ELSEVIER

Energy Policy 36 (2008) 704–713

ENERGY POLICY

www.elsevier.com/locate/enpol

The arguments for and against ownership unbundling of energy transmission networks

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Received 7 August 2007; accepted 18 October 2007
Available online 3 December 2007

Abstract

The question this paper addresses is: what is the evidence for the superiority of the ownership unbundled transmission models (i.e. UK or Nord Pool hybrid) over other models? We assess the theoretical costs and benefits of ownership unbundling and judge these to be generally positive, though these may be potentially offset by the actual reorganisation costs of the ownership unbundling process. Next, we assess the empirical evidence. This is in two forms—econometric evidence from samples of countries and case studies of reforms in particular jurisdictions. The econometric evidence is weak due to problems with simultaneity of reform steps and a lack of studies, but the case study evidence is compelling. We conclude with a discussion of the issues faced by countries considering implementing ownership unbundling. We conclude that evidence seems to be that ownership unbundling of transmission is a key part of energy market reform in the most successful reform jurisdictions.

Keywords: Electricity and gas reform; Ownership unbundling; Transmission

1. The European policy context

There is a general concern about whether current transmission ownership arrangements are delivering non-discriminatory access to electricity and gas networks and whether they, or indeed alternative arrangements, will deliver efficient and timely investment in capacity. Non-discriminatory access is essential for the extension and deepening of competition. The role of vertically integrated incumbents has been highlighted by the recent EU Energy Sector Inquiry. Following this, in September 2007, the EU Commission adopted a package of energy proposals, which include the separation of transmission of electricity and gas from production and supply.[1] The Commission gives 'ownership unbundling' as its preferred option for achieving this, but also makes provision for a second option—the creation of an independent system operator to operate the transmission assets separately from their vertically integrated owners. An important motivator of these proposals relates to investment adequacy given the apparent need to make substantial investments in transmission networks. Investment requirements in Europe are growing due to the need to replace existing assets as they come to the end of their lives, the need to accommodate increasing amounts of renewables (often in different places to existing capacity) and as electricity markets in recent and new accession countries and imports of non-EU gas grow and require stronger interconnections to the East.

There are a number of transmission ownership models in existence. Each has its supporters. One can identify at least five major models in operation.

1. The independent transmission system operator—TSO, e.g. National Grid in the UK [ITSO]. This is fully unbundled from the rest of the system and owns and operates transmission assets. This has a number of precedents in Europe and around the world in electricity, but is much rarer in gas.
2. The legally unbundled TSO, e.g. RTE in France [LTSO]. This is legally unbundled from the rest of system and owns and operates transmission assets.

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[1] http://ec.europa.eu/energy/electricity/package_2007/index_en.htm

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doi:10.1016/j.enpol.2007.10.011

This meets the requirements of the current EU Directives and can involve effective separation transmission operation from the rest of the sector, while transmission assets remain under the same ownership as generation/production or retail. This is an increasingly common model.

3. The independent system operator—ISO-model, e.g. PJM in the US, Scottish electricity within the UK [ISO]. This is the shallow system operator (SO) model where the system operator does not own the transmission assets but is ownership unbundled from the rest of the system. This does exist in several electricity markets but is less common in gas (e.g. VENCorp in Victoria, Australia, is a rare example of gas ISO with no transmission assets (see Energy International and GasTech, 2003). Such an ISO arrangement can operate at the regional level (though Nord Pool is an example of regional market which does not have a common ISO).
4. There is a hybrid model where both the ISO and the transmission owner (TO) are ownership unbundled from the rest of the system [ISO/ITO]. The ISO is asset-lite, while the TO has no system operation function. This is the case in electricity in Chile and Argentina, where it was observed in the context of rapidly expanding systems.
5. The vertically integrated utility, e.g. traditional utilities in Europe [VI]. This is the model that Europe has sought to move away from in successive directives; however, it is still in de facto operation in many European gas markets and some European electricity markets.

The issue that this paper addresses is simply stated. As the EU considers moves both to regional markets and to further strengthen competitive forces by recommending ownership unbundling of networks from the rest of the electricity and gas systems, what is the evidence for doing this?

The issue is therefore whether model 1 (and therefore, possibly, model 4) is clearly better than models 2, 3 and 5. We focus on transmission networks only and do not seek to address the issue of the unbundling of distribution networks.

As the paper makes clear this question though simple to formulate requires careful examination of the evidence.

2. Issues in looking for evidence on ownership unbundling

The direct evidence on the impact of electricity and gas networks is hard to distinguish from the general evidence on the impact of electricity reform. The coincident timing of several reform steps makes it difficult to find econometric evidence capable of directly testing the effect of ownership unbundling. In particular, ownership unbundling of transmission networks may occur at the same time as privatisation, the restructuring of generation or production markets, the introduction of incentive regulation, etc. Copenhagen Economics (2005a, p. 16) find that for electricity in the EU the degree of opening of the retail market, the presence of third-party access (TPA) in distribution and transmission, the wholesale trading system and the sophistication of congestion management are all correlated with unbundling of transmission.

We should note that the context in which we are thinking about this is in circumstances where we are considering ex post unbundling once competition has already been declared. This is potentially somewhat different from the consideration of unbundling at the time of an initial reform. This is because there are fixed cost elements (not least in political time) to restructuring of assets, the establishment of regulatory structures and the introduction of competition. Therefore, unbundling is likely to be cheaper when other restructurings are taking place and/or when initial ownership structures are cheaper to change (e.g. involve initial state ownership of an integrated company rather than a private one).

Logically, we should also have in mind the question of what unbundling is trying to achieve in addition to other measures that may have taken place. There may be both cheaper ways of achieving the benefits of ownership unbundling (e.g. legal unbundling) or unbundling may have additional advantages in forcing the pace of change (e.g. by creating a private company with an interest in extending competition). Thus, ISOs with continuing integrated TO (model 3 above) might be a cheaper option than the creation of ITSO for already liberalised systems, while ownership unbundling along the ITSO–ISO/ITO models may facilitate the introduction of further competition in generation/production/supply and the imposition of more effective network regulation than would be the case under an ISO alone. It is also important to point out that any recommendation of the form of transmission ownership is likely to assume that other supporting measures are in place at the time of the change of transmission ownership if the full benefits are to be realised (e.g. independent regulation, ending of monopoly franchises in retail supply).

3. A taxonomy of costs and benefits of ownership unbundling

It is useful to list the theoretical costs and benefits of ownership unbundling under the ITSO and ISO/ITO models. A useful amount of thinking has been done about this in the Netherlands, in the context of a debate about unbundling of electricity and gas distribution networks from retail supply (transmission ownership unbundling would similarly separate networks from competitive activities). Following Mulder and Shestalova (2005) and Baarsma et al. (2007) who provide a useful checklist of the costs and benefits, Table 1 has been inspired. It is important to stress that this table contains theoretical statements on how ownership unbundling *might* give rise to benefits and costs. It does *not* imply that there is necessarily any evidence for every theoretical possibility.

Table 1
Theoretical benefits and costs of ownership unbundling

Type of benefit/ cost	Benefit	Cost
Effect on competition	Reduces scope for discrimination against non-integrated rivals	May facilitate further generation mergers as sales of vertically unbundled transmission assets provide financial resources for horizontal integration
Ease and effectiveness of regulation	Improves cost (and other types of) transparency in network and competitive businesses	May increase requirement for regulatory oversight of transactions between unbundled stages of production
Facilitation of privatisation	May make privatisation of competitive and network businesses easier due to sustainability (and hence reduced regulatory risk) of unbundled market structure	May delay privatisation of network businesses because these can be retained in public ownership while generation and retail assets are privatised
Security of supply	May improve transmission company focus on security of supply and incentivises improved information systems	May create information problems between generators (electricity) / shippers (gas) and transmitters in the absence of investment in better information systems
Transaction costs of unbundling	May reduce transaction costs by facilitating creation of more efficient price signals	May increase costs if new computer systems needed to coordinate transmission and other separated segments. There may be also significant power contract renegotiation costs, which if with foreign parties may involve substantial wealth transfers and lower national social welfare
Cost of capital/ investment	Overall cost of capital may decline if transmission business can get access to cheaper capital and if there is increased ease of integration of generation and retail. In an efficient capital market separation will lead to efficient cost of capital for each business	May increase cost of capital and reduce investment if size of firms falls, or if regulatory risk is increased due to increased (and inefficient) regulatory oversight of investment decisions
Synergy/focus effects	Management of both parts of company may be subject to clearer incentives to improve business	Loss of synergy (vertical economies) benefits due to smaller size or loss of experience of operation of other segments
Double marginalisation	Not a problem when multipart tariffs are in use	May be an issue if available two part tariffs are not fully efficient
Foreign takeovers more likely	Sale of assets may make efficient foreign (and domestic) takeover more likely. Undesirable takeovers of strategic assets may be covered by competition policy	Sale of assets may lead to 'strategic' assets passing to foreigners if competition policy allows this
Reduced risk of arbitrary government intervention	Unbundling likely to reduce government willingness (and need) to undertake further major reform for a period	Unbundling may increase government interference in the operation of the network companies if these are kept in state ownership

Some of the realised effects of unbundling may be perceived to be negative but actually be positive economically, e.g. it is not clear why foreign ownership is ever a problem for European energy firms. The taxonomy indicates that for each factor the result might conceivably be positive or negative, in most cases. However, in most of the individual lines one can come to a judgement about whether the effect is likely to be positive or negative (we do this in Section 4).

The assessment of whether the net benefits are likely to be positive comes in two parts. First there is the ex ante assessment of the theoretical effects based on the above taxonomy and then there is the assessment one can make on the basis of the evidence.

4. Assessment of the theoretical arguments on the effects of unbundling

Table 2 offers an assessment of the balance of the argument under each type of effect identified in Table 1. Looking at Table 1 it seems to be likely that ownership unbundling will improve competition, ease of regulation, facilitation of privatisation, synergy, make foreign takeovers more likely and reduce the risk of arbitrary government intervention. In each of these cases the counter-argument seems weak. This seems all the more plausible (in theory) given the fact that these effects seem to be mutually reinforcing with governments committed to competition (and privatisation) and independent regulation more likely to enact ownership unbundling. For example, on competition, Joskow and Tirole (2000) analyse the relationship between transmission rights ownership and market power and show that the ownership of physical transmission rights (such would be the case under vertical integration) increases the ability of generators to exercise

Table 2
Assessment of balance of theoretical arguments on ownership unbundling

	Assessment
Effect on competition	+
Ease and effectiveness of regulation	+
Facilitation of privatisation	+
Security of supply	+
Transaction costs of unbundling	–
Cost of capital/investment	?
Synergy/focus effects	+
Double marginalisation	Not an issue
Foreign takeovers more likely	YES, but probably beneficial
Reduced risk of arbitrary government intervention	YES

market power through withholding transmission capacity. On cost of capital/investment, the arguments may be more debateable but there seems little technical reason why the managerial focus (on just operating the transmission system) that ownership unbundling brings will not lead to improvements. Thus, looking at the theory one might expect the impact of ownership unbundling to be positive on all but two of the dimensions above.

Experience suggests that there will be upfront costs, of reorganisation and physical separation of businesses (Newbery and Pollitt (1997) and Domah and Pollitt (2001) observe these for the UK electricity reforms). Though as all businesses incur these periodically, it is clear that some reorganisation costs would have been occurred in the absence of specific unbundling costs. There could also be significant contract renegotiation costs (PWC, 2006) observes significant contract renegotiation costs when distribution and supply were ownership unbundled in New Zealand). Mulder and Shestalova (2005) found that the contract renegotiation costs in the Netherlands (e.g. associated with contracts for interconnection capacity) for electricity distribution ownership unbundling were potentially significant. Clearly these transaction costs will vary from country to country and will differ in electricity transmission from electricity distribution (and indeed between electricity and gas). In addition, the true 'economic cost' to the country concerned will depend on the counter-party in the contract renegotiation. Thus, a contract between two domestic state-owned electricity companies that has to be renegotiated will result in a wealth transfer, the net social welfare effect (if the resource costs (e.g. lawyers fees) of the actual negotiation are excluded) of which is zero.

However, there is also significant evidence that unbundling (at least in general) should raise transaction costs, even the absence of contract renegotiation costs. The old literature on vertical economies in the electricity industry clearly finds that there are scope economies in the joint operation of electricity generation and transmission (e.g. Nemoto and Goto, 2004). Indeed Michaels (2006) reviews 12 papers on vertical integration in electric power and finds that 11 show benefits to vertical integration. Of these 11, eight test the separability of generation from either transmission alone, or a combination of distribution and transmission, while the remaining three examine vertical economies between generation and distribution. It also seems to be the case that analysis of US data also seems to show that vertically integrated utilities have lower costs than non-integrated utilities Kwoka and Pollitt (2007) find this for distribution wires business costs.

Mulder and Shestalova (2005) also pointed out that the effect of vertical separation of distribution from supply on the cost of capital of the separated assets is uncertain in its effects. Their reasoning may apply to the separation of transmission from electricity generation or gas production and retail supply. If the separated firms are now smaller then the cost of capital may rise; however, if they are now more focussed and can merge with similar firms or indeed integrate with negatively correlated risks more easily then the cost of capital may fall. However, it is difficult to believe that in an efficient capital market, the overall effect is likely to be significant. More to the point, separate market interest rates for the different businesses is important for financial efficiency, even if it does raise the cost of capital for new generation investments (and hence reduce the volume of investment in generation).

Foreign takeovers of domestic competitive segment firms are made more likely, but in the UK this has not come at the cost of higher costs of operation or reduced competition. Radical restructuring, as represented by ownership unbundling, is also a response to significant government pressure and does seem to be associated with a reduced willingness to further interfere in the structure of the industry (which indicates that governments perceive it to be effective in reducing the need for regulatory intervention). The EU Energy Sector Inquiry and the European Commission September 2007 proposals are good examples of continuing pressure on countries where unbundling is deemed not to have gone far enough.

Clearly a careful social cost–benefit analysis would be needed in each country case to calculate a sensible estimate of the size of the costs relative to the benefits. For small countries where the scope for competition may be limited and managerial expertise is scarce, the benefits of unbundling are likely to be small in relation to the costs (where these include larger regulatory agencies and more companies). Besant-Jones (2006), in a developing country context, defines small power systems as being less than 1000 MW. However, he notes that Guatemala has a competitive wholesale power market with a capacity of 1875 MW. This suggests that smallness is not an issue for continental Europe, the UK or Ireland.

It is also interesting to speculate on whether there is likely to be any difference in the strength of the arguments for ownership unbundling in gas and electricity, especially given the lack of ownership unbundling seen in gas relative to electricity. Looking at the list of factors it is difficult to

say that the arguments for gas unbundling would be expected to be weaker than electricity. The positive effect on competition might even be greater than in electricity (given the more concentrated starting point) and the transaction costs of separation might be less given the less complicated nature of vertical economies between stages of production in gas relative to electricity.

A recent theoretical model by Cremer et al. (2006) suggests that legal unbundling might have some advantages over the ownership unbundling model, in the area of optimal incentives for investment precisely because of the ability of other parts of the firm to capture the benefits of transmission investment. This would provide some support for the LTSO model. However, the assumptions of this model are extreme and do not take account of the anti-competitive information advantages of legal unbundling for the rest of the integrated firm. The major problem with this model is that it cannot explain the alledged tendency for integrated generation and transmission companies to under-invest in transmission under some ISO models. Congestion costs have been very high in PJM and were 7.7% of total PJM billing (including generation costs and transmission service) in 2006 (PJM, 2007, p. 9). As Cremer et al. (2006) suggest their model needs to be extended to take more of the details of actual markets into account.

A further theoretical paper by Bolle and Breitmoser (2006) also suggests that legal unbundling is superior to ownership unbundling for utilities in general. The authors focus on allocative efficiency only. They suggest that the advantage of ownership unbundling is that the regulator reduces prices closer to costs, but the disadvantage is the introduction of double marginalisation (an inefficient transfer price) between the formerly integrated incumbent's separated businesses. The paper then suggests that it is very unlikely that the advantages of better regulation can outweigh the double marginalisation effect. However, this paper is seriously unrealistic. First, double marginalisation assumes a one-part price. This is not the case in network service pricing, where multipart pricing is practised and marginal prices often equal marginal cost. Second, the paper assumes that regulators only reduce prices and fail to induce actual productive efficiency savings as a result of tighter price regulation. Third, the paper ignores the impact of unbundling on competition, which be can expected to increase when businesses are ownership unbundled (as in Joskow and Tirole, 2000), further reducing costs and prices. Incorporating more realistic and complete modelling to address these issues would reverse their conclusions.

5. Empirical evidence on the effects of unbundling

The evidence for the impact of unbundling can be looked for in two places: firstly in econometric studies and secondly in case studies of actual experience.

5.1. Econometric evidence—electricity and gas

There are few econometric studies, which look at unbundling specifically, for the reasons of the simultaneous timing of different reform elements. Some of the electricity studies are reviewed in the context of an assessment of general lessons in Jamasb et al. (2004).

Ernst and Young (2006) published a report for the DTI that looked at a case for the liberalisation of electricity and gas markets. There are a number of regressions in this report. One of them regresses industrial gas prices in a sample of countries against a number of variables including the existence of a separate transmission operator. This is highly significant and is correlated with significantly lower prices (p. 140). Gas prices seem to be around 15% lower as a result of legal (or ownership) unbundling. The unbundling variable picks up the change in unbundling in the Netherlands up to 2004 (pp. 34–36). Of course the direction of causality is uncertain and it may be that countries choose unbundling when they have access to cheaper gas anyway.

A similar but more sophisticated study by Copenhagen Economics (2005b) also examines electricity and gas price trends in the EU using data for 1990–2003. They find that for electricity, higher levels of unbundling (with ownership unbundling being the highest form) lead to lower electricity prices (p. 102). They do not find this result for gas, where private ownership seems to be negatively correlated with price but not unbundling (p. 239). It may be that the privatisation effect is masking the effect of unbundling.

Alesina et al. (2005) examine the effect of deregulation in a number of sectors, using OECD measures of product market reform. One of the sectors they look at is utilities—gas and electricity. One of the OECD's measures of product market reform is a measure of vertical integration, with the score running from 6—integrated monopoly—to 0—ownership unbundled networks and competitive segments. They find that investment in the sectors examined increases as the vertical integration score decreases.

Steiner (2001) uses panel data for 19 OECD countries covering 1986–1996. She tests whether regulation and restructuring has improved the capacity utilisation and the reserve margin in generation and effected prices. She finds that the separation of generation and transmission is not associated with lower prices but is associated with higher capacity utilisation rates. However, this study assumes that unbundling includes accounting separation as well as stricter models of unbundling.

Hattori and Tsutsui (2004) examines similar OECD data on the impact of unbundling of transmission from generation, TPA, the existence of a wholesale market and the impact of privatisation. They use analysis similar to Steiner but over a longer period 1987–1999. They find that the unbundling variable seems to raise prices. However, they use legal (or ownership) unbundling as the measure of unbundling not accounting and legal unbundling or indeed

ownership unbundling. The US ISO system is also counted as unbundled and is not distinguished from ownership unbundling.

The results of these last two studies are confusing. They do however find that privatisation and TPA in transmission reduce final prices. Thus, if unbundling makes these easier to implement effectively there may be no measured effect from the unbundling itself. Reform measures as a whole have a negative effect on prices in both papers.

Undertaking studies on the impact of unbundling on energy prices is complicated by the role played by fuel commodity prices (which may be rising through the reform period). A desirable effect of unbundling and the associated competitive effect is not just that prices are lower than would otherwise be the case (which may be difficult to model given differences in underlying resource cost) but that they are more responsive to changes in short-run costs. More rapid price adjustment to cost changes might be taken to indicate a more competitive market even in markets where resource costs are higher. A recent econometric comparison of the responsiveness of electricity prices to cost changes in UK and Germany found that UK prices were better explained by short-run cost factors than those in Germany, and further that the responsiveness of German electricity prices to costs was declining over the period 2002–2005 (Zachmann, 2006). Clearly a lack of ownership unbundling is not the only factor here, but it is suggestive of worsening competitive problems in the, de facto, vertically integrated German market.

The lack of definitive econometric evidence on reform effects (especially for gas, where an updated version of the Hattori and Tsutsui (2004) work on electricity seems desirable) clearly illustrates the need for further work on this now that we have more experience of reform. However, the problems of co-incidence with other reform steps and difficulties in modelling underlying resource costs will continue to be an issue.

Finally, we note one paper that looks at the determinants of the state of unbundling in EU countries. Van Koten and Ortmann (2007) find a positive correlation between the lower level of corruption in an EU-15 country (measured by Transparency International's Corruption Perceptions Index) and the strength of unbundling legislation (with ownership unbundling being the strongest form). They suggest that this is evidence that there are economic rents available to incumbent integrated utilities who will seek to defend them by with lobbying payments. Interestingly, this effect only exists for the EU-15 and not for the new member states. The authors urge robust action in the face of lobbying by utilities.

5.2. Case study evidence—electricity

Turning to case studies of actual experience we need to draw up a list of leading reform countries. This requires some implicit criteria, even if most experts could quickly name the leading jurisdictions. Thus, considering the extent of competition in generation and retail and the sophistication and effectiveness of regulation, we might suggest that a list of the leading electricity reform countries/regions includes New Zealand, Victoria and South Australia, Chile, Argentina, Nordic countries, England and Wales, New York, Texas and PJM. We can then ask the question as to what has been the extent of unbundling in each case and what are the lessons. Of course we can argue whether other countries should be added to this list. For a good overview of each of these countries/regions see Sioshansi and Pfaffenberger (2006). We briefly discuss each jurisdiction in turn, noting the unbundling status of its transmission system in [ ].

New Zealand—[*ITSO*]: Successful disintegration of ECNZ and introduction of competition. ECNZ is ownership unbundled though it and a significant part of the generation assets remain in public ownership.

Australia—[*ITSO*]: Victoria and South Australia have implemented ownership unbundling. They have both had a successful introduction of competition. In New South Wales, where there is unbundling but continuing government ownership of transmission and generation, residential switching rates are much lower.

Chile—[*ISO initially, now ISO/ITO*]: A successful reform with an ISO, but the failure to separate the transmission business of Endesa (the largest generator) from generation was a running sore in the reform until Endesa sold the transmission business. Now there is an ISO and an independent transmission company (Transelec), see Pollitt (2004).

Argentina—[*ISO/ITO*]: A successful and radical reform of transmission. Transener (the TO) was made an independent TO, an ISO was created (CAMMESA) and competitive bidding/user participation was successfully introduced for transmission expansions (see Littlechild and Skerk, 2004).

Nordic countries—[*ITSOs with regional coordination*]: Creation of Nord Pool and independent TSOs (in Norway, Sweden, Finland and Denmark). Highly successful model with competition but a lot of continuing public ownership of the assets.

England and Wales—[*ITSO*]: Independent TSO created, highly successful reform with competition in generation and fall of 30% in real transmission charges (1993–2005), promoted by incentive regulation. The creation of an ITSO followed an earlier unsuccessful attempt to stimulate competition in wholesale generation while leaving incumbent generation integrated with transmission.

New York—[*ISO*]: ISO created. Wholesale market reform has been very successful. Tierney and Kahn (2007) estimate that the net annual benefits of the ISO relative to the previous power pool arrangements are a significant 5% of system-wide production and fixed operation and maintenance costs.

Texas—[*ISO*]: ISO created. Highly successful reform with some voluntary ownership unbundling of transmission and distribution from generation and retail. Competition now proceeding along UK[2] type lines.

PJM—[*ISO*]: ISO created and introduction of nodal pricing. TOs continue to be integrated into local companies; however, a large market does exist, albeit with some local market power problems and concerns about the lack of incentive for new investment in transmission. Kwoka (2006) reports on five studies of effects of the extension of wholesale power markets (with ISOs). Two of these studies (Synapse Economics, 2004; Energy Security Analysts, 2005) find very significant benefits for consumers in PJM from the extension of the wholesale market relative to a counterfactual of no restructuring.

A number of lessons can be drawn from the above jurisdictions.

1. All of them were characterised by an independent system operator, independent of generation.
2. Where transmission has not been fully separated from generation as an ITSO or ISO/ITO there have generally been problems associated with this (e.g. Chile and PJM).
3. Some evidence that the more radical features of reform e.g. open access to build new lines in Chile (Pollitt, 2004) and the system of tendering with consumer involvement in Argentina (Littlechild and Skerk, 2004), yielded additional benefits beyond those experienced even in the UK. However, these were greatly facilitated by ownership unbundling of transmission (which was slow to emerge in Chile, but in place from the beginning of reforms in Argentina).

In each of the above cases, separation of transmission and generation primarily benefited the degree of competition in generation. However, there were additional benefits in keeping the costs of transmission itself down. There was also little evidence that transmission investment was adversely effected by unbundling. Indeed Chile reveals the reverse: that the integration of generation and transmission within Endesa delayed transmission expansions that would have benefited rivals. Where alleged problems have existed (as in the US) these have been due to the unwillingness of regulators to allow new investments to be included in regulated rates.

We could strengthen these conclusions by adding a list of countries where reform has failed to proceed as fast or as far as seemed possible—e.g. Germany, France, California. In no case of a failed (or disappointing) reform was there an ITSO in place, though the lack of an ITSO was clearly not the only reason for problems in these markets (e.g. 'the perfect storm' in California discussed in Sweeney, 2006). We observe that if we were to rank EU-25 + Norway countries by a percentage of very small and household customers who had switched since market opening, the first six countries all had what could be described as an ITSO (i.e. UK, Norway, Finland, Sweden, Spain and Netherlands).[3] It is also important to point out that there are examples of countries who had zero residential customer switching while having an ITSO (e.g. Italy in 2005).[4] This hardly constitutes evidence against the superiority of ITSO arrangements, but illustrates that transmission ownership changes must be accompanied by other pro-competitive policies (such as the ending of residential franchise monopoly) to have an impact.

5.3. Case study evidence—gas

The evidence from the gas sector is harder to come by because so few countries have implemented an ITSO or ISO/ITO model. Within Europe only the UK has any serious experience with ownership unbundling (see Arentsen, 2004). By the end of 2005, in addition to the UK, only Denmark (from 2004), Spain (from 2003), Sweden (from 2004 for one of two companies) and Netherlands (from 2005) had ownership unbundled gas transmission along the ITSO model (see Gomez-Acebo et al., 2005). The UK has been a successful model with rates of residential and very small business customer switching well above any other market[5] and a competitive, non-discriminatory regime for shippers.

In the US, there are many examples of ITSOs and the general consensus is that this model has been successful in facilitating a move to competitive gas markets and this has been a major improvement on the previous system of vertically integrated utilities (Jamasb et al., 2006). In a number of US states—e.g. Illinois—there has been the successful introduction of residential gas competition (Hasegawa et al., 2007).

While there are few examples of ownership unbundling in practice there are many examples of problems with VI or the emerging LTSO model in gas. The EU Energy Sector Inquiry highlights many of these and comments that 'vertical integration of network and supply interest [in gas] leads to conflicts of interest resulting, inter alia, in distorted investment incentives' (European Commission, 2007, p. 66).

[2]We use UK as a shorthand. Most UK electricity and gas market data (e.g. on customer switching) only relate to Great Britain as Ofgem regulates markets in England, Scotland and Wales. England and Wales has an ITSO, in Scotland there is an ISO (since 2005); however, the ISO is Great Britain wide.

[3]See 2005 data in European Commission (2005, p. 38). Finland has a separate TSO partly owned by two generating companies (owned by the state); however, it has the highest score in terms of unbundling compliance according to the EU Commission's criteria (European Commission, 2005, p. 79).

[4]See footnote 3.

[5]In 2005, 47% of all UK customers in this category had switched since market opening, against 5% in the Netherlands (the next highest, also ownership unbundled in 2005) (see European Commission, 2005, p. 39).

6. Issues raised by ownership unbundling

6.1. Is an ISO without ITSO or ITO sufficient?

Can best practice independent regulation (in the sense of Green et al., 2006) with an ISO achieve most of the advantages of ownership unbundling? Although an ISO is not the preferred ownership form in the EU Commission's September 2007 proposals it is their alternative option. It is also the option—organised at the regional level—favoured by the European electricity industry trade association, Eurelectric.[6] Joskow (2007) suggests that electricity ISOs are politically more acceptable in jurisdictions where agreeing to form a theoretically ideal ITSO would be politically very challenging. Electricity ISOs seem to deliver in the US—at least for pro-competitive short-term system management. However, the US has large regional electricity markets with many players and in such circumstances ISOs can be significant and powerful players who ensure fair play in the wholesale market. The PJM market is the largest interconnected system in advanced countries. A question mark remains over the ability of ISOs to manage long-term congestion costs. PJM's congestion costs are significantly greater than the total cost of transmission service (PJM, 2007, p. 9) and it has rather belatedly announced a programme of major new transmission investments to reduce its congestion costs. Thus, managing the ISO/TO interface in the absence of an ITSO is a significant challenge.

Governance of ISOs is also an issue. FERC—the federal energy regulator—recommended that the stakeholder board of the California electricity ISO be replaced by an independent non-stakeholder board in the wake of the California electricity crisis in order to improve the decision making and external accountability of the ISO (Sweeney, 2002). PJM has also had issues with internal governance when its internal (and independent) market-monitoring unit was threatened with outsourcing (Bowring, 2007). This raises the issue of whether an ISO, which is not independent (of its stakeholding generators) and which is a non-profit entity that relies on stakeholder support, can function as effectively as an ITSO.

In European countries, ISOs facing well-capitalised and large electricity and gas transmission asset owners may even exacerbate the problem of ensuring adequate transmission investment. Problems seem to be acute when transmission expansions are required and contested by incumbent generators (e.g. in the case of Chilean electricity). ISOs therefore seem to address the issue of non-discriminatory access but not solve the issue of investment adequacy (they may even create it). Clearly the unwillingness of integrated generation and transmission asset-owning firms to propose socially beneficial investments, which reduce prices by facilitating competition, is both a theoretical and a practical problem (in the view of the EU Sector Inquiry). Making transmission asset ownership separate from generation ownership improves incentives for market expansion and deepening. However, it creates the new problem of potentially excessive expansions in transmission assets if regulation is weak, though there is no evidence of this being a problem in Europe (not least because of planning restrictions on new transmission lines).

6.2. Is the LTSO a viable alternative to ownership unbundling?

The LTSO model in French electricity has little track record. The advantages of an LTSO are that it can potentially acheive the investment adequacy benefits of an ITSO without the potential costs of separation or the possible undercapitalisation of small ITOs or ITSOs. However, the residual problem of vertical integration remains, which may be difficult to police in less-developed EU countries. It is also not clear what the benefits of common ownership really are if there is effective legal separation. ITSOs can be large companies (through international expansion) and have different risk profiles to gas shippers/retailers and electricity generators/retailers. ITSOs are also free to merge electricity and gas networks, which may be very cost efficient. It is also undoubtedly the case that the success of the LTSO model relies on very strong regulatory oversight. An example of the sort of tough regulation, which vertical integration between network and competitive stages of production requires, comes from the regulation of electricity distribution and retail in the UK, where in 2000 Ofgem took decisive action to reallocate a significant share of costs from distribution to retail within legally unbundled distribution and supply businesses (see Ofgem, 1999). This was in order to facilitate retail competition with non-incumbents by more accurately reflecting the true costs of retail supply within the supply costs of integrated businesses.

6.3. Regulatory burden of unbundling

Ownership separation under the ITSO (or ISO/ITO) model may require stronger regulation than under vertical integration or under an LTSO with significant government ownership of electricity assets. This is because there are now more information asymmetries than before in the industry (between the firms) and more market-based transactions between firms. This has the potential to create perverse incentives to invest or operate the transmission system in effectively, in the absence of skilful regulation. Clearly fully vertically integrated firms do not *require* much formal separate economic regulation. However, they may require significant amounts of anti-trust monitoring and enforcement action if privately owned.

[6]See 'EURELECTRIC Offers EU Leaders and Policy-makers Pointers to a Balanced Energy Policy', *Watt's New*? Issue 31, April 2007.

6.4. Possible unintended consequences of ownership unbundling

Any structural reform of an industry can bring about unintended consequences and hence should be approached with caution. The evidence that structural remedies in general bring about social welfare improvements is mixed. Crandall and Whinston (2003) struggle to find consumer benefits arising from structural remedies in the most celebrated anti-trust cases in the US (including Standard Oil, Alcoa and AT&T). However, our present case may be an example where the gains are more certain.

The main problem of forced separation is unintended consequences. The UK beer industry provides a good example. Forcing breweries to limit the number of pubs they held led to increased ownership concentration in both brewing and pub ownership as firms specialised by selling assets to one another. This had the effect of raising prices because of reduced competition and increased costs (Slade, 1998). Clearly care must be taken to ensure that any sell-off of transmission assets by large integrated companies (following ownership unbundling) does not simply allow them to finance additional anti-competitive mergers in generation and retail. Any major policy-induced change to market structure may require significant vigilance on the part of anti-trust authorities as market forces (via mergers) seek to reconfigure the industry in the light of legal restrictions on ownership. However, it is worth noting that electricity and gas reforms, which do not include ownership unbundling, are also subject to the possibility of (negative) unintended consequences.

6.5. Consistency with future technological developments

Finally, one needs to be aware that restructuring should be robust to the likely future evolution of the electricity and gas industries. This is particularly the case for electricity where the scope for innovation with respect to the sources of supply seems greatest. With increased cross-border flows, increased demand for renewables on the electricity system and increased future expansion requirements, transmission increasingly competes with generation and electricity network expansions may be more important than in the past. This suggests that creating ownership unbundled transmission companies may be a good thing for encouraging competition between generation and transmission in electricity. It may also facilitate the introduction of competitive tendering for new lines and a move towards user negotiations over future investments (as in Argentina). Competition between generation and transmission may have the added benefit of improved information flow as, in contrast to the situation under vertical integration, one party (generation or transmission) will have an incentive to reveal accurate information that will benefit it, even if it is at the expense of the other.

7. Conclusion

Ownership unbundling of electricity and gas transmission networks is a key feature of jurisdictions with the most successful energy market reforms. It therefore appears to be closely associated with competitive wholesale and retail markets and effective regulation of monopoly networks. While the evidence is circumstantial and case study based, it seems to be consistent. One might go so far as to suggest that the reason why it continues to be strongly resisted by incumbent companies in so many European countries is precisely because it is likely to be successful in facilitating more competition in these markets.

Acknowledgements

This paper was prepared for Ofgem, whose support and encouragement is acknowledged. The author wishes to thank David Halldearn, Gert Brunekreeft, Christian von Hirschhausen, Paul Joskow, Stephen Littlechild, David Newbery and Catherine Waddams for helpful conversations and suggestions on unbundling. Three anonymous referees also made very useful comments earlier drafts. All errors and omissions are the responsibility of the author.

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