PWP-032

The Electricity Industry In Spain

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August 1995

This paper is part of the working papers series of the Program on Workable Energy Regulation (POWER). POWER is a program of the University of California Energy Institute, a multicampus research unit of the University of California, located on the Berkeley campus.

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ABSTRACT

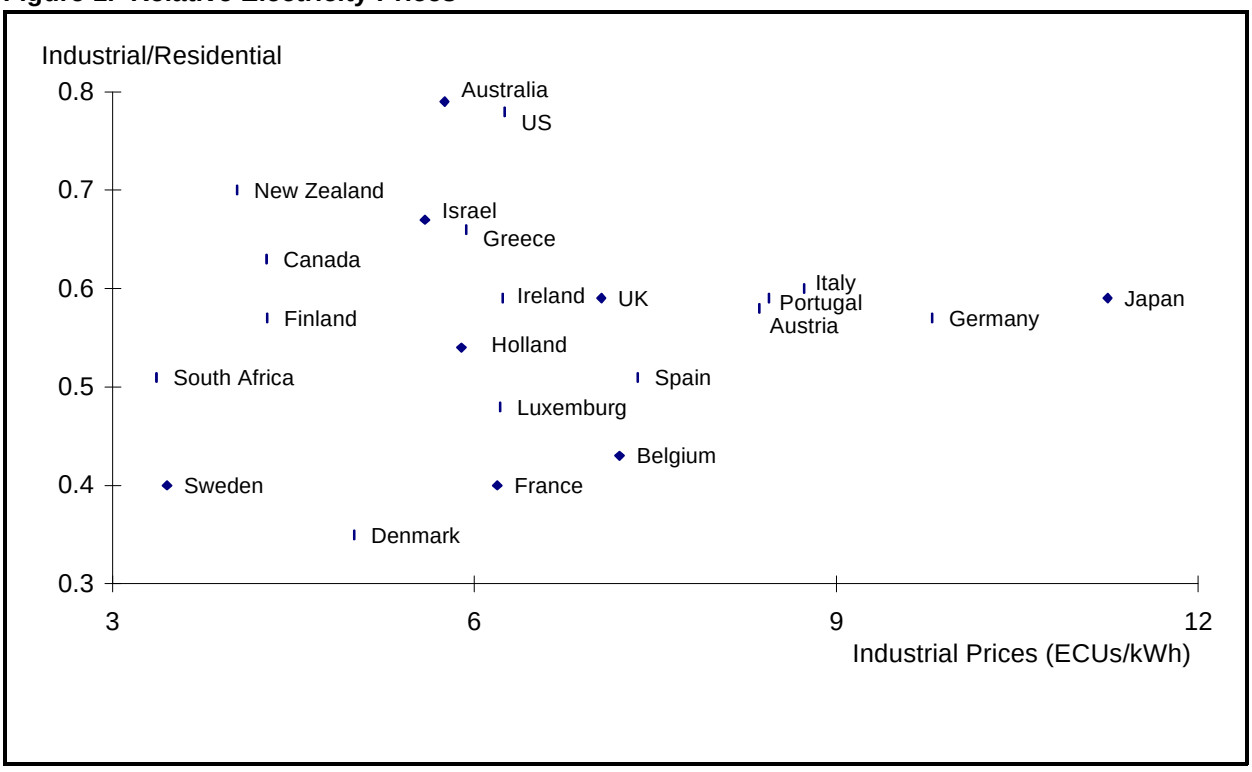
This paper describes the current structure of the electricity industry in Spain and recent changes to its legal and regulatory framework. Electricity pricing policy in Spain is compared with other industrialized countries. The size distribution of firms and the basic regulatory system, the Marco Legal Estable, are described. National policies concerning fuel markets place significant constraints on the flexibility of the industry. These policies include support of the domestic coal industry, the moratorium on nuclear power, and the impending import of natural gas from Algeria. The 1994 electricity reform legislation mandated the creation of an independent regulatory commission, requires competitive bidding for new generating plant and establishes a framework for customers and suppliers who wish to bypass the national system. The extent to which the new law will succeed in introducing more competition in the industry is still in doubt.

1.0 Relative Electricity Prices in Industrial Countries

Like many European countries, Spain is not generously endowed with energy resources. Therefore, its electricity prices are somewhat above the average for European and other developed countries, where the resource endowment is more generous. It is useful to situate Spain relative to pricing policy in the European Union (EU) and the industrialized countries. Figure 1 gives such a characterization, based on data collected by Electricity Association Services (1994).

The horizontal axis in this figure is industrial electricity prices denominated in currency terms. Currency exchange rates do not capture the relative purchasing power in different countries. Nonetheless, it is useful to compare industrial electricity prices in currency terms because industrial firms compete in the product markets internationally in exchange rate terms. It is interesting to note that two of the strongest industrial economies, Japan and Germany, have the highest industrial electricity rates in this sample.

Figure 1. Relative Electricity Prices



The vertical axis in Figure 1 is the ratio of the industrial price to the residential price. It shows the distributive rate-making policy in each country. Low values of this ratio show that rate making discretion is being used to show preference for industrial demand. France, Sweden and Denmark have the lowest of these ratios in this sample (0.35-0.40); the U.S. and Australia have the highest (0.78-0.79). Spain is at the lower end. The Spanish pricing policy is consistent with the efforts of the Spanish government to integrate its industrial economy with the European Union. Spain has a large automobile manufacturing base that exports 70% of it production. This helps to finance large energy related imports (Endesa, 1995a).

2.0 Structure and Regulation of the Electricity Supply Industry (ESI) in Spain

2.1 The organization of the ESI

The vertical structure of the ESI in Spain is complex, and somewhat unusual. The high voltage network is owned by Red Electrica de Espana (REE), a state-owned company formed in 1985 from the high voltage transmission assets of all firms in the industry. REE also directs the central dispatch of the system. Thus, Spain was one of the first countries to adopt an independent system operator for its ESI. The generation and distribution sectors, however, remain linked by ownership, even though all energy flows through the system managed by REE. Table 1 shows the size distribution of firms.

Table 1. Size Distribution of Firms[1]

Company	Generation Share	Distribution Share
ENDESA Group	50%	41%
Iberdrola	27%	40%
Union Fenosa	13%	15%
Hidro Cantabrico	5%	4%
Self Generation	5%	

Endesa reached its dominant position relatively recently by acquisition of Sevillana in 1991, and other subsequent asset consolidations (Endesa, 1995a). Although Endesa is primarily under government ownership, about 32% of its shares are controlled by others. Its stock is traded on both the New York and Madrid exchanges (Endesa, 1993). Iberdrola is completely under private ownership. Its historic base in northeastern Spain (near Bilbao) endowed it with the majority of the country's hydroelectric resources (Iberdrola, 1993).

Self generation is also a relatively recent phenomenon, facilitated by generous pricing provisions for excess power sold to the grid. There are legal limits to the size of self generation facilities which qualify for these pricing terms.

2.2 The Regulatory Regime

Regulation in Spain has been organized primarily around the Marco Legal Estable (MLE), which was set up in 1987. The MLE functions like price cap regulation, but has a highly disaggregated and explicit cost basis (Endesa, 1993; 1994a). The MLE establishes "standard costs" for all factors of production. These are used to produce tariffs that generate revenues collected by distribution companies. The MLE mechanism then distributes the revenue to both generators and distributors according to their standard costs.

The standard cost regulatory structure gives incentives for efficiency. Since the firms know what their revenues will be under the MLE, they know that cost reduction will increase profits. There are also incentives to improve the availability performance of generating units, extend the operating lives of assets, and reduce distribution losses, since all of these factors are incorporated in the standardization process. Certain of the standard costs are adjusted annually in response to changes in price indices and interest rates. Where the Ministry of Industry and Energy, which has overseen the MLE, requires extraordinary investments, those costs are incorporated into the process. Environmental costs will be recovered in this way.

[1]Based on Endesa (1994b).

Some data on the aggregate performance of the incentive system is presented in Endesa (1994b), which indicates that the MLE has succeeded over time in improving efficiency. For example, real electricity prices have declined at an average rate of 1.1%/year between 1988 and 1994. Average availability of the coal plants has improved, and the use of power for auxiliary services at thermal plants has declined. The financial performance of the firms, as measured by profitability, self-financing and external debt levels, has improved.

3.0 Fuels Policy Issues

Fuels policy has been a major driver of the electricity industry around the world (Gilbert, Kahn and Newbery, 1996). Countries have often imposed the requirement that the national electricity industry, however organized, achieve as much self-sufficiency as possible in electricity fuels, even if the economic cost is high. More recently, environmental regulation has begun to affect fuel choice. Newbery (1994) is a good account of this in the UK. Spain has not been immune to these influences. As in every country, however, the broader factors are worked out in the context of local constraints. The two largest factors in the recent past have involved the local coal industry in Spain, and the peculiar situation of nuclear power. In the future, natural gas will increase its role in Spain with the completion of a pipeline from Algeria.

Table 2 shows the large role played by solid fuels in the Spanish electricity industry. The energy shares are based on average hydro conditions (Endesa, 1994b).

Table 2. Capacity and Energy Mix

Fuel Type	Installed Capacity		Energy Production	
	GW	Share	TWh	Share
Oil/Gas	9.45	21%	9.48	6%
Hydro	16.65	37%	33.18	21%
Coal	11.25	25%	60.04	38%
Nuclear	7.65	17%	55.3	35%

3.1 The Coal Industry

Broadly speaking, most coal produced in Spain has higher costs than those which prevail on the world market (Henney, 1992, p.63-4). There is important variation, however, within Spain in the extent to which the mining costs deviate from internationally competitive levels. Table 3 shows the 1993 shares of different coal types within the coal segment of the electric generation market

(MIE, 1993). The least competitive coal is anthracite produced from underground mines. This coal has been heavily subsidized as a matter of national policy, a practice which has been common in Europe. The black lignite resembles similar fuels burned in the U.S., primarily in minemouth plant configurations in Texas. Brown lignite has extremely low heat content (roughly 60% of black lignite), and has no commercial value outside of minemouth electric generation because the transport cost would be prohibitive. In all cases, the domestic coal has high sulfur levels and other impurities which raise the costs of combustion (Menendez Perez and Mateo Alcala, 1993).

Table 3. The Coal Market (1993)

Coal Type	Share of Coal Market	Variable Electricity Price (mills/kWh)
Deep mined anthracite	50%	40.9
Brown lignite	20%	32.7
Black lignite	14%	37.2
Imports	16%	18.5

The dispatch market structure, administered by REE, is significantly distorted by vertical restraints in the form of "fuel forcing" over the annual cycle to guarantee certain production levels for national coal. In 1993, national coal (other than lignite) provided 21.6% of the production in the peninsular system.[2] The production from nuclear plants accounted for 39.2%, and from hydroelectric 16.5% (MIE, 1993). Given that 55% of the energy comes from resources whose output must be taken (i.e. nuclear and hydro), adding another 21% guaranteed to national coal makes for a highly constrained market.

This level of forced operation makes the dispatch rules implemented by Red Electrica de Espana (REE) necessarily opaque. REE must account for changing conditions by constantly adjusting the dispatch order in light of future expectations and the extent to which the guaranteed market for national coal has been realized at any point in time. Therefore, it may be difficult at any point in time to determine exactly how binding the national coal constraint may be on operations, and therefore what the implicit dispatch rules actually are.[3] This is a significant distortion.

[2]The statistics cited here refer to the electricity system on the Spanish peninsula. The Balaeric and Canary island systems are small factors that are neglected in this discussion.

[3]This is qualitatively more opaque than the dispatch distortions introduced in the US by "must take" requirements associated with PURPA Qualifying Facilities, which can be quantitatively as large as the fuel forcing in Spain in markets such as New York and California. In the U.S. case, it is known that these resources will always be operated on a priority basis, i.e.

The European Union has recently required that coal subsidies be removed from electricity tariffs, and made part of the government budget. These European Union policies on coal subsidies will have an significant impact on the competitive position of both the minemouth lignite plants and the other coal fired generating stations (Endesa and IIT, 1994). The EU directive requires that national support of coal production must be taken out of the electricity tariff and made transparent as part of the national budget. This policy is to be implemented by determining an "import equivalent" price for national coal that is based on international coal prices plus those extra costs that would be required were imported coal to be used. The import equivalent price computed in this manner is supposed to be used in electricity tariffs.

There will inevitably be a considerable degree of negotiation over the determination of the import equivalent prices involving uncertainties and ambiguities over what coals could be used in different plants and what the extra costs might be for each case. Some of the details and choices are discussed in Endesa (1995b). It is entirely possible that if the resulting prices were used in a purely merit order dispatch by REE that more national coal would be consumed than under a targeted regime. This result is possible because the brown lignite is not subject to these EU pricing requirements, while black lignite and anthracite are. Therefore, given the prices in Table 3, brown lignite should be displaced in a merit order dispatch by all fuels priced at an import equivalent level.[4] Moreover, if the import equivalent price is below true short run production cost at the mines, then the budgetary subsidies for national coal would actually have to increase compared to the case where the dispatch simply targeted the negotiated quantity of national coal.

The goals of supporting national coal, removing subsidies from the electricity tariff, and efficient dispatch appear to be in substantial conflict. It will be a major regulatory task to find an acceptable solution.

3.2 The Nuclear Moratorium

There are currently five nuclear plants that are subject to the nuclear moratorium imposed in 1984. Two of these (Lemoniz I and II) are located in the Basque region, and have been the objects of terrorist attacks by Basque nationalists. There was also local opposition to the construction of Valdecaballeros. The MLE made the moratorium permanent and incorporated the carrying costs of these plants into its category of Recognized Financial Costs in 1988. As of the

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what the dispatch order actually is. The only uncertainty is their output level, but even that has been quite predictable.

[4]Another lignite pricing option that might redress this potential problem, discussed briefly in IIT and Endesa (1994), would put some of the fixed costs of the lignite mines in the MLE. Minemouth coal plant costs are incorporated into utility rate base in Alberta, for example. Such a proposal would have difficulties of its own, including satisfying the transparency criteria of the EU.

end of 1994, the total Recognized Moratorium Debt was 729 billion pesetas. This is equivalent to about $5.8 billion, at an exchange rate of 125 Ptas/$. Table 4, from Endesa (1993), shows the breakdown of the moratorium debt by plant and ownership.

There has been some discussion of privatizing the moratorium debt by selling it at a discount. This would amount to a write-down for the companies involved, and require continued support of the financing costs through the MLE. It is unclear what the magnitude of the discount would have to be for the debt to be marketable, and what rights debt holders might have. This could be a particularly significant issue for Lemoniz, because Basque politicians have expressed some interest in pursuing a gas repowering strategy for these units as part of a region autonomy program. It is unclear how such proposals would fit in with the new electricity law discussed below.

Table 4. Size and Incidence of Nuclear Moratorium Debt

Plant	Ownership	Recognized Moratorium Debt
Lemoniz 1 and 2	Iberdrola	378 billion Ptas
Valdecaballeros 1 and 2	50% Iberdrola 50% Sevillana	340 billion Ptas
Trillo 2	40% Endesa 60% Union Fenosa	11 billion Ptas

3.3 Algerian Gas Supplies

As part of the Spanish government's commitment to supply diversity in energy, a new pipeline from Algeria will be completed, and begin gas deliveries in 1996. Some of this gas will be allocated to the domestic market and the rest to electric generation. Since the pipeline deliveries will be fully loaded, there will be a need for large-scale storage facilities, some of which are being planned now. There is an agreement between the Ministry of Industry and Energy and the electricity generators concerning the allocation of the gas (MIE, 1994). Conditions may change, however, and it is unclear how much gas will be allocated to electric generation, or which units will use it. The first issue depends upon the development of gas delivery infrastructure and the penetration of gas in the domestic market. The second question will probably be considered by the new regulatory commission, discussed below.

4.0 The New Electricity Law

Transparency and effective competition are regulatory goals that have become increasingly common objectives for the electricity industry in a number of countries (Smith and Klein, 1994). These are not universal objectives in practice, even within the EU, despite their having been adopted in principle (De Paoli and Finon, 1993). In France, the national monopoly is hardly conducive to transparency, to say nothing of competition. In Germany, where the electricity industry is not a monolithic monopoly, transparency does not appear, de facto, to be a regulatory objective (Muller and Stahl, 1994). Rather, the industry is governed, in effect, by self-regulation implemented in part by substantial municipal ownership.

In December, 1994, the Spanish government enacted a new electricity law, known as LOSEN,[5] which is intended to increase competition and transparency, while retaining the positive elements of the MLE. The three principal features of LOSEN are: (1) creation of a regulatory commission, CSEN, (2) requiring competitive bidding for all new generation, and (3) allowing for an "independent" system for those parties who seek to bypass the existing national system.

4.1 The Regulatory Commission

LOSEN replaces direct ministerial control of the ESI with administration by a regulatory commission, CSEN. CSEN consists of six commissioners appointed by the Ministry of Industry and Energy (MIE) for five year terms. The President of CSEN is the former President of the Competition Commission, who has experience with liberalization in a number of industries in Spain. The other members reflect the requirement for technical expertise, two academics and the former Director General of Mining in the MIE, and the desirability of political balance, i.e. representatives from the Basque and Catalonian regions. CSEN will implement the MLE and adapt it to the new requirements imposed by LOSEN.

The relationship between CSEN and REE will require some time to establish. REE had been essentially unregulated under the MLE. Its technical expertise, which is substantial, was an important administrative resource for the MIE in its oversight of the industry. Now there will be more of an arms length relationship between the policy process and REE. The initial stage in this separation will include the development of a technical staff at CSEN to provide independent analysis for the commission. CSEN needs to establish its own technical and analytic base of support, so that it would not be a captive of REE.

4.2 Competitive Bidding

The requirement for competitive bidding is likely to be result in significantly different practices under LOSEN than those in other countries. Instead of the utility companies (in the Spanish case, the logical choice would be the distributors) being the ultimate buyer, the bid taker under

[5]This is an acronym for Ley de Ordenacion del Sistema Electrico Nacional.

LOSEN will actually be CSEN. The regulatory agency will not only determine bid evaluation criteria and select winning projects, it will, in some sense, be the counter-party to the transaction.[6] In effect, this means that there will be no power purchase contract governing relations between buyer and seller, but rather only a regulatory compact to allow cost recovery under the MLE. It is unclear exactly how the financial community will treat such arrangements. A potential alternative to these informal mechanisms would be for CSEN to require that REE be the contractual counter-party, functioning as a national purchasing agent.

The first opportunity to implement a competitive bidding regime may occur in connection with the new gas supplies. While there had been some understanding concerning which units would be repowered to burn gas, CSEN may want to allocate this opportunity competitively. In such a case, the bidders would be the existing generating companies. When new capacity is required in the system, the number of potential bidders will expand to include major European utilities such as Electricite de France (EDF), National Power and Rheinisch-Westfälische Elektrizitätwerke (RWE) as well as IPPs from the US and other countries.

The long run question involving the implementation of competitive bidding will involve how much planning direction CSEN will impose upon the process. Will CSEN define the anticipated needs of the system, including fuel type, location and technology, or confine its activity to forecasting a capacity requirement and let bidders offer various alternatives?

4.3 The Independent System

The creation of an independent system represents the opportunity for "direct access" within the Spanish system. It is not at all clear what the participation will be in this system. On the customer side, the most likely candidates would be industrial firms. But as the data on tariff policy indicates, they are already receiving relatively low rates. Furthermore, the opportunities for self generation have been encouraged, and there has been significant development (see Table 1). If there are any interested customers, the possibilities on the seller side are quite numerous, essentially any entity that might bid for new capacity in the national system.

Entities operating in the independent system will inevitably interact both physically and economically with the national system. LOSEN delegates to CSEN the responsibility to manage that interaction. The only general principle the legislation offers to guide the regulators is the independent system should not "damage" the national system. In the language of US discussions about electricity restructuring, this looks a lot like compensation for stranded assets and opportunity cost pricing for transmission system access.

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[6]This significantly exceeds the regulatory intervention in the most aggressive states in the U.S., Wisconsin and California, where regulators have effectively determined the bid criteria and chosen winners. Even in those cases, there is still a contract between the winning project and the utility which specifies financial issues and performance requirements.

Determining reasonable prices to govern the interactions between the independent and national system will involve estimating the opportunity costs in the national system. Those opportunity costs will be strongly influenced by the operating procedures implemented by REE. Since these procedures are necessarily opaque, due to the national coal constraint, pricing support services to the independent system will be difficult.

The prospects for the evolution of the independent system are highly uncertain. At one extreme, it could become the springboard for further structural change in the ESI, as capacity responsibility shifted from CSEN to the end users, including distributors. Such an evolution would require further competition policies. At the opposite extreme, the independent system might never be realized at all. If the regime for interacting with the national system shifts too many costs on to potential participants, there may be no participation.

5. Challenges for the Future

LOSEN creates many opportunities for change and increased competition in the Spanish ESI. But the political constraints on the system are significant, and may ultimately limit such processes substantially. How the system will evolve in the future depends upon both factors within the industry and the larger political climate.

5.1 Over determination/excess constraints

The simplest characterization of the basic problem of the electricity industry in Spain is that it tries to do too much. The present supply mix has inflexible resource commitments that exceed strictly economic requirements. Nuclear and hydro resources must be used when available. The national coal constraint further reduces flexibility. Self generation has been encouraged by offering high prices for export to the grid. Future gas deliveries (which are also take or pay) will add more constraints. If demand growth were to increase, some of these problems would ease. But load growth , which had averaged 3.2%/yr from 1980-90 (Henney, 1992), has been lower in more recent years. A phase-out of national coal would ease the over-determined nature of the system, but at a political cost.

Given this situation, it is reasonable to ask what the new electricity law will be able to achieve?

5.2 Competition policy

While there is a good deal of language in LOSEN encouraging competitive mechanisms in electricity, it remains to be seen to what extent competition will be increased. While the new law creates the opportunity for expanded competition, there remains the fundamental question about how much of a role government should play in the industry. The fuel diversity policy, which has driven much of the industry's current structure, is based implicitly on a public goods rationale for intervention, rather than the more conventional natural monopoly view (Jaccard, 1994).

Whether fuel diversity policies need to be pursued further as economic integration with the EU proceeds will be one of the major policy issues in the future.

In the shorter run, CSEN will have opportunities to test competitive processes, either through allocating the gas repowering market through bidding, or by rationalizing the pricing of excess power producers by the self generators. The incentive prices paid to self generators are arguably in excess of their value to the system. With constraints playing such a large role in the energy management at present, it is likely that marginal values are low. Self-generators, however, are located at load centers, which is typically more valuable than remotely sited baseload generation. Reforming the pricing process for self-generators along value lines will give CSEN an opportunity to engage the industry in dialogue about the sources of value, and increase price transparency. Under suitably structured conditions, such exercises have led to productive examination of the electricity cost structure in the US (Kahn, 1995).

Competition in the spot market arguably exists under the current structure of the MLE and the central dispatch of REE. But the previous discussion of operational constraints suggests that there are limits on this even in the short run. A less constrained spot market based on generators bids, rather than the MLE would face many of the problems familiar in the UK due to concentrated market power. Newbery (1995) argues that these are limited by the threat of new entry in the UK. But even in that case, regulatory control over entry is still important, and the new entry by IPPs has proven controversial (Helm, 1994). Ironically, the regulatory defense of the IPP entry relied in strong part on fuel diversity arguments (OFFER, 1992). Given the control of new entry by CSEN, it is doubtful that a freer spot market in Spain would be constrained by entry threats.

Relations with the EU will be important in the intermediate and longer run. De Paoli and Finon (1993) argue that fuel diversity policies of national governments are incompatible with the EU's long run vision of a competitive electricity industry. But it remains quite uncertain whether the EU will be able to impose this vision on the ESI (McGowan, 1993).

5.3 Information access

Long run competition requires that information be available to participants about the opportunities and constraints in the market. In electricity, this typically involves making information about the network and its characteristics accessible to potential competitors. There are a variety of ways to approach this problem, depending upon the institutional structure of the ESI (Kahn, 1994). The Electricity Policy Act of 1992 in the US accelerated this process in that market (FERC, 1993), but there is a long way to go before anything like transparency concerning network costs exists. By comparison with current practice in the EU, however, the US system looks extremely transparent (Beesley, 1994).

5.4 Ownership

The current structure of ownership linkages between generators and distributors would not be

compatible with evolution of the system toward a fully competitive structure. If responsibility for new capacity additions were to devolve upon customers and distributors, it would be necessary to separate the ownership ties between generators and distributors. While LOSEN requires corporate separation of these entities, i.e. separate companies, ownership linkages will still persist. The prospects for de-integration with ownership separation appear fairly remote today.

6. Conclusions

Institutional change in the electricity industry is a worldwide phenomenon. Although the benefits of a more competitive structure in this industry appear to be widely recognized, there are substantial obstacles to its development. These are largely historical commitments based on government policies that have a good deal of inertia. Understanding how to guide institutional change is the policy challenge facing the electricity industry today. Comparative studies of institutional adaptation in different countries will contribute to the base of knowledge that will facilitate long run change. The experience of Spain is important in this regard, and not as well known as the evolution in other European countries. The experimentation that will be taking place under LOSEN should provide valuable lessons elsewhere in the world.

7. Acknowledgements

This work was supported by the University of California Enegy Institute. The author benefitted from extensive discussions with industry participants in Spain including Ignacio Perez-Arriaga, Luis Rodriguez Romero and Michel Angel Fernandez Ordonez of CSEN; Marie Louisa Huidobro, MIE; Rafael Miranda, Jose Bogas and Ramon Jimenez Collado, Endesa; Felix Alonso de las Fuentas, Iberdrola; Francisco Javier Domingo Blanquez, Union Fenosa; Angel Landa, REE; Jaime Roman Ubeda, Tomas Gomez San Ramon, and Juan Alba, IIT. None of them are responsible for any of the conclusions offered here.

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