing concerns and lower-meshed high pressure transportation networks can therefore (a) be separate stand-alone networks, operating as ITSOs; or (b) provide a service that is to a greater or lesser extent bundled in with the gas sales contracts. This is true in any context but may apply more in practice to long-distance transit issues.

As regards long-distance gas transport the US operates the former system based on long-distance commercially initiated pipelines⁷⁷ and local (State and municipality based) distribution. For the EU, network planning and building, including interconnector investment, has operated under a planning system but with separate arrangements for long-distance transit pipelines. (Transit pipelines are no longer a separate legal concept in the 3rd Package but the underlying contracts are still operational but with the intention of the contracts being redrawn over coming years.)

One reason for the US arrangements is that the US as a single gas consuming area does not have obvious security of supply concerns. That is very different from the EU where, for most countries, all or most of the gas consumed gas is imported from non-EU countries such as Norway, Russia, Algeria, etc (64% for the EU as a whole). In addition, EU member states in Central and Eastern Europe – and in Southern Europe – have significant security of supply concerns arising from dependence on Russian (and to a lesser extent Algerian) long-term contracts. Some of this concern relates to the availability of gas transportation network capacity from alternative sources. These issues raise security of supply concerns for CEE and Southern EU countries about gas that don't affect electricity, most of which is generated within nation-states and which do not affect the US other than minimally.

One important additional feature is that the pattern of demand for gas is changing significantly as renewable electricity generation expands. With large volumes of unpredictably intermittent wind-powered generation, the need for rapid-response generation becomes much more important and gas powered generators are the technology of choice, in economic as well as in technical terms. This is particularly important for the EU. (Wind power is expected to be the dominant technology in achieving the 20% EU renewable electricity target for 2020 and its further increase beyond.)

⁷⁷ These are sometimes referred to –particularly by energy economists- as “merchant” pipelines. However, in gas industry terminology, “merchant” activities involve the buying and selling gas. But, in the US, interstate pipelines operate under contract carriage and are forbidden from buying or selling gas.

Within the US, large and liquid gas trading markets have arisen that provide for gas-on-gas competition and have broken the link with oil prices. That has built on – and supports – the development of long-distance gas transportation ITSOs. Within the EU, the long-term take-or-pay contracts have come under increasing pressure as oil prices have been rising and they have been attacked for their impact on market competition (e.g. in the 2006-7 DG Competition Energy Inquiry). Large and liquid short-term gas market hubs have developed in the UK and in the Netherlands. They are also growing rapidly elsewhere in North West Europe (e.g. Belgium and Germany) but not elsewhere.

These concerns are crucial for providing the context within which to understand the currently highly fraught discussions of an appropriate multi-area EU gas model. They also pose major questions as to the feasibility (let alone the desirability) of a model similar to that of the Nord Pool/Project Target electricity multi-area model⁷⁸.

One extra point worth noticing is that US inter-state gas pipelines are regulated, albeit in a light-handed manner by a single regulator – the FERC. For the EU, other than an embryonic ACER with very limited powers, pipeline and SO regulation is the preserve of national regulators. The regulatory infrastructure for liberalised and unbundled gas industries is new and much less developed for gas in the EU than it is for electricity. That implies a major learning process for regulators, especially EU gas regulators

These difficulties are most likely to bear on interconnector investment between EU countries. The new reforms are intended to give EU-wide regulatory entities more power to promote cross-country gas transport investment but it is far from obvious that, even on paper, they have sufficient powers to do so given national market-preserving interests and national security of supply concerns – and, of course, effectively implementing the new regulatory arrangements will raise additional problems.

⁷⁸ See Makholm (2011) 'The Trouble with Europe: Infrastructure, Institutions and Investment' and Hunt (2011) 'The EU Gas Target Model: Towards a Market in Gas Transportation?' Both of these gas economists have written extensively – and scathingly – about the Project Target gas model.

Will decisions on interconnection investment genuinely be taken jointly across countries by separate national TSOs and their regulators? It is far from obvious and there are many sceptics. We do not claim to have an answer to this question but we note that a positive answer would be more likely if there were explicit multi-country SO arrangements which would be regulated by supra-national (or joint) regulatory entities.

4. 5. 3. US Multi-area Gas Arrangements

US federal gas transmission and SO arrangements have been very successful at providing effective and efficient short and medium term co-ordination as well as long-term investment incentives. Inter-state gas pipelines gain revenues purely from transport fees and have full separation from gas buyers and sellers. The consequence is that, unlike the EU, there are incentives to maximise the use of transport capacity and, hence, to develop effective secondary capacity markets, UIOLI provisions, etc. This helps create an effective market for pipeline capacity, where, the investment planning; investment implementation and regulatory oversight arrangements are all fully aligned. In our terminology, these pipeline companies operate as multi-area ITSOs.

Of course, there are many other reasons for the success of the US gas pipeline model but its establishment as a set of ‘merchant’ investment ITSOs is clearly an important factor and in contrast to the US electricity RTO/ISOs⁷⁹. The US model is, of course, a result of many local factors and depends on a set of well-established liquid gas trading markets so that it would be absurd to argue that it - and its SO arrangements - should be taken as the basis for EU markets. However, we note that gas economists supporting the US model have expressed considerable scepticism about the viability and the net benefits of the officially proposed EU gas model.

The US may have major advantages over the EU in this area because so much of its gas is domestically produced (particularly with the development of unconventional shale gas resources, etc). Nevertheless, the US gas arrangements based on competing ITSOs

⁷⁹ See Joskow (2009) op cit.

have clearly been very successful on their own terms – and much more successful than the equivalent electricity arrangements based on RTO/ISOs.⁸⁰ Makhholm (2011) claims that delivered gas prices in the EU are over twice as high than in the US. Oil price indexation is major issue but the pipeline arrangements probably also play a significant role in this.

4.5.4 EU Proposed Multi-area gas Arrangements

Coordination across national EU gas system operators is crucial, since transportation between the production and the consumption areas commonly involve multiple Countries. This has led to extensive discussion before and since the enactment of the 3rd Package. CEER have now produced a proposed model and way forward. It is perhaps best described as an (absent) virtual ISO. Further details are set out below⁸¹.

In Europe, the Third Package has granted the Commission potentially rather greater powers in this area and has established institutions, the European Network of Transmission System Operators for Gas (ENTSO-G) and the Agency for the Cooperation of Energy Regulators (ACER), whose primary objective is ensuring coordination, respectively, of the gas system operators and of the European regulators. However, even on paper, their powers are weak compared to FERC – or to national regulators and the new powers are yet to be tested. FERC powers in this area have progressively developed since the 1930s, while for the EU they are very new.

Given the incentives to protect national gas companies and national gas supplies, it is at least questionable whether ACER and ENTSO-G will be able genuinely to exercise powers sufficient for national governments and regulators to support and national TSOs actually to build sufficient additional interconnection and related transport investments.

⁸⁰ See Joskow (2009), op cit, Makhholm (2011), Vasquez, M., Hallack, M, Glachant, J.M. (2012) 'Building Gas Markets: US versus EU, Market versus Market Model' RSCAS 2012/10 and many others.

⁸¹ See CEER (December 2011) 'CEER Vision for a European Gas Target Model: Conclusions Paper' C11-GWG-82-03

This looks set to be at least a complicated process as Project Target electricity if not more so, with all the associated risks of ill-designed compromise procedures.

One important point to note there is no apparent role in the governance process for consumers. Presumably, consumer interests are intended to be taken into account via retail competition.

We present below the institutional processes that have been proposed and implemented to coordinate the activities of the gas system operators. We address first management of the interconnected gas system and then network development.

Proposed EU gas markets

Article 13 of the 2009 Gas Regulation requires the establishment of entry-exit zones each with a trading hub. The default is presumably that each member state is a separate entry-exit zone. However, the CEER proposal is that countries should group together around a trading hub as electricity has done for Nord Pool, CWE, etc. Trading within the entry-exit zone is open but with trade between zones expedited by inter-zone interconnection and trading arrangements. Note that the proposed hubs are virtual hubs rather than real hubs⁸². Currently, there is an active UK gas (virtual) trading hub and, as discussed above, others in the Netherlands and elsewhere in NW Europe

The CEER paper makes it clear that there should be fewer hubs than member states but does not suggest how many or how the reduced number should be achieved. The process will evolve so that hubs may concentrate in response (a) to greater trading volumes and (b) to more interconnection - as the electricity hubs have already done. Boltz (2012) suggests a 25bcm annual trading volume as an indicator for the viability of a hub. However, his illustrative map suggests separate hubs for France, Germany, Belgium and Luxembourg, and the Netherlands. In electricity, these countries make up

⁸² See Vasquez et al op cit (2012)

the single CWE control area. (Note that smaller hubs might be used as trading arrangements for smaller balancing markets.)⁸³

The CEER paper sensibly, argues that to create effective wholesale competition, the number of hubs required should depend on a number of factors including the Herfindahl HHI index (where they recommend a number of under 2000). The paper also makes it clear that the establishment of new and/or merged hubs depends on the amount of available interconnection. However, this has long been recognised as low in absolute and relative terms, at least other than across the long-distance transit pipelines.

Of course, major scarcities of gas transport capacity should not be assumed – there are dissenters to the argument that significantly more gas transport interconnection is necessary. There is also no question that improved short and medium-term usage of transport capacity would reduce the need for additional capacity.

As discussed elsewhere in this paper, interconnection investment is the Achilles Heel of all multi-area ISOs, including US and EU electricity ISOs. The problem looks worse in virtual ISOs as in Nord Pool and worse still for EU gas where the national TSOs seem to have more power.

Under the CEER proposals, network – and interconnector – investment would be undertaken by national TSOs operating in a world of virtual trading hubs. There is no obvious regional ISO or other SO for cross-country investment other than co-operative arrangements between national gas TSOs and national regulators. This looks to be problematic and has come under heavy criticism. It can be argued that this gap will be filled by the PCI Directive but this is still to be developed and implemented.

The problems above are all made much worse by the existence of the long-distance transit gas pipelines bringing gas from Russia, Norway, Algeria, etc across a number of countries on long-term contracts.

⁸³ See Boltz, W. (2012), 'Gas Target Model', 21st Madrid Forum, 22 March 2012.

The gas economist critics take fire at the official entry-exit model that has been proposed. The more strident critics argue that the proposed entry-exit model basis would be a disaster for EU gas, particularly for pipeline capacity investment. They also point to the problem being worse the more entry-exit zones there are and the smaller they are⁸⁴.

Newbery (2012) takes a less strident position but argues that entry-exit models cannot define network capacity easily⁸⁵. He argues that this makes it hard to trade as well as providing poor investment signals. Because this makes it hard to net and create FTRs (financial transmission rights), merchant pipeline contestability is prevented. In general, Newbery argues that entry-exit pricing works best in a small area and is unsuited to a continent.

Ascari (2011) takes an intermediate position between the EU proposals and the US-oriented critics⁸⁶. He suggests that the development of gas trading hubs should be left to the market rather than determined by regulators and governments. If applicable in practice, this would almost certainly lead to a few large trading areas – provided that there was enough transmission capacity to support them. Again, we return to the issue that there needs to be effective SO, investment planning and investment implementation institutions in place across and between the trading zones, rather than relying on national TSOs whose interests do not include creating effective pan-European gas markets.

North Western Europe is developing trading hubs, and interconnection but the rest of the EU is not. It is unclear how much additional interconnection capacity will be needed other than in southern and Eastern EU countries. Given the relevant economic incentives, it is however very doubtful whether the *national* TSO based system can provide effectively for additional interconnection investment should it be needed on any significant scale. Newbery (2012) explicitly recommends allocating cross-country

⁸⁴ See Hunt, P. (2008) 'Entry-exit transmission pricing with notional hubs: Can it deliver a pan-European wholesale gas market?' OIES NG 23.

⁸⁵ Newbery, D. (2012), 'The State of the Union: Achieving the Internal Market'

⁸⁶ Ascari, S. (2011), 'An American Model for the EU Gas Market?' EUI Working Paper RSCAS 2011/39.

European gas pipelines to an ISO under which capacity can be both netted and traded. That would separate the cross-country pipelines from networks wholly within entry-exit zones. Newbery suggests that the latter can operate as national TSOs regulated by national regulators.

Coordination of gas system operations

It is intended that the operations of the gas systems of the European States should be coordinated through network codes elaborated by ENTSO-G. This is similar to electricity and, in general, follows the structure of the Nord Pool/Project Target electricity model. The network codes should cover virtually all the system operations activities, including network security and reliability rules, capacity allocations and congestion management rules and balancing rules⁸⁷. However, in contrast to electricity, there is no agreement as to the underlying gas Target Model that can be written down – nor any currently functioning examples. Indeed, there is considerable disagreement on model design and a number of competing market designs. This is discussed in Vasquez et al (2012), who outline five currently proposed market designs. Some of the proposed market designs envisage a continuing significant role for a spectrum of long-and short-term gas contracts trading via transport-linked virtual hub/hubs (e.g. the CEER December 2011 proposals, Glachant (2011) and related)⁸⁸.

Other observers, more connected to the gas industry, see a continued and relatively favoured role for the traditional long-term take-or-pay gas contracts (Frontier Economics, CIEP, both 2011). A key concern of EU gas companies is how to move away from oil-price denominated long-term contracts and how to resolve the mismatch in the duration of commodity contracts with the duration of transportation contracts under the 3rd Package.

⁸⁷ Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 June 2009, on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005.

⁸⁸ See CEER (2011) op cit, Glachant J-M. (2011) 'A Vision for the EU Gas Target Model: The MECO-S Model', RSCAS 2011/38.

The Target Model process is intended to result in the adoption of a network code starts with non-binding framework guidelines submitted by the ACER to the Commission. ENTSO-G is then requested by the Commission to draft a network code in line with the Framework Guidelines. The proposed network code has to be reviewed by ACER, in discussion with CEER, member state governments, the gas companies and others to verify compliance with the framework guidelines before being finally adopted by the Commission. Should ENTSO-G be unable to deliver a network code, the Commission may request the ACER to develop it or adopt a network code on its own initiative. This process has, however only recently begun. In electricity it started in 2008 with a clear example of a working model – Nord Pool – on which to proceed, a process that is still some way from completion.

The first network code on Capacity allocation and congestion management has recently being submitted by ENTSO-G to the ACER⁸⁹. The code introduces a highly coordinated capacity allocation systems, where entry/exit rights across all the European control areas are allocated simultaneously via auctions.

The underlying question is whether and how far this framework will provide a mechanism whereby national markets can operate to co-ordinate short and medium term trades more efficiently, which will in turn require effective incentives on inter-connector investment. The necessary SO functions depend critically on the chosen market structure – and vice-versa. As yet, the market structure is a very long way from being clearly defined.

Coordination of network development

In each Member State, the system operator is responsible for developing a ten-year network development plan, containing measures that guarantee the adequacy of the system and the security of supply. The national development plan is binding, in that the

⁸⁹ ENTSO-G, Network Code on Capacity Allocation Mechanisms. An ENTSO-G Network Code for ACER review and Comitology Procedure (CAP-210-12), downloadable from: <http://www.entsog.eu/publications/index.html>.

national regulator is required to take the appropriate measures to ensure that the projects included in plan are executed by the system operator⁹⁰.

However, there is no obvious enforcement mechanism by which to achieve this and there are strong national corporate and governmental pressures that have – and will continue to hold up the opening-up of markets via higher cross-country transport capacity investment. As Newbery (2012) shows, industrial gas prices have barely converged since 2008 even though hub trading prices have converged. More interconnection and greater market linkage clearly jeopardises the profits being made by the high price gas supply companies such as France and Germany.

The national development plans are to be coordinated through a Community-wide European ten-year network development plan elaborated by the ENTSO-G. But, the Community-wide development plan is not binding on the Member States - it identifies investment gaps and it acts as a reference for the ACER and the national regulators to assess the consistency of the national plans and that is all. If the Agency identifies inconsistencies between a national ten-year network development plan and the Community-wide network development plan, it can recommend amending the national ten-year network development plan or the Community-wide network development plan as appropriate, but, again, it is difficult to see how that can be enforced against seriously foot-dragging countries (or gas companies).

The mechanism to achieve coordination among the national and the Community-wide development plans, based on the ACER's recommendations to the ENTSO-G and to the national regulators, is clearly lacking in detail. However, the process to identify and implement major projects of common European interest, laid-out in the proposed new regulation on trans-European energy infrastructures⁹¹ promises to be more structured

⁹⁰ Regulation (EC) No 715/2009, art.22.7.

⁹¹ Regulation of the European Parliament and of the Council on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC, COM (2011) 658 final.

and with a greater role for the Commission. However, the Commission has very few real powers in this area. In this context, an absence of any explicit multi-area SO investment-planning and implementation mechanisms could be a serious weakness.

The Commission has the responsibility of identifying the routes and areas where investment in network infrastructures should be granted priority. The project promoters – transmission operators, system operators and other operators or investors developing the project – submit proposals for projects of common interest to the Regional Groups. These are entities composed of representatives of the Member States, national regulatory authorities, transmission system operators interacting under an obligation to cooperate on a regional level set by the Third package, the promoters of projects in the region, the Commission, the ACER and the ENTSOG. But, each proposal must be approved by all the affected Member States which gives considerable veto power to opponents.

Under these proposals, each Regional Group submits its proposed list of projects to ACER, which issues an opinion to the Commission. Finally the Commission decides on granting status of projects of common interests to the proposals. The projects of common interest are included in the national development plans and in the Community-wide network development plan. The investment costs of the project of common interest are born by the transmission system operator of the Member States to which the project provides a net positive impact, and paid for by the network users through the transmission tariffs. The new assets will be operated by the system operators.

According to this model, the execution of cross-border investments is subject to a further round of approvals by the national regulators, taking place when the project has reached sufficient maturity. At that stage a thorough cost-benefit analysis is carried out and the regulators are supposed to agree on the cost-allocation across States. In the case where the national regulators don't reach an agreement on the investment request the decision is supposed to be taken by ACER. However, does ACER actually have the legal, financing and other powers to enforce disputed decisions? Maybe in theory; but, in practice, that seems highly unlikely. Past experience is far from encouraging. Makhholm

(2011) and others are scathing as to the likelihood of this happening, while Glachant and others point to the need for large-scale funding from the TEN programme – something that is very unlikely to be in place over the next few years⁹².

The key problem is that Commission proposals do not adequately address the incentives on incumbent gas companies, regulators and governments to resist interconnection investment, even where an impartial CBA would find it justified. Interconnection investment creates losers as well as gainers. In addition, security of supply concerns are likely to be raised where countries are more dependent on imports of gas, particularly imports via short-term markets. Finally, as with US electricity RTOs, there is likely to be considerable resistance from national regulators – and other parties – to transport capacity investment that is financed locally but provides most of its benefits to customers and companies in other jurisdictions. It may be that new elements of the as yet uncompleted framework will assist, but, as yet, the EU-level powers do not seem to be sufficient to encourage optimism.

The multi-area investment planning SO model being implemented proposed seems to be a regulator driven model where it is hoped that co-operation between national regulators will, with the support of national gas TSOs, provide SO - like investment planning and financing. But, regulators cannot enforce transport capacity investments by privately owned companies even nationally let alone across borders. They can provide incentives and, sometimes, a degree of investment support but, in the absence of a major return to planning and directed investment at the EU and national level, no more than relatively weak incentives.

There are, of course, many market design issues related to this judgment but the absence of an explicit ISO for cross-border pipelines would clearly improve matters. It would not least align the coverage of the multi-area ISO with EU-level regulatory

⁹² The indicative TEN-E 2012 budget for both electricity and gas is Euros 21.2 billion and this sum will be needed to fund many other projects e.g. investments in Central and East European energy network improvements.

oversight. This should allow rather more effective incentives for cross-border trade, competition and investment than relying on national TSOs and national regulators operating under EU guidelines.

The proposed new institutional setting tries to reflect the intrinsic complexity of a multi-layer decision-making process, consistent with the division of powers between the national and the union level selected in Europe. However, compared to the past, in the new model the interaction among the States, as well as among the States and the union-level institutions, in theory appears more structured and less reliant on voluntary cooperation, but in practice looks highly problematical.

For multi-area electricity markets, Nord Pool provided a positive example – but from one should not generalise too far. However, in gas, there are (regrettably) no similar models for the EU proposals on which one can draw.

4. 6. Concluding remarks on gas SOs

Under the Third Package the role and responsibilities of the European gas system operators are planned to change significantly. The proposed integration of national markets is expected to foster spot gas trading, which will require a more dynamic gas system management and greater coordination of system operations in all areas, ranging from capacity allocation and congestion management to the enforcement of use-it-or-lose-it provision, from system balancing to the administration of the gas settlement system. However, the official CEER and Madrid Process proposals have come under very considerable criticism and it is questionable whether they are feasible let alone economically efficient.

The proposed coordination of the gas network development on the European scale would place considerably increased responsibilities on and new challenges for the national system operators, all the more in a context where central planning and merchant investments will coexist, for pipeline capacity investment. The emerging institutional framework shapes the national system operators as quasi-regulatory institutions – both at the national and at the union level – emphasizing the need for

organizational arrangements that guarantee their independence. Given national policy, security of supply and commercial objectives this may be difficult to achieve.

In economic terms, we consider the proposed (super-virtual) SO arrangements from our short, medium and long-term perspectives.

- (i) For multi-area gas, short-term within-day network and congestion management is less critical than for electricity but emergency management can be very important. For the proposed Project Target approach, this would seem to rest with national TSOs and regulators and how well they co-operate within the (relatively small) trading zones. Whether or not this is successful will depend on the quality of the ENTSO-G and network codes in promoting short-term trading.
- (ii) For medium-term issues, there need to be sufficiently large and liquid trading markets attached to the virtual hubs plus (a) effective trading incentives and (b) capacity availability allocation arrangements (implicit or explicit auctions). It is at this point that the critics argue that an exit-entry zone system with no supra-national ISO at least for cross-country pipelines could well be problematic.
- (iii) For long-term investment issues, the proposed CEER model looks to be potentially seriously inadequate. As regards pipeline capacity investment in general and interconnection investment in particular, it has all the problems of other multi-area SOs (explicit or virtual) plus additional ones arising out of the dependence of gas markets on long-distance, cross-country transit pipelines. It may be that the PCI and other Directives will assist but the underlying incentives on national TSOs do not encourage optimism, particularly in the absence of any supra-national ISO - at least for cross-country pipelines.

It is the last issue that creates most concern. The official CEER proposals require considerable regulatory intervention and co-operation over interconnector investment to facilitate market development. These are required in circumstances where conflicts of

interest and incentives for anti-competitive behaviour by national gas companies are powerful. It is noticeable that supra-national regulatory capacity is weak. Given all of these factors, it is not surprising that the proposals have not only attracted considerable (and substantial) criticism from market-oriented gas economists; but have also generated a number of alternative and competing market frameworks.

Finally, we note that relatively little effort has so far been expended to ensure that the gas system operators' objectives be in line with the public interest. Several features of the system operators and of their activities make providing economic incentives a complex exercise. These include, among the others: the hybrid nature of the system operators - at the same time profit-seeking firms and quasi-regulatory institutions; the trade-offs involved in total cost minimisation, between short-term congestion management measures and long-term investment measures; possibly diverging national and European agendas.

We expect that the provision of the correct incentives to the gas system operators will continue to be a prominent issue in the future policy discussion. The currently proposed SO and market arrangements look likely to be the starting point of ongoing discussions rather than their conclusion.



CENTRE ON REGULATION IN EUROPE



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5. Extensions to the rail and water sectors

5. 1. Railway SOs

The railway sector in Europe has been through major reforms in at least some member states. These have separated the operation of (passenger and freight) services from the provision of infrastructure, mainly track and stations. In the UK separation has extended to, in some periods, maintenance and the provision of rolling stock. Even where separation has not occurred (and the incumbent rail operator remains vertically integrated), national governments and/or EU Directives have permitted competitive services to come into being.

Despite this mixed picture in sectoral structure, there has been little explicit discussion in the sector of the role of systems operators. But inevitably, SO-type functions are discharged throughout, and the creation by the First Railway package of the role of infrastructure manager is an important step in the direction of SOs. Nonetheless, the absence of acknowledged SOs makes the discussion more hypothetical or speculative.

This section begins, by way of background, with a preliminary discussion of the separation debate in railways. We then examine the nature of implicit, explicit or virtual SO activity in the three time frames distinguished throughout this report, taking the UK as an example, with occasional reference to other member experiences. ‘Multi-area SOs’ are covered in the final section.

EU Railway packages⁹³

The three packages to date of railway regulation in Europe have an impact both on (i.e. multi-area) objectives, and on purely national services. They are, of course, accompanied by copious national legislation and regulatory enactments, but the Directives, when implemented, provide a common thread throughout the EU.

⁹³ A helpful summary can be found in Railways: EU Policy, House of Commons library, available at <http://www.parliament.uk/briefing-papers/SN00184>

In summary, the First EU Package was adopted in 2001 for implementation in 2003. Promoting the aims of market opening, improved freight performance, and enhanced interoperability and integrated transport planning, it opened up an international freight market by mandating access to infrastructure. It also separated the management of infrastructure from the operation of rail services. Capacity allocation had to be done by an organisation which does not provide services, in order to provide non-discriminatory access to tracks, and separate accounting was introduced.⁹⁴ Infrastructure managers also have to co-operate with their opposite numbers in other Member States. Track access charges must satisfy specific rules.

The First Package was strengthened or 'recast' by a merged draft Directive approved in 2011.

The Second Railway Package was tabled in 2002 and adopted in 2004. Its aim was to create a legally and technically integrated European railway area. It opened up the rail freight market (national and international) to competition from 2007, and widened access rights to international passenger services. A further Directive harmonised and clarified interoperability requirements for both high speed and conventional rail systems, applying to the design, construction, operation and maintenance of parts of the system placed into service after 2004. The system of safety regulation was also tightened up. A concurrent Regulation created the European Railway Agency.

The Third Railway Package, adopted in 2007, endorsed proposals to open up international passenger markets to competition from 2010, including for the purposes of cabotage. Providers of such services must be granted access to the infrastructure. An 'international driver's licence' was introduced for train crew. Passengers' rights were strengthened. A further Directive on interoperability was agreed.

⁹⁴ A 2009 consultancy report found defects in the separate accounting processes adopted: RGL Forensics et al. Study on Separation of accounts of rail way undertakings and rail infrastructure managers, Final Report, 2009.

The Commission is working on a Fourth Railways Package. There is speculation that it may require mandatory separation between (a) track owners and operators and (b) train operating companies.

5. 2. Separation in railways

Whether separation does or does not provide net benefits is an unsettled question in railways. In 2011, exactly half of 26 Member States were separated – the most recent in 2002. We begin with a brief review of the stormy history of the UK experience.

The railway industry in the UK is often regarded as the test-bed on which structural separation has failed. It is, however, arguable that special factors were at work, which made the situation unusually bad. Our chief interest is how investment incentives were affected.

After considering various options, including vertically integrated regional companies and a hybrid structure, with some services integrated with the track, the UK Government in 1996 adopted a four-way separation of the passenger railway industry into: a regulated track and stations company; a large number of franchised train operating companies (a small minority of which compete over the same or 'parallel' tracks); putatively competitive rolling stock leasing companies (ROSCOs); and track maintenance companies. The freight industry operated on a separated and competitive (but highly concentrated) basis.

The potential operational problems in this structure were considerable. For example, maintenance companies, bore the burden of repairs to the track, according to their contracts, but could pass the cost of replacement through to the track company. Another example: it is well known that 'the point where steel wheel meets steel rail' is about the size of a dime, but bad profiles as one or both can lead to millions of dollars' worth of problems for railroad car and maintenance of we people'. It is asserted that national track infrastructure was damaged by train wheels with flat spots or them and that flat

spots were caused by poor train maintenance by the rolling stock companies, which were not liable for damage to the track.⁹⁵

The investment record of the UK track company, Railtrack, has also been subject to examination.⁹⁶ In the period after privatisation in 1996, investment fell short of expectations as the value of Railtrack's stock rose- largely as a result of too generous access prices set by the government. The regulator, the Office of Rail Regulation (ORR), initially left issues of capacity expansion to negotiation among the parties, but these proved difficult given the short duration of the franchises awarded to train operating companies and the different benefits to operators running trains on the same track. As a result of these difficulties, investment decisions were taken out of the hands of Railtrack and its successor, Network Rail. Gomez-Ibanez concludes that in the light of the virtual abandonment of plans to encourage competition among operators- which were thought likely to increase the subsidy budget - it would have been better, in the light of the co-ordination difficulties, to have maintained, or to have reverted to, an integrated structure.⁹⁷

In 2011/2 proposals have come forward to reverse (to a limited extent) the complete UK separation. What is suggested is a half-way house between separation and integration in form of 'partnerships' between network rail and various train operating companies. Exactly how this would work is not clear, but it has the potential to align incentives between Network Rail and some, but not necessarily all services providers. The regulator is thus forced to confront the possibility of a motive for discrimination which would be absent in a fully separated environment.

A number of studies have examined a wider body of evidence concerning the impact of separation. One approach is to examine the evidence of a cross-section of countries

⁹⁵ R Pittman, 'Structural Separation and access pricing in the railways section: sauce for the goose only?' pp. 35-47 of *Structural Separation and Access Pricing: a New Synthesis?*, 2004.

⁹⁶ Gómez-Ibáñez, J. *Regulating Infrastructure: Monopoly, Contracts and Discretion*, Harvard University Press, 2003, Ch 11.

⁹⁷ Op. cit. in fn [81], p. 297.(Gomez.Ib)

using econometric methods. An early study finds that organisational (something akin to functional) separation produces the same effects as full integration, but that structural separation has a positive effect on efficiency in a sample which, for data reasons, excludes the UK.⁹⁸

The OECD has also produced a careful analysis of the impact of structure on investment. It reports that upgrades to the rail infrastructure in a vertically separated structure will confer benefits and impose costs on different operations to different degrees.⁹⁹ They may therefore require either protracted negotiation or a decision (as in the case of airports considered below) by a regulatory authority. The OECD notes that such co-ordination problems are present even in a partially vertically integrated structure, where the infrastructure provider is responsible for some services. They are wholly avoided only in a vertically integrated monopoly.

A number of studies note the confounding nature of the fact that separation and competition often go together. Thus Cantos et al. find productivity growth to be faster when vertical separation is combined with competition.¹⁰⁰ As far as the effect on the transport market is concerned, Laabsch and Sanner find that full separation reduces the share of rail in passenger transport, while the results in freight are ambiguous.¹⁰¹ Drew and Nash conclude that there is no correlation between separation and the growth of freight transport or rail's share in total freight, and that growth in passengers cannot be attributed to separation.¹⁰²

There is thus no consensus view on separation of the rail industry. According to the OECD (2005), where access is mandated, "decisions not to separate [structurally]

⁹⁸ G Friebel, M Ivaldi and C Vibes, *Railway (de)regulation: a European efficiency comparison*. CEPR discussion paper 4319.2004.

⁹⁹ *Structural reform in the railway industry* DAF/COMP (2005) 46, OECD, 2005.

¹⁰⁰ P Cantos, J Pastor and L Serrano, *Vertical and horizontal separation in the European railway sector: an dits effects on productivity*, *Journal of Transport Economics and Policy*, 44 (2) 2010, pp 139-160.

¹⁰¹ C Laabsch and H Sanner, *The Impact of Vertical Separation on the Success of the Railways*, *Intereconomics*, 47 (2) 2012, pp. 120-128

¹⁰² Drew and C Nash, *Vertical separation of railway infrastructure – does it always make sense?*, University of Leeds, Working Paper, 2011.

should only be made after careful consideration of the costs that will result in the form of the additional regulatory burden and on-going residual discrimination." It goes on:

‘For example, in the case of a service which is both a “dominant” user of the track infrastructure and where there is scope for effective competition in-the market, it is not clear whether the objectives set out above are best achieved through regulation of a vertically-integrated entity or through vertical separation, and regulation of access to the track infrastructure. This might be the case for, say, one of the coal-dominated rail lines in Australia. These lines are profitable and could probably sustain effective competition, especially if train operations were separated from the track infrastructure. On the other hand, such separation could risk creating problems in regulating quality and investment in the track infrastructure and could undermine the ability of these services to form part of a seamless just-in-time “production line” coal-mining process. The appropriate choice of policy is not clear.’¹⁰³

5. 3. SO functions in a single area rail context.

We now apply the analysis to a national railway system based on a single network.

5. 3. 1. Traffic management

This adaptive activity, which largely involves responding to foreseen (planned maintenance) or unforeseen (breakdowns or accidents) changes in circumstances is normally the responsibility of the network operator. The logic underlying a hierarchical mode of governance is strong. But that leaves open the question of how it is performed or supervised.

This acquires salience in the case of a vertically integrated network, which, if the task of short-term adaptation fell to it, would have an incentive to let affiliated services through first and delay competitors’ services.

¹⁰³ Op. cit. in fn. 99 above, p. 63.

Under the Directives, the infrastructure manager must publish priority rules to be utilised in case of disruption. However, these might be only very general in form (“give priority to passengers over freight”), and hence still permit discrimination among competing passenger services.

There are, however, two reasons which may militate in favour of maintaining the norm of infrastructure responsibility. First, the implementation mechanism for conveying adaptation decisions is the signalling system, which is naturally part of the network. Allowing an SO access to it in abnormal conditions is risky. Secondly, recovery decisions are in practice in the UK [and elsewhere] taken by some combination of staff of the infrastructure operator and service providers. This is desirable because the latter are likely to have a more detailed knowledge of the ramifications of any particular recovery strategy for the service’s later timetable. Where this is so, discrimination in favour of service affiliated with the network would be fairly transparent, and provided the regulatory regime has an adequate enforcement mechanism, it could be deterred.

5. 3. 2. Access to existing capacity

One could imagine accomplishing the allocation of existing capacity in the medium term by a fully market-driven process. This would involve allocating train paths via an auction process. The auction would have a number of features. The auctioneer, or systems operator, would be assigned duties, including the following. It would:

- ensure that the network provided the maximum capacity achievable, in the interests of customers;
- have regard to the interests of customers in achieving a variety of service (this would impose restrictions on minimum service levels, especially on smaller stations on commercially desirable routes);
- have regard to the interests of customers with respect to the frequency of services provided by the same operator (this would prevent a fragmentation of services, which operators would in any case seek to avoid);

- to promote competition between suppliers of services with different characteristics and prices over the same route: this would be achieved by appropriate packaging of train paths;
- to prevent the emergence of singly or jointly dominant providers, where effective competition is feasible; this would imply imposing caps on the amount of train paths which any operator can acquire and packaging paths in a way which would reduce the likelihood of collusion.

Subject to the constraints on the process implied by the above duties, the SO would conduct the auction. Any new train paths generated by track enhancements would be auctioned. Subject to appropriate legislative changes, secondary trading of paths would be permitted, probably subject to ‘soft caps’ – i.e. caps which the SO, possibly on the advice of a competition authority, has the discretion to over-ride. Where the auction generated competition within a properly defined anti-trust market, prices would be subject solely ex post competition law remedies. When it did not, price controls would be imposed. A decision would have to be made concerning the reserve price in the auction. This would clearly influence the degree to which services could be provided. It could be as low as, or even lower than, the level of operating costs only. Bids would, however, be confined to positive values. If those were not attainable in a competitive framework, the services in question would to be subject to a reverse auction through the parallel franchising process.

Two recent developments in auction practice make the procedure more practicable. The first is the use of combinatorial auctions, which allow bidders to make offers on combinations of slots – on a scale allowing them to provide service over a day or week.¹⁰⁴ The second is use of so-called clock auctions, which allow similar slots to be auctioned interchangeably, leaving it to a later process to make detailed assignments.

¹⁰⁴ See P Cramton, Y Shoham and R Steinberg (eds), *Combinatorial Auctions*, 2006.

One important one is the length of the period for which rights are assigned. Too long a period may lead to ossification; too short a period may chill investment in collateral assets as the end of the licence period approaches. The latter problem is probably impossible to mitigate. The former can be addressed by making rights tradable, and by allowing the government or regulator in narrowly defined circumstances compulsorily to buy back rights.

It is worth noting that i) this system can be accompanied with pre-emption of certain train paths for socially necessary services; these are simply bid into the auction at an infinite price; and ii) that such a system could be introduced stage by stage. These qualifications notwithstanding, the above process is unlikely in the near future to be used to allocate network capacity.¹⁰⁵

5. 3. 3. Capacity allocation in the UK and elsewhere

In the UK the task under examination is split between: ‘capacity allocation’, undertaken and supervised by the regulator, ORR and generating an aggregated allocation to service providers, taking account, where appropriate, of their franchise obligations and of existing contracts with the network operator, Network Rail, which themselves are approved by ORR; and ‘capacity co-ordination’ – the crucial timetabling function. The latter task is performed by several hundred employees of Network Rail.

Network Rail has a published Code of Practice on the Management of Strategic Capacity, setting out how it will identify available capacity on key routes to create strategic paths, include these paths in the timetable development process, and maintain them as far as practicable during the development of future timetables. It is required to publish Route Utilisation Strategies (RUS), prepared under ORR Guidelines on RUS

¹⁰⁵ The same point is made in C Nash, ‘Competition and regulation in rail transport’, in A de Palma et al. (eds.), *Handbook of Transport Economics* (2011) p. 775. For further discussion Patricia Perennes, of Université Paris 1 and RFF, *Can The “Invisible Hand” Draw The Railroad Timetable? And the symposium on auctions for infrastructure* edited by Jon Stern and Ralph Turvey in *Utilities Policy* 11(1), 2003.

which contain a provision for the ORR to object, and to receive representations on them from third parties such as service providers.¹⁰⁶

Three key issues arise in this connection: efficiency, discrimination and alignment of incentives.

We conjecture that timetabling is an activity which requires intimate knowledge of the network, or ready access to the necessary information. Given that, the actual task may be relatively separable in management terms from other tasks of network operation – taking account of the fact that the issue here is not adaptation to unexpected events, but the development of a timetable likely to be fairly stable in the medium term. Combining timetabling in a unitary managing structure with network management may not be necessary.

It is obvious that timetabling would be a powerful instrument of discrimination, in a partially vertically integrated structure in which the network operator had a stake in some but not all service providers. Recent discussions of the UK rail sector have incorporated the notion of ‘alliances’ between the network operator and (some) service providers. This would break the present complete separation of interests, and bring the discrimination issue to the forefront of the debate about system operators. Under EU law, an appeal mechanism must exist to deal with complaints from service providers over capacity coordination. However, it may be difficult for the appellate body (usually the regulator) both to get to the bottom of the situation and to unpick the complex interlocking mechanism of the timetable.

Then there is the question of alignment of incentives. The incentive regime for a network operator is likely to be geared heavily towards productive efficiency, especially in circumstances where considerable excess costs have been identified.¹⁰⁷ It may be difficult to combine these with more nuanced incentives aimed at allocative efficiency –

¹⁰⁶ ORR Guidelines on RUS, available at <http://www.rail-reg.gov.uk/server/show/nav.1236>

¹⁰⁷ See the recent McNulty report, Realising the Potential of GB Rail, Department for Transport, May 2011.

ensuring that the socially optimal set of rail services is timetabled (subject to the numerous other prior constraints on the process noted above).¹⁰⁸

When problems of discrimination have been encountered in other contexts, some form of separation of network and services has been proposed. It could be functional rather than ownership separation, but the strategy is to design a structure which aligns the incentives of each type of agents separately with the social goal, rather than allow cross-contamination of the incentives of each type by the interests of the other.¹⁰⁹ A similar approach may be desirable as between capacity co-ordination, with one incentive instrument applied to the network as a whole, and another to the 'systems operator' undertaking the timetabling function.

There are notable cases in Europe where full ownership separation between capacity allocation and provision of services is not accomplished. In Germany, Deutsche Bahn contains several legally separated companies, including a network and several services companies within group subject to unitary ownership. As a result, network operations, capacity allocation and provision of services fall under a single ownership umbrella.

In France, where network operations delivered by RFF and the largest service provider (SNCF, historic integrated monopolist) are separated companies (although both owned by the French state), the timetabling function is delegated by RFF to an independent branch of the SNCF. The consequences of this arrangement would repay further study.¹¹⁰

¹⁰⁸ The ORR's recent Update and Further Consultation on Aligning Incentives to Improve Efficiency, May 2012, focuses on aligning network and service provider incentives, in the interests of productive efficiency.

¹⁰⁹ See M Cave 'Six degrees of separation,' Communications and Strategies, No. 64, 2006, pp.

¹¹⁰ See Perennes, op. cit. in fn.[91] above, pp. 8-9.

Capacity expansion

Rail subsidies are pervasive throughout the world.¹¹¹ As a consequence, capacity expansion decisions are fundamentally made by governments – in Europe principally at Member State level, but also, with respect to international routes, at EU level.

The mechanism for this process in the UK involves the Government and the network operator, as well as the regulator and service operators. In particular, every five years, corresponding to the five year period over which Network Rail is subject to revenue control, the Government is obliged under the Railways Act 2005 to prepare a High Level Output Specification and Statement of Funds Available.

The last one was published in a White Paper.¹¹² It sets out the Government's priorities for investment over the period 2009/10 to 2013/14 in both rolling stock network expansion, both based on the priority of expanding passenger capacity. Particular projects were outlined including the redevelopment of Reading Station and the construction of a cross-London connection known as Thameslink. Total funds available (expressed, unhelpfully, in nominal prices) were £15.3 bn (€17bn). A new strategy document covering the period after 2014 is expected in the summer of 2012.

With this level of central control, the key issue relevant to SOs is whether a separate organisation (than Network Rail and ORR) might be able to collect and collate better information to underpin the government's decision-making process, which, as the 2007 White Paper makes clear, involves the necessary building blocks of demand and cost projection. We are not in a position to answer this question.

In practice, the Government in most European contexts is the ultimate authority on railway expansion issues, leaving little room for decisions to be distorted by combined

¹¹¹ In England and Wales, the average subsidy per passenger mile of franchised train operating companies in 2010/11 was 8.1 pence. See <http://www.dft.gov.uk/publications/dft-business-plan-indicators-input-01/> In other Member States it is more.

¹¹² Department for Transport, Delivering a Sustainable Railway, Cm 7176, July 2007.

economic interests of network operators and service providers, except through the provision of information and analysis.

5. 4. Multi-area SOs in rail

As is clear from the summary above, the two main thrust of the European railways Directives are market opening and the development of international freight and passenger services. Attention is paid to imposing duties on infrastructure managers to grant access to international services and to co-ordinate internationally with a view to developing international corridors. In addition, some resources are made available to widen bottlenecks at borders or along international routes.

It is easy to see how capacity allocation might otherwise militate against international services. At one level, Friebel, Ivaldi and Pouyet show how an international infrastructure manager can avoid double marginalisation.¹¹³ This follows earlier work by Agrell and Pouyet on the underinvestment arising from regulatory competition and lack of co-ordination.¹¹⁴

More immediately, international services may come at the bottom of the infrastructure manager's list of priorities. This could happen if passengers were generally not citizens of the member state in question, possibly considered unworthy recipients of subsidy. Or, if cabotage were significant, they might be seen as unwelcome interlopers.

To counteract these tendencies, a number of European measures have been taken at the institutional level. The European Railway Agency (ERA) was established as part of the Second Railways Package to take charge of finding joint safety and interoperability solutions.

¹¹³ G Friebel, M Ivaldi and G Pouyet, *Competition and Industry Structure for International Train Transportation Services*, July 2011, available at

¹¹⁴ P Agrell and J Pouyet, *The regulation of transborder network services*, Ecole Polytechnique, Laboratoire d'Econometrie, May 2005.

RailNetEurope was set up in 2004 by a consortium of rail infrastructure managers and seeks to promote Europe-wide timetabling, operational co-operation and real time data exchanges across borders. It also develops and disseminates information about international corridors.

In relation to interoperability, a European Rail Traffic Management System (ERTMS) sets a single signalling equipment standard, allowing trains to move across compatible national networks smoothly. The Interoperability unit of the ERA is active in a wide field.¹¹⁵

This amounts to a range of 'voluntary' international SO activity. However, a key role in practice is played by the national infrastructure managers. To the extent that their incentive regimes are defective or distorted by integration into services, the outcome will be affected.

Finally, a programme of the European Commission, the Trans-European Transport Network (TEN-T) makes funds available to support particular transport objectives, ranging from rail to roads to 'motorways of the sea'. However, the sums of money involved, measured in hundreds of millions of euros, pale into insignificance compared with the estimated requirement for transport infrastructure in the EU of €1.5 trillion for 2010 to 2030.

5. 5. Railways SOs – summary and unresolved issues

The above discussion has identified a possible role for a single area SO in each of our time divisions - short, medium and long-term.

In short term adaptation, there is a risk of discrimination in a partly vertically integrated environment, which must be balanced against possible efficiency losses from separation. In capacity allocation and co-ordination, the risk of discrimination with vertical integration

¹¹⁵ European Railway Agency, *Progress with Railway Interoperability in the European Union*, Biennial Report, 2011

appears to be more substantial at the timetabling stage than in adaptation. This is combined with the difficulty of constructing a suitable incentivising maxim and in an ITSO, where the chief may be improvements in productive efficiency. There may be a case for a separate SO, guided by incentives based on the satisfaction of end user demand rather than cost cutting.

Network expansion in rail is now in practice largely a government rather than a network decision. The network thus influences the decision largely via information it provides. This raises the hard-to-answer question of whether an independent SO might provide better information.

The record indicates that a kind of virtual ‘federal’ SO has been created in the EU in the form of RailNetEurope. The proof of its effectiveness will be the extent to which international passenger and freight traffic grows. If that fails to happen the next step may be an explicit federal SO, covering international train flows.

Finally, there is the issue of whether, if an SO is created for some purpose – for example, to avoid discrimination in capacity allocation in a vertically integrated world, that might switch the balance in favour of assigning other tasks to the SO, on an incremental cost basis.

5. 6. System Operators in Water

Water supply companies are typically small, vertically integrated companies. In Germany, there are over 6,000; while in 2001 there were almost 18,000 in Japan¹¹⁶. In France and Italy, there are fewer but still hundreds, many operated by management contracts or lease concessions and some by full concessions, with the responsibility for funding investment. In contrast, the Netherlands has only 10 (publicly owned) water supply companies. In Britain, for England and Wales, there are 22 fully regulated

¹¹⁶ See Zschille and Ruester (2009) ‘The impact of governance structure on firm performance – and application to the German water sector’ for Germany and Urakami, T. (2006) ‘Economies of vertical integration in the Japanese water supply industry’ for Japan.

(privatized) water supply companies of which 10 are large water and sewerage companies and the other 12 are smaller water only companies; for Scotland, there is one (publicly owned) water company covering the whole area.

Water supply operates as follows. Water, treated to the regulated quality, is supplied from a river or other water source to the customers in a defined area by a vertically integrated company. That company may also handle the waste water processing and disposal (as for most British water companies) or waste water handling may be separate (as in Germany). For small water companies with neither upstream (water resource) nor downstream (retail) competition, system operation is a very minor issue. However, for large vertically integrated, monopoly water companies, system operation functions can be important in engineering and efficiency terms even if by definition they do not involve competition¹¹⁷.

The implications are that larger water companies, even if monopoly vertically integrated companies, operate *SO functions*. However, the SOs are typically *implicit* SOs and the exercise of those functions may be spread around the company rather than concentrated in an “SO Division”. It is only when there is a desire or need to introduce competition – particularly upstream competition and/or bulk water trade that SO issues become important. It happens then because there is a concern among regulators and competition authorities that water companies should not favour their own upstream supply facilities (or long-term contracted suppliers) relative to lower cost upstream competitors – the same issue that arises in energy and elsewhere.

Current and future expected water shortages are crucial to the potential importance of SOs in water. In countries like Germany where water resources are plentiful, there is no need or interest in promoting upstream water competition. Hence, the interest in SOs as a way of fostering resource and/or bulk water competition and trade has almost entirely

¹¹⁷ In what follows, we concentrate on water supply and omit any further discussion of wastewater. That is because there seems to be little current scope for competition in wastewater around the network elements. Hence, SO issues per se don't arise in wastewater.

developed in water-short areas such as Australia and California. England has now joined that list – raw water supplies are becomingly serious stretched in the East and South East of England with many water zones classified by the Environment Agency as over-abstracted. These regions include the highest income and most populous parts of Britain as well as the main arable crop-growing areas. There are also predictions of potentially much greater summer water shortages over the next 30 years as a result of Climate Change¹¹⁸.

In the light of these developments, in 2010, Ofwat (the England and Wales water regulator) launched a consultation about whether regulated water supply companies should be required to set up a functionally separated SO. This followed the 2008-09 Cave Water Review which initially proposed that water companies be required to set up an ‘independent procurement entity’ (effectively a single buyer) and later proposed a somewhat less ambitious ‘independent contracting entity’. The Ofwat SO consultation included papers commissioned from various water and infrastructure industry specialists¹¹⁹. We draw on these extensively in the discussion below.

Unlike the other infrastructure network industries discussed in this paper, there is no existing or proposed EU legislation that would affect the structure of the water supply industry or trade in water. There is, of course, much EU legislation on environmental standards for water supplies. However, neither inter-country water trade nor the role of water as an input to other commodities are seen as sufficiently important to require EU legislation to eliminate anti-competitive trade barriers let alone to promote wholesale or retail water competition.

¹¹⁸ London now has lower annual average rainfall than Rome, Sydney or New York. If the UK were rather closer to the equator and with less cloud cover, SE and E England would be classified as semi-arid. Eastern Scotland has similar problems but not as severely. See Defra Water White Paper 2012 for more details.

¹¹⁹ These papers by Chris Bolt, Keith Harris, Peter John, Michael Pollitt and Jon Stern can be downloaded from http://www.ofwat.gov.uk/competition/review/prs_web110317sysop

5. 7. Water SOs in a Single Area

Harris (2011) identifies the role of an SO within the Ofwat consultation as “ ... organising supply from the chosen upstream wholesaler to the final consumer, including providing a menu of prices for access to each part of the system from raw water abstraction, through treatment to distribution and local storage¹²⁰”. As the paper makes clear later, this definition includes issues such as organising company imports and exports of water, interconnection and network investment planning.

Harris lists SO functions for an integrated water supply company as follows:

- (i) Daily system operation to ensure that water of the right quality is delivered in the right quantity to the right customers from the cheapest possible sources;
- (ii) Scheduling planned maintenance;
- (iii) Publishing and administering transparent and unbiased access network rules and prices;
- (iv) Ensuring that trading parties are paid; and
- (v) Network investment planning, including treatment facilities etc and planning interconnections with neighbouring companies.

In the terminology of this paper, item (i) is a short-term function, items (ii)-(iv) are medium-term functions and item (v) is a long-term function. The list is familiar from the list of electricity and gas SO functions but is much simpler. There is no reference to congestion management, co-ordination of and with resource trading markets or the complications from large-scale or long-distance trade.

¹²⁰ Harris, K. (2011) ‘An evaluation of the potential introduction of a system operator for water in England and Wales’, p.8.

The model above could provide a functionally separated SO but it could also be a division within a water company co-ordinating with the network operator. In terms of EU energy discussions, the resulting SO would be something towards that in the 2nd Electricity and Gas Directives but much less than a 3rd Package ITO. However, Ofwat's November 2011 proposals for 2014-19 focused on a system operator incentive within a wholesale price cap rather than a separate system operator (or system operator price cap). This would imply accounting but not management or business separation between wholesale and retail supply activities (where all network services, including system operation, are included in wholesale services)

Ofwat confirmed in May 2012 that it would explore ways to provide incentives to better manage and optimise networks to facilitate water trading and transfers. This would reflect better understanding of water trading and the implementation of the UK Government's proposals for new entrants into the market. The logic of this approach is to help ensure that networks are optimised and managed in a way that makes efficient water transfers possible, before the establishment of explicit water company SOs (or SO price caps). Without that, the effectiveness of water trading in delivering the best resource management solutions will be diminished.

A functionally separated SO or explicit SO incentive as Ofwat suggested in 2010 (and as discussed in the Cave Review) could have some benefits. In particular, it would increase regulatory transparency and allow more effective cost comparisons by companies and regulator. However, it appears to do little directly to encourage upstream water trade. In addition, most English water companies opposed even Ofwat's proposed SO incentive, not least because it could be seen as 'the thin end of the wedge' in favour of more radical unbundling and pro-competition action.

More radical SO options for water supply companies include:

- (i) legally or ownership separated ISOs to carry out the functions discussed above;

- (ii) single buyer integrated or independent SOs, where a single buyer operates as part of an SO and is the (monopsonist) purchasing agency for the company; and
- (iii) legal or ownership separated ITSOs responsible for implementing as well as planning network investments.

The questions at issue here are, firstly, which will most encourage operational and investment efficiency; and, secondly, which will most foster water trade. The latter issue, not surprisingly, raises concerns about interconnection investment, stranded assets and similar.

There is little evidence from elsewhere about the relative merits of the alternative models in the water supply industry as opposed to other industries. Australia is perhaps the best example of water restructuring with an explicit SO entity. Single buyer model variants have been introduced e.g. in Melbourne, Victoria and Queensland. The approach adopted is to separate bulk supply from retail distribution and supply. Where there is resource competition, the bulk supplier operates the single buyer facility and sells the water on to the retail distribution and supply company/ies. However, note that there is, as yet, no retail competition in any of these areas. It is also noteworthy that many parts of Australia experienced severe drought in the last decade, and that this has led to a major rethink of all aspects of the water sector.¹²¹

In Melbourne, Melbourne Water acts as an ITSO, acquiring water from various sources – including a major recently-constructed desalination plant and by the purchase of water from holders of abstraction rights in the Murray- Darling Basin. It treats the water and sells and delivers it to three retail companies with local monopolies which also undertake local distribution. The more radical model can be found in South East Queensland where Seqwater is responsible for bulk water supplies (a single buyer SO), but Linkwater

¹²¹ See National Water Commission, *Urban Water in Australia: future directions*, 2011. Productivity Commission, *Australia's Urban Water Sector*, 2011.

- a separate company - owns all the major pipelines while the SE Queensland Water Grid Manager (and TO) operates the newly constructed water grid.¹²² Water is delivered to retail utilities, each owned by a group of local governments. This structure is clearly familiar to that found in electricity and gas for single areas where there is significant upstream competition. It should also eliminate problems of vertical discrimination.

Within the EU, there are no examples of explicit SOs or of significant upstream competition. Germany is unusual in having high levels of upstream water trade. However, it is trade without competition. Sales of potable water by inter-regional water companies on medium to long-term contracts appear to account for around 25% of delivered water¹²³. But, these are typically contracts between upstream and downstream companies with significant common ownership so that what we observe is at least as much internal intra—corporate trading as external market-based trade. In this it follows the German ‘stadtwerke’ model which also applied in electricity and gas until mandatorily opened up by the 2nd EU Electricity and Gas Directives. There is also no German economic regulator for water nor any systematic competition oversight. Germany does, however, have some abstraction charges (the ‘Water Cent’) which appear to be a way of funding environmental improvements but they are not scarcity related charges¹²⁴.

The Stadtwerke model generates a set of multi-utilities which retail electricity, gas, water and sometimes local transport within municipalities or wider local authority areas. Pollitt and Steer (2011) suggest that these multi-utility models can achieve efficiency gains via scope economies that help reduce prices¹²⁵. However, Stadtwerke can (and have in the past) also be used in various anti-competitive ways. They could be developed into single buyer SO purchasing models, but that has clearly not happened in the German water industry and nor is it likely to do so, at least in the medium-term.

¹²² See <http://www.watergrid.com.au/u/lib/SEQ-Water-Grid-FS-Grid-story2011.pdf>

¹²³ See Stern, J. (2010). ‘Developing Upstream Competition in the England and Wales water Supply Industry: A New Approach’, CCRP Working Paper No 17.

¹²⁴ See Wackerbauer, J. (2009) ‘The Water Sector in Germany’ for a good overview.

¹²⁵ See Pollitt, M.G. and Steer, S.J. (2011) ‘Economies of Scale and Scope in Network Industries: Lessons for the UK water and sewerage sectors’.

As these examples have only recently been put into operation, there is little evidence as to the net benefits (or costs) of these new arrangements. However, there are questions about whether the volume and intensity of upstream competition is sufficient to justify this relatively complex structure. Nevertheless, the Australian Government Productivity Commission has proposed taking these and more unbundled models as its recommended basis for the future of Australian urban water supply arrangements¹²⁶.

The other example used in this paper is the discussion of water SOs in the UK, primarily in England, about which there has been much debate in recent years.

For England¹²⁷, the current and projected volume of bulk water and short-term water licence trade is crucial as to which of the three models above is best. Trade levels are currently low. Only about 1% of delivered water is imported from other companies and about four-fifths of that is of raw water, much on long-term contracts that have been in place for over 25 years, in some cases for over 100 years. However, in the dryer South East, water imported from other companies accounts for around 8% of delivered water and around two-thirds of that is potable (treated) water¹²⁸. Nevertheless, even in the South East, these are very small import and export trade volumes compared with those in electricity and gas.

The authors of the commissioned papers were cautious since there was so little evidence available on water SOs per se. None expected any major benefits from a functionally separated water SO, not least because the prospects of significant growth in upstream bulk water growth were low for the short-medium-term. That in itself suggests that other measures besides SOs would be needed to promote any significant increase in trade and upstream competition let alone new entry, such as the development of scarcity based raw water pricing and/or further developments towards more explicit SO

¹²⁶ See Australian Government Productivity Commission, August 2011, 'Australia's Urban Water Sector'.

¹²⁷ The current Welsh Government – a devolved entity with powers over a set of identified functions which includes water supply - has made it clear that it opposes any further movement away from a single Welsh vertically integrated, monopoly water supply company.

¹²⁸ See Stern (2010) op cit.

and network separation. It also suggests that improving water trade incentives may be a worthwhile, low cost method of fostering upstream water trade before embarking on mandatory (and more costly) explicit SOs. (Note that there is nothing to prevent existing water companies voluntarily introducing explicit SOs or unbundling their networks.)

Pollitt was the most sympathetic to water ISOs, but took the view that it would be better to start with some voluntary trading arrangements (e.g. between water-rich and water-poor companies) and see how they developed. Harris inclined to a legally separated single buyer SO but preferred some lesser steps first. Bolt and Stern inclined to ITSOs, but not necessarily to individual company ITSOs. In all cases, it was felt that a simple SO arrangement, particularly only a functionally separated SO, would have little impact¹²⁹.

A single buyer SO might do more but there have been serious problems with electricity single buyers. Experience in Central and Eastern Europe, and SE Asia showed that they had strong incentives to over-invest and were very difficult to regulate, particularly if they were only functionally separated. Stern (2010) and (2011) drew on this experience to argue against single buyers and neither the UK government nor Ofwat have argued for them.

Stern (2011 and elsewhere) has argued for at least legally separated ITSOs over ISOs in water largely because of US and EU electricity and gas experience. The key point is that inter-company trade and investment just does not happen sufficiently unless networks are separated. However, single company ITSOs are not necessarily the right answer unless arrangements can be made to boost interconnection investment. As we have described earlier, interconnection is the dominant problem for multi-area gas and

¹²⁹ See Pollitt (2011) op cit, Bolt, C. (2011), 'Introducing the concept of a system operator in the water sector; Lessons from the gas and rail sectors in the UK.', Stern, J. (2010) op cit and Stern, J. (2011), 'System Operators: Lessons from US and EU Energy Industry Experience and Implications for the England and Wales Water Industry', City University, CCRP Working Paper No.18.

electricity, not least because single-area companies have a strong incentive not to build interconnection that threatens utilisation rates of their own upstream and network assets.

Scotland has some limited SO functions associated with the operation of retail competition in the non-household sector. However, as there has, as yet, been no move in Scotland to develop upstream bulk water competition and trade. In consequence, the SO functions on utilisation of water resources within Scottish Water remain at the engineering and cost control level – and similarly for Welsh Water.

For the UK debate, the fostering of upstream bulk water and licence trading has brought in other issues. The Cave Review advocated relaxing the currently very stringent merger controls. This could allow inter-company water network leasing arrangements or mergers and a market-driven approach to regional ITSOs.

A major problem in developing upstream water trade in England (and probably in many other countries) is that the water companies own a very high proportion of the abstraction licences for surface and groundwater sources that are suitable for public water supply. They also, at least in scarcity areas, have a low or negative incentive to give up or sell these licences.

To deal with this issue, Stern (2010) postulated a forced trading model on the lines that had been used in the UK gas industry in the 1990s, while Stern (2011) proposed competition based water release schemes of the type that DG Competition has imposed as competition remedies in cross-border electricity and gas mergers. Energy sector experience strongly suggests that creating company SOs or ITSOs without requiring measures of this type is unlikely to have much effect either on short and medium term efficiency or on bulk water competition and trade.

In other EU countries, there are water companies that operate via concession contracts, some of which involve investment financing from water charges. We are not aware of explicit SOs being developed.

Portugal has issued water concessions for downstream water and waste water collection, which include investment obligations. This has similarities with the some of

the Australian models. However, it does not appear that there is any significant upstream competition to supply water which would require an explicit SO function.

There does seem to be substantial bulk water trade in Germany. That trade is primarily wholesale trade in *treated* water by inter-regional providers who typically sell water to small local distribution companies. Indeed, sales of potable water by inter-regional German water companies on medium to long term contracts appear to account for around 25% of total delivered water. Not only are there some very large wholesale sellers but, in theory, there appears to be competition between sellers (e.g. from sellers on two different river basins to municipalities that are sufficiently close to both)¹³⁰. However, in practice, these bulk water sales are on the basis of long-term contracts between companies with inter-locking ownership arrangements. Hence, there is no real upstream competition – and no need for an explicit SO.

5. 8. Water SOs in a Multi-Area Context

There are very few multi-area water trading arrangements of the kind that exist in electricity or gas. In Australia and California, there is abstraction licence trading which allocates scarce water resources between different types of agricultural use (as in the Murray-Darling Basin trading system) or between rural and urban water users (as in California). However, these do not in themselves require an explicit SO.

The only example of which we know of any substantive discussion of multi-area water SOs in Europe or North America is in England and, to a lesser extent, in Great Britain as a whole.

In England, the issue of multi-area SOs was discussed during the Ofwat SO investigation. Indeed all the commissioned expert papers discussed it to some extent. Most were cautious. Pollitt put the case for an eventual multi-area water ISO e.g. to

¹³⁰ We are grateful to Mark Oelmann of WIK and others for information including the reality of German water (non)-competition in upstream trade.

facilitate the development of wholesale markets and interconnection, on the lines of the Great Britain electricity ISO.

The exception was Stern who argued strongly for multi-area ITSOs. The main reason for that was to foster the growth of interconnection between water companies by a (preferably) ownership separated regional ITSO. The ITSO would at least manage, plan and (preferably) finance interconnection network investments and possibly some (or all) of the other water supply network assets. Ultimately, one might expect to see a small number (e.g. 3-5) consolidated ITSOs across England¹³¹.

The argument for multi-area as opposed to single-area water ITSOs primarily concerns interconnection. Multi-area ITSOs internalise the externalities of interconnection and remove the anti-competition biases. Stern argues that regional ITSOs for water in England and Wales would, if operated as pure transport and trade facilitation companies, not owning the water have the following advantages:

- they would provide effective commercial planning and implementation of investment within a sizeable wholesale market and set of water resources;
- pure transport regional ITSOs effectively separate network from supply incentives which eliminates the use of network as an anti-trade discriminatory device and encourages network (including interconnection) expansion; and
- regional ITSOs provide the obvious way in which interconnection expansion between existing company areas can be planned, implemented and financed.

¹³¹ For Scotland and Wales, the question is whether or not they want a single-area ISO or ITSO and there is no sign of a desire for one in the foreseeable future. Substantial growth in new water trades and interconnection might suggest a GB ISO but not a GB ITSO.

However, Stern also argued that this should be a largely market-driven process rather than a top-down regulator driven process. He also argued that it would be much more effective as a promoter of trade and efficiency if accompanied by (a) improved abstraction licence trading arrangements; and (b) scarcity based abstraction prices – real or shadow abstraction prices¹³².

In this context, with suitable encouragement and incentives, it might be possible to create the first regional water ITSOs from (or around) the regional water planning entities in the water-short areas of the South East and Eastern England.

5. 9. Concluding Comments on Water SOs

SO discussions in water are much more low-key because there is as yet very little upstream water resource trade or competition. In consequence, reconciling market transactions with network use is much less of an issue than in the other three industries we have discussed. But, that is beginning to change. In Australia, the Western US and a few middle income countries with chronic and/or acute water shortages, attention is beginning to turn to the greater use of markets as well as to technical and engineering solutions – and this inevitably involves a consideration of system operator functions and how they should be organised.

In general, the lessons from electricity and gas hold good for water supply. It is unclear whether functionally separated SOs would actually make any substantial difference to efficiency or upstream competition, particularly at the company (single area) level. However, a more separated SO may be helpful at the single company level as one component involved in promoting upstream competition and trade. In this context, a single buyer-type SO might help, at least as a transitional model – provided that it can be sufficiently separated from the rest of the company and that sufficiently strong regulatory

¹³² See Stern and Mirrlees-Black ‘A Framework for Valuing Water in England and Wales from 2015 Onwards’ *CCRP Working Paper*, October 2011 for more discussion of the abstraction and related issues.

and competition scrutiny can be maintained. That has been problematic in other contexts.

The real issue with water SOs and markets is interconnection. Water companies are rarely large enough to sustain sufficient resource competition to justify a company ISO or similar. Multi-company ISOs may be better but face the problem of how to achieve as well as to plan interconnection investment. For that reason, multi-area ITSOs - ITSOs covering a wide enough area to support upstream competition - look to be the most effective way of promoting the necessary interconnection investment. For wider areas, ISOs may be useful but they have the standard weaknesses over implementing investment plans.

It is, however, clear for the water supply industry that SOs, even regional ITSOs, are only part of the reforms needed. For significant amounts of upstream trade and competition to develop, it will require allowing network mergers across borders, introducing scarcity based abstraction prices, increasing short and long duration abstraction licence trading and probably water release programmes or similar.

Short-term and medium term capacity allocation issues are very important for SO choices in electricity, railways and - to a lesser extent - in gas. However, as yet, they are relatively unimportant in water and are likely to remain so. This means that long-term investment implementation issues are much the most important, arguably even more so than in electricity and gas. Given the particular importance of interconnection, that points to the likely superiority of regional ITSOs, e.g. arranged around major rivers.



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