

Chapter 2

Hybrid Electricity Markets: The Problem of Explaining Different Patterns of Restructuring

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Summary

This chapter explains the divergence in the design and structure of liberalized electricity markets. The main question is why there are so many “hybrid” markets, markets that are somewhere between their former state of a regulated monopoly and perfect competition. Electricity market design is found to be shaped by the relevant policy goals, the situation in the market at the outset of the restructuring process, and a variety of exogenous factors, outside the control of market participants and government policymakers. Moreover, feedback from market performance to the policy process is limited by time lags and bounded rationality.

2.1. Introduction

Many electricity markets around the world have been or are in the process of being restructured with the purpose of introducing or expanding competition, but few have actually reached a state that could be described as commensurate with the economics textbook ideal of a liberalized, competitive market (cf. Joskow, 1996; Stoft, 2002). Perhaps the electricity markets in the United Kingdom, Argentina, Texas, New Zealand, Chile, and Alberta have come closest to this ideal, at least in terms of market design. However, they also have many idiosyncrasies, vestiges of their pre-liberalized state or results of political compromises, such as publicly owned competitive companies, preferred treatment of incumbents, inadequate network regulation, price regulations, or limited competition. Most electricity markets are still further removed from the textbook ideal and are somewhere in between their former pre-liberalized state and retail competition (Joskow, 2006; Newbery, 2005a,b; Victor, 2006; Rudnick et al., 2005; F. Sioshansi, this volume).

If a function can be performed adequately by competitive firms, there is no need for public ownership. Nevertheless, public ownership remains common in restructured power

markets, so the state can often retain a strategic position. For instance, in many developing countries the single buyer remains a public entity. If the single buyer also owns some of the generating capacity, this leads to a situation in which it competes with independent power producers (IPPs) (Dehdashti, 2004). In many OECD (Organization for Economic Cooperation and Development) countries, the state, provinces, or municipalities maintain their shares in power production and networks.

Another phenomenon is that markets have been restructured with all the features of a competitive wholesale market, but continue to be dominated by a single party – often, the former monopolist. Examples are Electricité de France, Electrabel in Belgium, or CFE in Mexico. Whereas ENEL, in Italy, was forced to divest a substantial amount of its generating capacity a few years ago, currently there appears to be a tendency in Europe to create “national champions” – large power companies that are expected to protect national interests in an increasingly international power market (Thomas, 2003; Haas et al. 2006).

Finally, there are countries in which many of the requirements for a competitive market are met, both with respect to market design and industry structure, but in which the government continues to intervene beyond the minimal requirements for facilitating competition such as network regulation. Examples of government intervention are the use of a capacity mechanism, which influences investment in generating capacity (e.g., in Ireland, Spain, and in several markets in the United States) and wholesale or consumer price regulation. Price controls are common both in developing countries and in restructured OECD markets.

Whereas in some markets a state of incomplete liberalization is clearly a transition phase, other markets appear static, stuck somewhere on the path to reform, while in a third group of markets the reforms are being reconsidered. Is this an indication that there are multiple steady states possible? Is there not a natural tendency for the design of markets to converge over time? Are markets typically moving toward more competition, or have some achieved a steady state? What drives these structural changes? What are the hurdles for further liberalization? What are the prospects for agreement upon a single market design, even within the European Union (EU) and the United States, where there are mechanisms available for coordinating state policies? The aim of this chapter is to investigate these “hybrid” markets and to provide an explanation of the apparent stagnation of the process.

The main focus of this chapter is, How can the current divergence in the design and structure of liberalized electricity markets be explained and what are the prospects for convergence and agreement upon a single market design? In this chapter, countries that have undertaken attempts to introduce competition, from opening of their systems to new entry by IPPs to full-fledged restructuring, but have not adhered to the textbook model for competition will be examined.

Neoclassic economic theory provides the contours of the desired end state of a restructuring process by defining the characteristics of an ideal market. It also provides a framework for diagnosing market imperfections (see Shuttleworth, 2000; Newbery, 2005b; Joskow, 2006; Jamasb and Pollitt, 2005; Haas et al., 2006; Kwoka, 2006). However, due to its prescriptive nature, neoclassic economic theory does not explain differences between the ways in which countries go about the restructuring process, or why markets in practice are so rarely fully organized according to the neoclassical economic textbook ideal. Neither does the neoclassic economic theory make clear why some companies are horizontally separated or privatized while others are not. There is a lack of understanding of the evolution of restructuring processes and hence also of their outcomes in as far as they do not conform to economists’ expectations. In this respect Heller and Victor (2004, p. 6) note: “Experts

attribute this yawning gap between theory and practice to ‘politics,’ poor ‘rule of law’ and other ‘weak institutions’ that are needed to put the state on the sideline and to give the space for markets to operate. Yet, so far, nearly all scholarship has treated them as a residual category. [...] The lack of rigorous attention to these factors is particularly strange since political, legal, and institutional forces are hardly transient. Indeed, these factors appear to be the dominant ones in explaining the actual pace and character of market reforms in the electric power system in developing countries.”

A promising approach for exploring the situation in these hybrid electricity markets is provided by Institutional Economics, a sub-discipline of economic science that deals with the evolution of institutional arrangements in markets (see, for example, North, 1990; Williamson, 1998; Glachant and Finon, 2000; Victor et al., 2006). In this theory, the behavior of market actors, as regards pricing, production, resource allocation, investment, strategies of horizontal and vertical integration, and so on, is assumed to be influenced by a market-specific body of rules and conventions: the institutional arrangements. Of course, the traditional economic perspective also relates the conduct of actors and their performance to structural characteristics of markets, like the degree of concentration, the shape of production functions, regulation. Yet, these characteristics are considered as a *given*, exogenous to a market.

What distinguishes the approach of institutional economics is that it considers this body of rules as being an endogenous *part* of the market. Institutional arrangements are shaped by a path-dependent interaction between *political*, *economic*, and *physical* factors, driving deliberate interests, choices, and strategies of the policymakers, the firms in the industry, (groups of) consumers, and other parties involved, like international organizations and NGOs. This implies that an explanation of why certain types of hybrid markets have developed – and their future – should include the interaction between these factors and the resulting behavior of the actors in a specific market. The main elements in the institutional economy of power system restructuring are the situation at the start of the restructuring process, policy decisions regarding market design, related policies such as competition policy, fuel policy and environmental policy, and a number of exogenous factors that constrain the decision space, like the scale of systems and the availability of primary energy resources. Section 2.2 will further elaborate on this analytic framework.

In Section 2.3 an overview is presented of the characteristics and achievements in respect of restructuring in a selection of electricity markets. The evaluation of the restructuring process of the electricity supply industry is based upon case studies of OECD countries, developing countries, and formerly communist countries (e.g., Heller and Victor, 2004; Victor and Heller, 2006; Newbery, 2005a; Joskow, 2005a; Rudnick et al., 2005; Sioshansi and Pfaffenberger, 2006). By considering North America and Europe as well as non-OECD countries, the full range of possible market designs becomes apparent. This section attempts to explain this diversity within the framework that was developed in Section 2.2. Section 2.4 provides an analysis of the country comparisons, while the conclusions are summarized in Section 2.5.

2.2. The Institutional Setting for Restructuring

In this section an analytic framework will be developed. Section 2.2.1 starts with an analysis of the constraints that limit the decision space of governments as well as market players. Within this context, the motives of public authorities and the industry determine the direction of the restructuring process (Section 2.2.2) Section 2.2.3 describes the different market design variables. Given a specific restructuring policy, the strategies of

market parties determine the market outcomes in a dynamic process, as is described in Section 2.2.4. Section 2.2.5 summarizes the analytic framework.

2.2.1. *The restructuring context*

The *physical situation* in a country provides a set of relatively “hard” constraints. A crucial element is the presence of indigenous energy resources, such as hydropower, coal, natural gas and oil, or – at the other end – dependence upon other countries for energy resources. Market size and degree of isolation matter too. Small isolated systems, in small countries or on islands, like Iceland, Malta, or in the Caribbean, cannot efficiently support multiple competing generating companies as a consequence of the relatively large minimum efficient scale of the several types of generation units. This also impedes the use of specific technologies or fuels, such as large-scale coal plants. The geographic distribution of demand also plays a role: in thinly populated areas or small, remote concentrations of electricity demand it may be difficult to create competition in supply (see also Weinmann and Bunn, 2004).

A second set of constraints relates to *macro-economic characteristics* such as the level of economic development, the rate of demand growth, and the availability of investment capital. These factors influence the acceptability of changes in tariffs or prices to different categories of users, the need for investment, and financing options for system expansion and/or rehabilitation. Three obvious categories of countries are, firstly, developing countries with a relatively stagnant economy; secondly, countries on the path of economic development and industrialization; and, thirdly, the OECD countries.

The third category of constraints derives from the *institutional and socio-political environment* of a power system. North (1990), Williamson (1998), Glachant and Finon (2000), and Finon (2003) explain how informal institutions such as culture, traditions, and values affect the development of formal institutions, such as property rights, legislation, regulation, and the role of the (federal) state in the economy. In De Vries and Correljé (2006) it was discussed how formal institutions can be divided into general institutions, such as the polity, the judiciary, and the bureaucracy, and sector-specific institutions, such as sector legislation and regulation and jurisprudence, which are the main tools of market design. Arguing that the freedom of action for those who are in control of the reform process and the need to coordinate different aspects of the reform process are essential to the success of a restructuring process, Glachant and Finon (2000) consider the power of the central government a key factor with respect to the success of market reform.

Table 2.1 provides an overview of the physical, macro-economic, and institutional constraints. Together they determine to a large extent the *solution space* that is available to governments that wish to restructure their power sectors. Within the context of these constraints, governments need to find a balance between their own multiple objectives and those of the energy sector and of consumers.

Some confusion may arise with respect to the difference between variables and constraints, as the starting value of a variable itself may pose a constraint on the liberalization process. For instance, the fuel mix at the outset of liberalization influences the economic and environmental performance of the sector for many years after the reforms have been instituted. However, this should not be considered a constraint, but rather the beginning value of the *variable* “fuel mix,” which may change over time. Undeniably, “take-off” variables such as the fuel mix have a significant path-dependent impact, but analytically it is essential to make a clear distinction between fixed constraints, as factors that lie outside the control of the actors within our system, and variables that are (more or less) under their control. Market design variables will be discussed in Section 2.3.

Table 2.1. Factors that determine the context of the restructuring process

	Factor	Impact
Physical factors	<i>Natural endowment with energy sources</i>	Presence or absence of primary energy sources drives the choice of primary fuels, the technical and economic characteristics of the sector, and interests and policies.
	<i>Physical size of the market</i>	Due to scale effects, small markets are likely to be more concentrated. Larger markets may constitute a number of separate subsystems, with their own economic and institutional structure.
	<i>Geographic distribution of demand in relation to network capacity</i>	Relatively dispersed demand and/or limited network capacity increase the likelihood of network congestion, which results in market fragmentation and limits competition.
Economic factors	<i>Level of economic development and growth</i>	Influences demand growth, the potential for investments, and institutional stability.
	<i>Growth rate of demand</i>	Capacity investment lead times are long. With a high growth rate, large volumes of capacity must be under construction. Market signals or regulation must be effective. Stable demand, on the other hand, limits the "room" for new market entrants.
	<i>Financing options</i>	Especially in developing or transition countries; with a weaker economy financing options may be limited.
Institutional factors	<i>Ideology</i>	General acceptability of and commitment to particular policies and institutions.
	<i>Institutional stability and rule of law</i>	Facilitates investment and external funding; stabilizes and provides coherence in policies; helps align policy, regulation, and the legal framework.
	<i>Degree of institutional centralization and homogeneity</i>	The power of the central government influences the coherence of policies and their support in terms of regional, sectoral, and social dispersion.
	<i>Influence of stakeholders</i>	Strong stakeholders may be able to influence the reforms in their own interest.

2.2.2. Motives for restructuring

A large number of states have embarked on the process of power sector restructuring, each starting from its particular national context (see Jamasb, 2002). A wide variety of motives can be observed for these attempts. Prior to liberalization, the electricity sector was considered a natural monopoly which, in the prevailing neoclassical approach, justified state intervention (Scherer, 1980; Stiglitz, 1986).

In the United States, privately owned utilities were regulated by sector-specific Federal and State agencies. In Europe and its many (former) colonies and Latin America, public ownership became the dominant mode. In the communist world, of course, the state was

the owner and operator of virtually the entire economy. In addition to providing electricity at reasonable rates, the power sector policy served a number of public interests associated with these services, such as issues of safety, security of supply, acceptable prices for specific types of users, objectives of local and sector development, the supply of jobs, and – more recently – sustainability and environmental protection (see, for example, Foreman-Peck and Milward, 1994; Correljé et al., 2003).

By the early 1980s, this perspective was replaced by the kind of “liberalism” that was associated with the ideas promoted by the governments of the late Ronald Reagan and Margaret Thatcher, which were based on monetarist and public choice theories. Efficiency, economic reform, and political power were sought through a reduction of taxes, “rolling back the state,” and by bringing market-driven competition into so-called “gold-plated” industries. Competition – modeled after the revised economic textbooks – was to be imposed upon public sectors wherever possible (Friedman, 1962; Demsetz, 1968; Helm, 2003; Parker, 2000). Gradually – initially only in a number of Anglo-Saxon countries and Chile – privatization and competition were introduced as the basic elements of structural change in the energy sector. Encouraged by the apparent successes of the early efforts, the introduction of competition became a common goal for many markets (see also Chao et al., Chapter 1 in this volume).

As the competitive market paradigm became accepted in OECD countries, international organizations such as the World Bank and the IMF started to require developing countries to implement similar market reforms if they wished to be eligible for support. Thus, for many developing countries – as for some EU countries – reform was imposed, rather than a voluntary effort. Another possible reason for reform in developing countries is to attract private capital when the public owners cannot provide sufficient investment.

In addition, other policy objectives often play a role, such as social and economic stability, fuel policy, environmental policy, and CO₂ trading. These policies may impact restructuring policy by excluding or enforcing particular fuel mixes and through systems of levies and subsidies (see Glachant and Lévêque, 2005). Moreover, competition policy may influence the success of restructuring. In general terms, it appears that the commitment to, and faith in, competition as a means of maximizing welfare is an important factor. The success of market reforms in other utility sectors may turn out to be an important example to policymakers (see F. Sioshansi’s Introduction).

2.2.3. Market design

The preceding section provided an overview of the motives for power sector restructuring. Now the analysis will turn to the options for achieving these goals, the market design variables. Basic choices are the pace of market opening, the degree in which competition is introduced, the market model, decisions to restructure horizontally or vertically, and decisions to privatize (Glachant and Finon, 2000; Newbery, 2005a; Littlechild, 2003). An important means of achieving competition is by redesigning the market to make it attractive enough for new entrants to whittle away the market power of the incumbents. In designing markets, however, a tradeoff is to be made between competition and the investment climate. Ideally, the combination of economic and institutional structures and contract forms in a market reflects the risk structure in that market, involving market, fuel, regulatory, technical, and other risk components, as regards both short-term operating decisions and long-term investments (Joskow, 2005b; Alexander and Harris, 2005).

The first question is to what degree competition is to be introduced. A relatively light form of restructuring of publicly owned industries is their *corporatization*. State-owned

enterprises normally operate under the responsibility and control of a particular department with “soft” budget constraints. Placing the enterprise at arm’s length from the responsible public body, while imposing a hard budget constraint, is a first step toward enhancing the efficiency of the electricity industry and making it less responsive to political and interest group capture.

A next step, introducing some competition without structurally addressing the state monopoly, is to allow IPPs. They sell to the state-owned monopolist (called the single buyer), who often continues to generate electricity (Heller and Victor, 2004). While this allows the state monopoly to dominate the system, the IPPs may provide benchmarks for performance and may increase their influence over time.

The following step is to remove the single buyer and create a *wholesale market* in which there is wholesale competition between a number of generators, supplying large customers and distribution companies with a retail franchise. The final step is the introduction of competition at the level of retail customers. To an increasing extent, these categories of market design allow for competition (Hunt and Shuttleworth, 1996). It is possible to open up the market to full retail competition at once, but it is also possible to gradually introduce competition by moving through these different models. The pace of restructuring is therefore a variable. Retail competition was often regarded as the desired end state of restructuring (it is, for instance, required by the EU in Directive 2003/54/EC), but in Chapter 1 of this volume Chao et al. make a case against competition at the retail level. Newbery (2002) also pointed out the advantages of retaining the retail franchise, such as retail companies being able to enter into long-term contracts for generation.

With respect to the wholesale market model, there is a fundamental choice between *integrated markets* and *decentralized markets* (Hunt, 2002). Integrated markets are preferred in the United States. In these markets the system operator operates a mandatory pool, in which the physical and economic aspects of electricity trade are strongly connected. In decentralized markets, the preferred model in Europe, the system operator only has a technical function and supply and demand meet elsewhere, either bilaterally or in voluntary power exchanges.

In the case of restructuring publicly owned utilities, *privatization* becomes an issue, as it is generally not considered necessary or desirable for government to be involved in competitive activities. Nevertheless, it is not uncommon for states to have their publicly owned companies operating in competitive electricity markets, perhaps due to the strong public goals with respect to this sector. Public authorities may engage private capital via a system of concessions, a flotation of packets of shares in the industry on the exchange, or via a merger with a foreign firm. The choice of approach has important consequences for the resulting vertical and horizontal structure of the electricity sector and for the behavior of firms. The main variables are, firstly, the degree of privatization of the industry, ranging from a government monopoly via the admission of new privately financed firms into the sector to full privatization. Secondly, there is the issue of what segments may be privatized – generation, wholesale and retail trade, the networks? In some cases, as in the Netherlands, it is argued that the networks, as critical infrastructures, should remain in public ownership (see Künneke and Fens, 2007). The third element involves the character of the new private owners: will they be anonymous shareholders, national or foreign financing institutions, foreign electricity companies? A final aspect involves the timing of privatization, relative to other elements of a restructuring.

Depending on these choices, a new market structure emerges with a specific pattern of interests, strategies, and behavior. Obviously, the degree of privatization not only impacts the economic behavior of the firms in the industry, but also their activities in influencing

public authorities and regulators. Indeed, shifts in the structure of ownership bring about different constellations of interests, involving new parties and new strategies vis-à-vis the government, the regulators, and the market. The arguments for choosing a particular approach emerge only to a certain extent from *pure* efficiency considerations associated with restructuring. Other policy motives may include the size of the revenues to the state from privatizing the industry, the degree of control a government wishes to maintain over specific segments of the industry, international relations, security of supply issues, and the management of national energy resources such as gas or coal, and so on.

If the goal of restructuring is to introduce competition, it may be necessary to break up existing companies into smaller ones or to force the incumbent to divest some of its assets. Indeed, a debate is currently taking place within the EU about the question as to what extent large cross-national firms should be allowed, as a means to enhance security of supply and investment potential, or whether these former national champions should be divided up in a number of potentially competing firms. Even if the market design is perfect, the potential benefits of restructuring are not likely to be obtained if the market continues to be dominated by the former monopolist. Fringe competition may provide some benefits, but due to economies of scale and the long life cycle of key assets such as power plants, it is not likely to lead to a level playing field for competition very quickly. Therefore, horizontal unbundling is a key element of restructuring if multiple potential competitors are not already present. Public monopolies are in principle easier to split up than private companies (Finon, 2003). However, in case of public ownership, conflicts of interest with, for example, powerful labor unions may keep a government from acting. Some also consider it desirable to prevent or break up vertical integration between generation and retail. However, in Chapter 1 of this volume Chao et al. argue that this is a necessary instrument for risk hedging. This argument is supported by the observation that in most electricity markets there is a strong tendency toward vertical integration between generation and retail.

The way the networks are regulated will fundamentally affect the network owners' investment policies and therefore impact the adequacy with which demand growth and shifts in the pattern of supply and demand are met. Depending on the choice for a model, the issue of *the position of the transmission and distribution networks'* monopoly becomes important. The regulation of network *tariffs*, the provision of regulated or negotiated *third party access*, and the degree of *unbundling* of the networks from competitive generation, trading, and retail activities strongly influence the overall effectiveness of competition in the market:

- The quality of access regulation and the level and structure of tariffs affect the competitiveness of the supply of power and the development of trade.
- The degree of unbundling also plays an important role in this respect, as it keeps incumbent owners of networks from obstructing access for new entrants and avoids cross-subsidization of competitive activities by non-competitive activities (see also Chapter 1).
- Incentive regulation of transmission and distribution networks directly impacts the level of transport costs as a component of overall supply cost.

In addition to access to transport, there are certain essential *system operation* functions that need to be provided. The main functions are scheduling and dispatch of transmission and distribution, balancing (in case of decentralized markets), congestion management, and ancillary services (such as black-start capacity and voltage control). These functions can be designed in multiple ways, but because of their relation with network management they are often provided by the transmission network manager (Knops, 2003).

Trade between different electricity markets is often an issue. The connection with neighboring electricity systems may have a significant impact upon the competitiveness of the market and the incentives to market parties. At the same time, it exposes the industries of connected countries to competitive forces, a phenomenon that may or may not be appreciated.

In many markets, *wholesale and/or retail prices* are regulated. In this respect a balance needs to be struck between the interests of consumer groups, who often embody specific political power, and the incentives to the industry for providing sufficient investment to cover future demand. It is still debated whether competitive electricity markets without price restrictions provide sufficient investment incentives, or whether consumers would be better off with some kind of *capacity mechanism*. If there are price restrictions, theoretically a capacity mechanism is necessary to compensate generating companies for the foregone revenues; otherwise, they will under-invest (Hogan, 2005; Stoft, 2002). A capacity mechanism may also be needed, or be beneficial, for other reasons (De Vries, 2004).

An overarching issue is the role and position of the *regulatory function*. At what level should the regulator be placed? Local, provincial, national, or even supranational regulatory bodies may exist. The choice has consequences for the relation between the regulator and the regulated industry and its independence from other parts of the public realm. It also affects the degree of detail, specificity, and generality in which regulatory problems can be solved. A second aspect is the balance between sector-specific regulation and the application of general competition law. Both approaches have an *ex ante* component, addressing structural sector characteristics, prescribing behavior, and evaluating plans for mergers and acquisitions, and an *ex post* component for the detection and punishment of abuse of market power. Consequently, the position of the regulator(s) and competition authorities within the policymaking arena and the role of governments as decision-makers for the transition toward a competitive market and the design of that market and, ultimately, for the allocative and dynamic efficiency of the market, are of great importance in terms of efficiency and welfare.

The organization of the electricity supply industry prior to the restructuring process affects a number of these decisions by providing default choices. The number of generating companies at the beginning of the restructuring process, the degree to which they are integrated with network companies, the ownership structure of these companies, generating and network capacity, the capacity of network links with neighboring systems, whether there already is a regulator (e.g., for the regulation of private utilities) determine the starting conditions of the restructuring process. These conditions are relevant, as will be seen later in this chapter, because the restructuring process is subject to path dependency.

2.2.4. The dynamics of restructuring

The *solution space* of governments with respect to restructuring – the range within which governments can choose the market design variables that were discussed in Section 2.2.3 – is restricted by the situation at the outset of the restructuring process and by the “hard” constraints that were described in Section 2.2.1. Within the context of the different constraints, governments need to find a balance between multiple objectives with respect to the energy sector. To a large extent the specific balance between the policy objectives is a function of a country’s socio-political context, involving ideology and the representation of interest groups such as specific categories of energy consumers, producers of indigenous energy resources and their staff, the citizens at large, and components of the central and local administrations (see also Heller et al., 2004).

The solution space of market parties is restricted by the market design decisions of government, as well as by the exogenous constraints that were described in Section 2.2.1. Within these limits, parties optimize their positions through the contracts and transactions that they enter into with their suppliers and customers. An important element in this respect is the facilitation of trade by exchanges and other trading places by providing more or less standardized contracts. To a large extent, these market institutions emerge from the initiative of actors in the market, reflecting the opportunities for trade within a given system.

The market structure evolves over time through mergers, takeovers, and the establishment of joint ventures. This process accelerates during the process of restructuring, as a consequence of firms' growing insights in the newly developing context and the associated changes in their roles and opportunities (see also Kwoka, 2006; Jamasb, 2002). These strategic decisions by the firms, finally, determine the space within which they make their operational decisions, which lead to the market outcomes (Williamson, 1998). Based upon the performance of the market with respect to the government's policy goals – and responding to public perception – government may adjust its policies (Willman et al., 2003; Correljé, 2005).

The feedback from market performance to government may be weak, however, as North (1990) points out. First, for some of the market design choices, there may not be sufficient information to reach an unambiguous conclusion about which is the better one. For instance, as of now, the experience with liberalized markets is too limited to provide definitive evidence whether a market design without a capacity mechanism provides sufficient incentives for investment in generating capacity. Similarly, there is no consensus about the optimal design of a capacity mechanism. Given that the lead time for new generating capacity is several years, the length of the business cycle in the electricity generation business will probably be longer than a decade. Adding to that, many markets started restructuring with excess generating capacity, and it is clear that current experience with competitive markets is relatively short. There simply is not sufficient empirical data with respect to the issue of generation adequacy. Economic models cannot sufficiently capture the details of existing markets, generation parks, and oligopolistic industry strategies to provide an unambiguous answer to the question of generation adequacy. Therefore, for the time being, answers to the issue will remain somewhat speculative (see De Vries, 2004; Cavaliere et al., 2007; Weinmann 2007).

A second reason, according to North (1990), may be that the models with which actors process information may not be adequate. This is true both of formal models, such as simulation models, and of the "mental" models of reality that policymakers have in their mind. Regardless of the type, a model is a simplification of reality and therefore always highlights particular elements of the real world. Different national policy traditions and socio-political backgrounds equip policymakers with differing mental models. Of course, these models improve over time if there is coherent feedback from what is happening in the real-world power sector and the economy at large. However, if the process takes too long, or when feedback signals are too weak and diffuse or contradictory, it stalls. The mental models are not consolidated and adjusted and insights remain ambiguous and open to multiple interpretations. In a highly complex system such as a competitive electricity market, this may easily be the case. The limited feedback is the main cause of path dependency. If it is not clear whether a change constitutes an improvement, the change is not made.

This may explain the differences in market design between the United States and Europe, where many believe their own model is the best choice. Starting conditions were quite

different, with much of the industry in the United States privatized before the restructuring process. Perceptions are also different, with European countries emphasizing the need for “national champions,” among others, as a balance against the large national energy companies that supply Europe with natural gas or against foreign electricity suppliers that would give preference to supplying their home country, in case of problems. This focus on national (or state) “champions” is absent in the United States.

Finally, the blocking power of key actors may be another important cause of path dependency. Even if government has a clear vision for its market reforms, as the EU does with respect to electricity market restructuring, key actors such as powerful EU member states or incumbent companies may prevent it from happening.

2.2.5. Conceptual framework

Combining the above elements leads to the conceptual framework that is represented in Fig. 2.1. This figure summarizes the relations between the different factors that influence the development of electricity markets. The market design process takes place within an *institutional context*: the process is influenced by informal institutions such as culture and values and constrained by formal institutions such as international treaties and the constitution. This context influences the choice and relative weight of the policy goals, as well as the general effectiveness of policymaking and implementation, as a function of the “power” and legitimacy of the government (Williamson, 1998; North, 1990). The institutional context also manifests itself through decisions of the past, as the institutional context is relatively static.

The policy goals set the direction for the restructuring process. The policy goals, and the relative weights attached to them, vary widely. Objectives in *related policy areas*, such as energy security of supply, environmental and employment policy (fuel choice), social policy (energy prices) may also affect electricity market policy. The way these policy

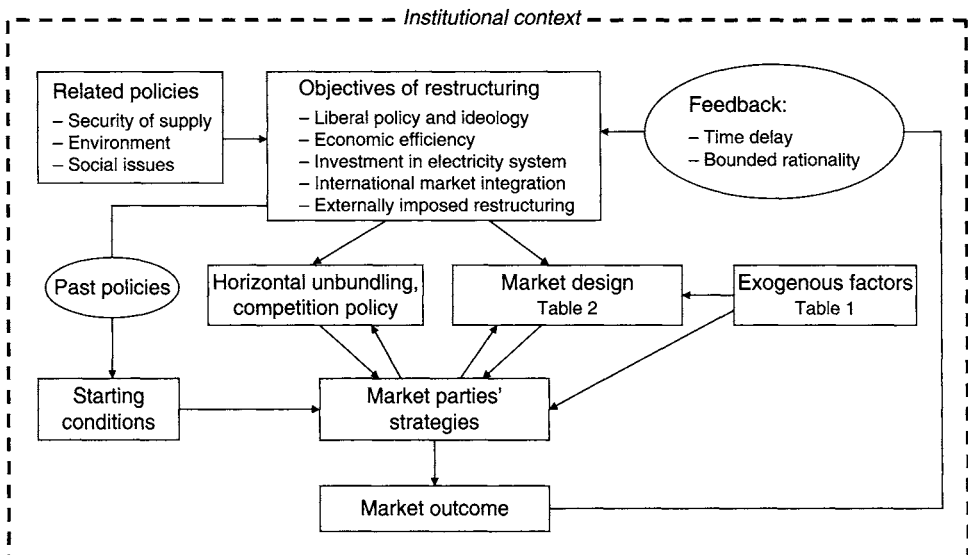


Fig. 2.1. Conceptual framework.

Table 2.2. Market design variables

Variable	Consequences
<i>Degree of market opening</i>	Corporatization of a state monopoly, single buyer, wholesale market and competition in the retail market allow for an increasing degree of competition, but involve increasing transaction costs and requirements as regards the economic and institutional structure.
<i>Pace of market opening</i>	Being a leader or a follower vis-à-vis neighboring countries/states, or higher (EU, USA Federal) policy.
<i>Integrated versus decentralized market</i>	Integrated markets with mandatory pools, reduce transaction costs, but combine both economic and physical control over the system in the hands of a single party, potentially facilitating governance.
<i>Public versus private ownership</i>	Public ownership provides a means for direct control but entails policy captivity, may impede effective regulation and limits financial resources. Private ownership requires political and institutional stability and regulatory commitment.
<i>Competition policy and horizontal unbundling</i>	Influences the competitiveness in market segments, trading off economies of scale and scope.
<i>Network unbundling</i>	Unbundling influences the independence of network managers and their interest in providing equal conditions for all network users.
<i>Network regulation of network tariffs and access conditions</i>	Influence the conditions for competition and the pressure upon network managers to work efficiently.
<i>Congestion management method</i>	Affects trade opportunities between regions.
<i>Arrangements with neighboring networks and interconnector congestion management</i>	Market integration may enhance the competitiveness but may also cause higher prices in the exporting country.
<i>Balancing mechanism (in decentralized markets)</i>	Balancing mechanisms affect cost and revenues of type generation, especially for intermittent sources, and influence entry.
<i>Wholesale and end-user price regulation</i>	Protects consumers, at the expense of investment stimuli to the industry.
<i>Capacity mechanism</i>	Different types of capacity mechanisms exist in order to stimulate investment in capacity.
<i>Position of regulator</i>	<i>Ex ante</i> or <i>ex post</i> regulation.

goals are combined influences the design of the market. The actual design choices are summarized in Table 2.2.

The restructuring process is further constrained by a number of *exogenous factors*, as are listed in Table 2.1. These factors not only affect the market design process as policymakers take them into account, but they also affect the behavior of market parties directly.

For instance, difficulty with financing capacity expansion in developing countries will stimulate a market design that reduces investment risk; the combination of the incentives provided by the market design and the financing possibilities together determine investment behavior.

As argued above, due to path dependency, the *starting conditions* influence the restructuring process. It is easier to introduce competition into a market with fragmented ownership than into one with a monopoly. If the monopoly is state owned, the government has the power (if not always the willingness) to break up this company. Similarly, past fuel policies will affect the market for decades after the beginning of restructuring, due to the long life cycle of generation assets.

Within these constraints, *market design* and *competition policy* provide the tools for restructuring. Feedback exists in that government observes the performance of the market and responds by changing policies, also stimulated by involved interest groups. However, this feedback is characterized by long time delays, due to investment lead times, incomplete information, and incomplete understanding of the meaning of that information. Faster feedback takes place in the form of lobbying by market players, trying to influence competition policy and market design decisions.

2.3. Hybrid Markets and Patterns of Restructuring

The objective of this section is to investigate the evolution of a number of restructured electricity markets and to examine their prospects for convergence toward a single market design. A review of recent case studies on power market restructuring in a number of countries provides an insight into the factors that led them to their current situation as hybrid power systems. First the situation in a number of developing countries is discussed, followed by an examination of OECD countries.

2.3.1. Developing countries

The power sector of Chile, the first example of liberalization in the 1980s, was plunged into crisis when Argentina curtailed its natural gas exports to Chile in 2004. The power system had become dependent upon natural gas from Argentina as a consequence of its border conflict with the alternative supplier Bolivia. Investors debated between coal, using LNG for natural gas plants, and banking on a return of the cheaper Argentine gas. As they could handle these risks, which were partly political, they turned to the government for leadership (Rudnick et al., 2005). Despite being pioneers worldwide, these South American countries almost “froze” the reforms and – partly due to their political instability – no substantial adjustments have been made to cope with the challenges that emerged in recent years (Arango et al., 2006a, b).

Argentina was also among the first countries to reform its power sector in the early 1990s. Initially it was a showcase with a highly competitive generation market, but the deep macro-economic and political crisis in 2001 and 2002 and the subsequent devaluation of the peso led the government to freeze consumer electricity prices below cost. This, in turn, created a need for credit support to generating companies and government involvement in generation expansion. Eventually, the government resorted to the establishment of a new public firm (Arango et al., 2006b; Rudnick et al., 2005).

Brazil was also confronted with the need to adjust its power sector by the end of the 1980s. Until then, the centralized power system of Eletrobras, largely based on hydropower, had been expanding significantly. A macro-economic crisis led to the need

for foreign investment in the sector. However, tariff adjustments and the lack of a stable regulatory environment posed obstacles to private investors (De Araújo et al., 2006; De Araújo et al., Chapter 15 in this volume). The adoption of a price mechanism that protected the operators of hydropower plants, at the expense of thermal gas-fired power plants, further discouraged private investment. Reform efforts stalled during a major power crisis in 2001 and 2002, when a drought led to the rationing of electricity for 9 months. It was concluded that spot prices were inadequate for signaling the need for investment, considering the price volatility of a hydro-based system and the large fluctuations in the growth rate of demand that were due to periodic economic crises. Within this context, the leftwing government that was elected in 2002 re-established central planning based upon hydro generation, involving cost-plus pricing and power purchase agreements for existing and new capacity, including a capacity mechanism in the form of mandatory forward contracts (Rudnick et al., 2005).

In **Mexico**, the drive for reform has not been very strong, perhaps because the traditional system was successful in providing electricity to more than 96% of the population. Historically, the state-owned utilities could purchase oil at subsidized prices from the large publicly owned oil industry. In the mid-1980s, pressure arose to restructure the power sector, as part of a general wave of market reform in other sectors of the Mexican economy (Carreón-Rodríguez et al., 2003). This involved reforms in tariffs and fuel pricing, the creation of an IPP scheme by 1992, the creation of a (fragile) regulatory commission (CRE) by 1993, and the establishment of a new tariff structure in 2000. The current move toward populism, common in many countries in Latin America, has caused the policy to shift away from further private involvement in the power sector.

Toward the end of the 1980s, the government of **India** was confronted with strong economic development, associated growth in power consumption, and limitations on public resources. The central government responded by trying to attract private investment in IPPs within the traditional framework of the State Electricity Boards (SEB), but this attempt failed. Consequently a decentralized approach was undertaken by a new reform-oriented national government, in which the federal states were left free to adopt their solutions. In most states, the transmission company was given the role of single buyer. While this involved a combination of decentralization and corporatization, states were able to maintain their influence in the sector. The role of IPPs remained marginal. Political opposition to market-based tariffs by farmers and others who previously had enjoyed relatively low tariffs led to their continued cross-subsidization at the cost of industrial and commercial consumers (Tongia, 2003). As a consequence, industrial users started to engage in self-supply, thereby reducing their contribution to the cost recovery of the network and public generation. The financial situation of the single buyers continued to be weak as a consequence. At the instigation of the central government, State Electric Regulatory Commissions were established, but they were unable to improve the situation. Currently there appears little motivation for reforms, but the gap between the regulated tariffs and the cost of investment may force change in the future (Tongia, 2003, p. 58).

Several countries in **South-East Asia**, like Thailand, the Philippines, Malaysia, and Indonesia, have implemented modest forms of restructuring, generally involving IPP investments under power purchasing contracts. A crucial element was the robustness of these contracts during the Asian crisis at the end of the 1990s. Due to the relatively stable institutional and political framework, IPP investments in Thailand and the Philippines survived the South-East Asian crisis better than in Malaysia and Indonesia, which were affected by political clientelism, under which local and national politicians provided advantages and protection to the incumbent firms (Henisz and Zelner, 2001).

The following picture emerges with respect to developing countries with strong demand growth. Reform was typically triggered by a large need for capital to finance the rapid expansion of the sector. For political reasons, the strong position of the publicly owned incumbents was often used for continuing the dominance of the state, which led to hybrid markets in which private initiative had a limited role. Usually, market restructuring was limited to allowing IPPs and/or establishing a single buyer model in order to minimize investment risk (Heller and Victor, 2004; Victor and Heller, 2006). In markets with wholesale competition, or a single buyer without retail competition, it is not necessary to unbundle the distribution networks and to regulate access to them.

This model yields an ambiguous, unstable situation, particularly in the context of the macro-economic shocks that have occurred in many of these countries. Often, governments have sought to provide security to investors, for instance through a single buyer who would offer very long-term power purchasing contracts. Due to these macro-economic shocks, exchange risk became a serious issue to foreign investors that required adjustment of these contracts, which sometimes happened and sometimes did not.

In most developing countries the introduction of retail competition has not been considered an option, as domestic consumption is often so low that it is not worth the restructuring and transaction costs. Especially in countries with substantial poverty, governments have attempted to protect the poor from high energy prices, for example by keeping consumer prices below average cost via cross-subsidization, or by squeezing the revenues of the IPPs. This of course discourages investment and causes a return to the initial problem of capital scarcity (see also Williams and Ghanadan, 2006).

2.3.2. *OECD countries: the United States*

The restructuring of electricity markets in the United States took place in a more decentralized manner than in the EU. A series of initiatives of the Federal Energy Regulatory Commission (FERC) brought about considerable development in open access to large-scale regional transmission systems, but FERC has not been able to implement a single market design. An explicit attempt at doing so in 2002, FERC's Standard Market Design, failed due to opposition from the states and lukewarm support from the Federal Government. Consequently, the states have considerable room for deciding whether and how to restructure. Due to significant differences between the electricity market context and between the interests of stakeholders in the states, a variety of restructuring paths have developed. According to Joskow (2005a), a key obstacle to the "difficult and contentious" reform process in the United States is a lack of political willingness.

A number of states did not go further than opening up their transmission lines to wholesale "wheeling." A lack of network capacity and of network unbundling hampers wholesale trade in many regions. Other areas have better-developed wholesale markets, most notably the East Coast, California, and Texas. Market designs vary, but there is a preference for integrated markets with locational marginal pricing and for capacity mechanisms for stimulating investment in generating capacity (except in Texas). In addition to differences in the design of these capacity mechanisms, electricity markets in the United States vary with respect to price caps, retail price regulation and default supplier regulations, the position of the system operator, and network unbundling and access regulations. Differences between market designs reflect differences in interests and political influence of different stakeholder groups such as generators and consumers (cf. Cronin and Motluk 2006). The success of retail competition has been limited (Blumsack et al., 2005). The interest of consumers in switching to a different electricity provider has been minimal – perhaps

due to the attractiveness of staying with the regulated prices of “default providers” – and in general there was no noticeable decrease of retail prices (cf. Joskow, 2006; Newbery, 2005b).

An interesting difference between the United States and Europe is the preference for integrated markets in the former and decentralized markets in the latter, using Hunt’s (2002) terminology. In Europe, there was a deliberate choice against the integrated model, as it would put too much power in the hands of the integrated system and market operator. In addition, the decentralized system, with physical bilateral trade, was deemed more transparent, while in the United States, the same reason was used in favor of integrated markets (Blumsack et al., 2005). This illustrates the degree to which bounded rationality plays a role.

It can be concluded that there is a patchwork of more or less interconnected hybrid markets and supply systems in the United States. This patchwork is the consequence of the large variety in political decision making regarding the reform approach in the individual states, reflecting local conditions, as regards primary fuel supply, age of plant, structure of demand, and interconnection (see Joskow, 2005a). Many of the substantive issues of market design are decided at the state level, whereas the FERC provides general guidelines on particular aspects of interstate aspects of the market. Political and interest group pressure drives the states’ choices, primarily, toward optimizing the design of their local market from their own perspective.

In the restructuring process in the United States, state governments have had to confront a number of regulated private companies. Some of these firms defended their positions, but others saw a window of opportunity for expanding outside their franchise areas. Nevertheless, unbundling typically involved a struggle over compensation payments for “stranded cost.” Incumbent firms tried to maintain their strong market position by obstructing competition or through mergers, if they were not taken over. In some states the process of restructuring was effective in the end, whereas in others it was limited to minimal compliance with FERC standards.

Despite this mixed picture, the United States tends to be more inclined to pursue effective competition with a larger number of smaller players than European countries, perhaps because the United States is endowed with sufficient indigenous energy sources whereas the EU is severely dependent upon imports of fossil fuels. For the latter, the purchasing power of their energy companies in the international fuel markets is thought to play an important role with respect to security of supply issues. A tendency toward large, national gas and power companies can be observed in Europe, whereas the North American gas industry is much more fragmented and hence more competitive.

The US experience underlines the significance of path dependency and learning effects. The industry structure at the outset of liberalization drove the political commitment to restructuring in particular states. States developed a variety of approaches to restructuring, based upon their particular circumstances, starting situations, and preferences. Over time, states have the opportunity to learn from each other, so something of a natural selection model develops. The success of some states in overcoming problems common to other states provides an example to others. The PJM system appears to have this role. PJM Interconnection is the regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia. In this respect Joskow’s argument (2006) about the lack of a generic model, as in the EU, may also be construed as an advantage. In the EU, the pressure of such a common “one size fits nobody” model appears to generate

considerable resistance, whereas the American diversity of approaches may in the end lead to voluntary convergence upon a preferred model (Weinmann, 2007).

2.3.3. OECD countries: Europe

With the exception of the United Kingdom, the Netherlands, and Scandinavian countries, the restructuring of electricity markets in Europe is driven by EU policy. The European Commission (EC) started with a rather loosely defined model of sector reform – with clear Anglo-Saxon principles – but has imposed increasingly strict requirements with respect to market design (CEC, 1996, 2003). The intention of the EU was to increase economic efficiency through the introduction of competition and thereby reduce end-user prices. With respect to the goal of sustainability, restructuring is also intended to facilitate the application of economic instruments, most notably the CO₂ emissions trading system. The goal of security of supply, the third general policy goal, is expected to be served by restructuring, as the unbundling of the industry and the introduction of competition where possible should lead to optimal investment in each link of the value chain. Moreover, well-functioning markets should promote diversity, which provides resilience in case of disturbances.

Recent reports by the EC show that these objectives have not been reached (CEC, 2006a, 2007b). The Sector Inquiry provides a thorough analysis, supported by a wealth of empirical data, that shows that European electricity markets are far from integrated and in most cases also far from competitive (CEC, 2006b, 2007c). A main problem is that the restructuring effort focused on market design but ignored competition issues and horizontal integration in most member states. Consequently, many member states' electricity markets are dominated by a very small number of companies. Other important shortcomings are as given below:

- Insufficient unbundling of the transmission networks from generating companies. The EC now strives for ownership unbundling or, if that is not feasible, the creation of independent system operators (ISOs).
- A lack of effective regulation (in particular in case of incompletely unbundled networks) and too strong a focus by regulators on their national markets instead of on the development of the EU internal electricity market.
- A continuing lack of sufficient transparency. The availability of information varies significantly between member states.
- Inadequate capacity of the infrastructure between member states.
- Insufficient network security standards.
- Insufficient signals for investment in generating capacity.

Many of the “hard” measures that are prescribed by the EC have been implemented only pro forma, which has not led to an effective single market or even a set of competitive national or regional markets. Member states strategically interpret and implement the directives and guidelines of the EU, their main concern being their own (future) position within the emerging EU energy market. Countries differ with respect to their commitment to, and faith in, competition, which appears to have an important impact upon the extent to which effective competition is created. Table 2.3 presents an overview of the present state of restructuring in the EU. Three groups of countries can be discerned

Table 2.3. The state of restructuring in the EU

	GDP in PPS 2006	Population (in millions)	Wholesale market					Transmission		Distribution		End-user price regulation	Regulator
			Concentration		Ownership	Market opening	Institutions	TSO Unbundling	Ownership	DSO Unbundling	Ownership		
			Largest	Top 3									
<i>Greece</i>	85	11	100	100	Public	62	Pool	Legal	Public	Acc.	Public	All	OK
<i>Cyprus (d)</i>	88	0,7	100	100	Public	35	Bilateral	Legal	Public	Legal	Public	All	Weak
<i>Malta (d)</i>	70	0,4	100	100	Public	0	None	None	n.a.	Int.	Public	All	Multi
<i>Latvia</i>	52	2,3	95	100	Public	76	None	Man.	Public	Int.	Public	All	OK
<i>Estonia</i>	65	1,3	90	100	Public	10	None	Legal	Public	Exempt	Public	All	Weak
<i>France</i>	107	59,9	85	95	Public	70	OTC/PX	Legal	Public	Own.	Pub/loc	All	Weak
<i>Belgium</i>	118	10,4	85	95	Private	90	None	Own.	Private	Legal	Private	Dom.	Weak
<i>Slovenia</i>	84	2	70	95	Public	75	None	Legal	Pub?	None	Public	Dom.	Weak
<i>Ireland</i>	139	4	85	90	Public	56	VIPP	Own.	Public	Own.	Public	All	OK
<i>Luxemb. (d)</i>	257	0,5	14	?	Mixed	57	None	Legal	Private	Legal	Private	Dom.	Weak
<i>Portugal</i>	70	10,5	50	80	Mixed	100	Bilateral	Own.	Mixed	Legal	Public	All	OK
<i>Poland</i>	51	38,2	15	35	Public	52	Bil./PX	None	Public	None	Public	All	Weak
<i>Slovakia</i>	59	5,4	75	85	Mixed	66	Bilateral	Legal	Mixed	Legal	Mixed	Dom.	OK
<i>Lithuania</i>	55	3,4	50	80	Public	0	Bilateral	Legal	Public	Own.	Public	All	OK
<i>Spain</i>	98	42,3	40	80	Mixed	100	Pool	Own.	Public	Legal	Mixed	All	Weak
<i>Czech Rep.</i>	76	10,2	65	75	Mixed	100	None	Own.	Public	Acc.	Mixed	None	Weak
<i>Italy</i>	99	57,9	55	75	Mixed	79	PX	Own.	Mixed	Legal	Mixed	All	Strong
<i>Austria</i>	123	8,1	45	75	Public	100	None?	Legal	Public	Legal	Public	None	Weak
<i>Germany</i>	110	82,5	30	70	Mixed	100	Small	Legal	Mixed	Acc.	Mixed	Dom., com	Weak
<i>Hungary</i>	64	10,1	30	65	Mixed	67	Bilateral	Legal	Public	Acc.	Mixed	All	Weak
<i>Netherlands</i>	126	16,2	25	80	Mixed	100	PX	Own.	Public	Legal	Mixed	None	Strong
<i>UK</i>	117	59,6	20	40	Private	100	Large	Own.	Private	Own.	Private	None	Strong
<i>Sweden</i>	116	8,9	15	40	Private	100	PX	Own.	Private	None	Public	None	Strong
<i>Denmark</i>	122	5,4	15	40	Mixed	100	PX	Own.	Public	Exempt	Public	All	Strong
<i>Finland</i>	113	5,2	15	40	Mixed	100	PX	Own.	Mixed	None	Public	Dom.	OK
<i>Norway</i>	169	4,6	15	40	Public	100	PX	Own.	Public	Legal	Public	None	OK

Sources: CEC (2005), (2006a,b), (2007a); Haas et al. (2006); EFTA 2007.

with more or less comparable characteristics regarding the implementation of the EU Directives.

The first group is characterized by a highly concentrated market and a near monopoly of the incumbent. This is generally paired with weak unbundling, absence of retail competition, and regulated tariffs for all consumers. This group includes many of the small new accession countries like in Estonia, Latvia, and Slovenia, which have low incomes and an underdeveloped post-communist institutional framework, and islands such as Malta, Cyprus, and Ireland, whose size limits the options for competition. The limitations of small, isolated systems are recognized by the EU and they may obtain a derogation of substantial parts of the EU Directive 2003/54/EC, art 26. Also traditionally state-oriented, monopolistic countries such as Greece, Portugal, France, and Belgium are in this group, in which a negative attitude toward competitive power markets dominates. Consequently, the governments in these countries see no pressing motivation, or possibility, for bringing about change. This is either because of their difficult economic position or because of their being captive to electricity industry lobbies, via the channels of business and labor interest. This position is also reflected in the generally weak position of regulators (see Glachant and Finon, 2005; Finon, 2003; Meritet, 2007). In addition, the absence of indigenous resources has given rise to the nuclear energy policies of France and Belgium.

In the second group the market is moderately concentrated. Most countries have opened their markets fully, but the degree of network unbundling varies and in some cases price regulation is applied. This group is fairly heterogeneous and includes new accession countries such as Hungary, the Czech Republic, Poland, and Lithuania, plus long-standing member states such as Germany, Spain, Austria, Italy, and the Netherlands. These countries are characterized by the fact that their electricity industry always included multiple companies. In the central European countries the common objective to get rid of their past dependence on energy supply from Russia is a strong driver for change. Particularly these industrialized countries may harvest the advantages of improving the competitiveness of their economies. However, social and regional antagonisms need to be solved and economic problems arise in this process. The group of long-time EU members is characterized by a variety of governance traditions, ranging from corporatism to clientelism. Generally, intra-industry relations are relatively informal, but the industry is at some distance from the state. These countries all depend to a large extent on imported fuels.

Generally, public policy in these countries needs to balance between opening up the power sector and their strategic interest with respect to security of supply and the survival of their national industries. In Spain and Germany, the use of indigenous coal and lignite has been supported to protect the jobs of miners. The multiple objectives cause conflicts between the state, regulators, and the industry, while political parties remain divided over restructuring issues. Compromises in the restructuring policy are the consequence. For example, Germany was one of the first EU members to fully open up its electricity market. However, as the cooperating incumbents were not required to unbundle their networks and because network access and tariffs were not regulated, the market remained virtually closed to new entrants. Only recently the process was given an impulse by the establishment of an independent regulator and the further implementation of the EU Directive (see Brunekreeft and Twelema, 2005). During the 1990s, the Netherlands appeared to make a strong shift toward the Anglo-Saxon model. However, after years of intense conflicts between the electricity sector and government, there now appears to be a movement back toward a more consensus-based approach in which network tariff regulation is less strict and companies are more involved in rule making. As a defense against foreign influence in the industry via takeover, the Dutch government decided

to prohibit privatization of the networks (Van Damme, 2005). The Spanish process of adjustment is also rather conflictive. From its protectionist background, the Spanish state chose for a policy of restructuring from a position of "strength," allowing the national industry to compete with foreign firms, at home and abroad. Given the diversity of interests in the Spanish system and their relations with the polity, this policy does not produce clear guidelines and choices. This is also illustrated by the ongoing struggle between the government and industrial interests over the position of the electricity company Endesa (Crampes and Fabra, 2005; Serrallés, 2006).

The third group of countries, consisting of the United Kingdom and the Nordic countries, are the most liberal, with low market concentration, integrated markets (in Scandinavia), and retail competition. These countries have deliberately chosen, on an ideological basis, to liberalize their power systems, by dismantling their former monopolies and restructuring their industries. In the United Kingdom, an important additional objective for restructuring was the limitation of the coal miners' union power. The strength of these countries appears to be their relative independence from imports and their access to a variety of fuels, which has ascertained their belief that the process of allocative decision making can be trusted to the "internal" market. Moreover, the institutional context of these countries places organized industrial interests at some distance from policymaking, while economic growth and ideology make them less vulnerable to the consequences of occasionally high consumer prices (Kinnunen, 2004). This process is illustrated by the political reactions to the electricity prices spikes in the Nordpool market in 2001 and 2003 and the price hikes in the UK gas market during the winter of 2005–06.

An important explanatory factor for the market situation in European countries appears to be the initial ownership structure of the power sector. Apparently, the existence of national monopolies, as in France, Portugal, Belgium, and Greece, makes it difficult for a government to create competition. The only exception is the United Kingdom that split up its Central Electricity Generating Board. The general solution is "fringe competition," the facilitation of "competitive" entry alongside the monopoly. However, because of the continued alliance between the dominant public monopoly and the state, the development of new institutional arrangements and the regulatory body proceed slowly. Price regulation needs to be maintained against the market power of the monopoly, but this often harms the interests of (potential) new entrants (Glachant and Finon, 2005).

If the government is confronted with a number of vertically integrated firms that are publicly owned, whether by the state or by provinces and/or municipalities, the situation appears relatively straightforward. Unbundling, the introduction of access rules and tariffs, and wholesale and retail competition can be established by political decision making. Main causes of resistance are conflicts of interest between public bodies at different levels and interest groups clamoring for consumer protection, environmental issues, and the unions. Eventually, this state of affairs may progress and lead toward privatization. When the government needs to confront a number of private firms the situation is more complex. In the EU it can be doubted whether effective unbundling is legally possible, as it may be considered expropriation.

States that only reluctantly accepted liberalization may try to protect the interest of their "national" firms through influencing its quasi-independent regulator, assuming that they will serve the country better than new entrants. This argument runs two ways. If new entrants are private firms, they are thought to be driven only by profits and ignorant of the public character of electricity supply. If the new entrants are foreign public firms, the situation is also suspect, as these firms are thought to give preference to their home market in case of supply problems.

The European markets have witnessed the emergence of a set of large multinational conglomerates, the so-called seven brothers (see Thomas, 2003; Green, 2006; Haas et al., 2006) that extend their activities by taking over energy companies in their home country and abroad. These companies may be considered as (potential) competitors in the future pan-European market. Their purchasing power in the international fuel markets is often brought forward as an important asset with respect to security of supply issues, as it provides a counterbalance to the market power of Gazprom and the Middle Eastern gas suppliers. On the other hand, the EC recently announced plans to take on the dominant position of companies such as Electricité de France, E.On, RWI, and ENI (EC, 2006, 2007).

In response, governments of countries that are not home to one of the seven brothers feel an even stronger need to protect their power market against “foreign domination,” either by establishing their own mini-champions or by keeping the market relatively closed to takeovers, for instance by a minimalist implementation of the Directives or by not privatizing their companies. So while these governments may sound supportive of the notion of introducing competition and may not oppose the corresponding changes to the market design, they may oppose attempts to really restructure the market. This situation causes inconsistencies, on/off policies, and a slow development of an effective market. It also leads to competition between the EU member states’ “national” companies, which has led to the reintroduction of a great deal of economic nationalism in the restructuring process, often veiled in terms of environmental protection, security of supply measures, or public service obligations.

2.4. Analysis

This section will review how the empirical evidence that was presented in Section 2.3 fits with the conceptual framework that was proposed in Section 2.2.5. While in general, the empirical observations appear to match our expectations, it is now possible to fill in the blanks in the conceptual framework.

Clearly, restructuring processes are driven by a wide variety of objectives. Much of the literature describes projects that were meant to evaluate and support policies of particular organizations, such as the World Bank and regional organizations such as the EU, APEC (2000), and industrial associations, which is why these studies tend to focus on sets of relatively comparable countries with similar objectives. Without such a restricted focus, a rich variation in motives for restructuring and in the backgrounds of such processes emerges.

After the adoption of the single European market in 1985, liberalization became a priority for the EC, initially as the main instrument for removing the existing intra-communal barriers to trade and later as an objective on its own merit (Haaland and Matlár, 1997). In addition to economic efficiency, an important motive is the idea that open markets would increase the interdependence of European countries and therefore bring them closer together. However, the goal of competition is not shared by all EU member states and some have restructured merely in order to comply with the Directives. Even when states believe in competition as a means of maximizing social welfare, they will need to balance the commitment to restructuring with other policy goals. Country-specific motives also play a role, such as in the case of Britain’s Prime Minister Thatcher, who used liberalization of the electricity industry and the subsequent dash for gas as a means to put an end to the political power of the coal unions (Parker, 2000). Similar decisions are

made by states in the United States that need to comply with FERC regulations (Joskow, 2006).

The end of the Communist regimes in the Soviet Union (Tompson, 2004; Balaschak, 2006) and its former satellite states in Eastern Europe and elsewhere was the starting point of a "transition" toward a market-based economy. In these countries, restructuring the electricity sector was part of the general economic transition, which was partly an autonomous process and partly driven by the prospect of EU membership.

Developing countries, which inherited the industry structures from their former colonizers, have announced restructuring plans on a large scale. In some cases restructuring is a direct corollary of the existing political ideology and economic strategy. However, Victor and Heller (2004) argue the principal driving force for reform is financial: "Even in cases where reformers have held the reins of power, substantial reform has rarely followed until the state dominated system is bankrupt and the lights are dimming." Within the context of a financially fragile public sector, this meant that investments in the supply and provision of electricity would have to be undertaken mainly by private operators and funded by private funding agencies.

In many developing countries, however, restructuring was imposed by the IMF or the World Bank as part of economic support packages (see Rosenzweig et al., 2004; Yi-chong, 2006; Potts Voll et al., 2006). Generally, these packages are geared toward providing the necessary investment in infrastructures and *institution building* to facilitate further development of these economies (Thomas, 2006). Hence, expanding and renovating the electricity system in developing countries requires a certain degree of restructuring and a shift in the role of government and publicly owned firms. The relatively weak capacity of the public organizations and the allegedly more efficient operation of private sector firms is also a motivation for restructuring (Bacon and Besant-Jones, 2001; Victor, 2006).

In other developing countries the situation is somewhere in between these two extremes. Restructuring may be undertaken voluntarily, not because of an inherent faith in competitive markets, but as a means of attracting foreign investment. The restructuring process in these countries is vulnerable. A shortage of electricity in a competitive market or high fuel prices (which may also be caused by a devaluation of the local currency) may cause high electricity prices, which may be socially and politically unacceptable. The temptation would be strong to re-regulate prices, which, without compensating measures, would discourage investment, returning the country to the original problem of attracting investment.

So whereas the introduction of competition is often presented as a logical and inescapable consequence of the superiority of "the market" as an economic coordination device, it can be observed that a range of different motives exist in different countries and at different times. Shifts in drivers and process dynamics lead governments and market parties to adjust their strategies (see Green, 2006). Hence, when evaluating the progress in restructuring and the emergence of hybrid markets, it is necessary to distinguish the initial drivers behind the process from later adjustments to them. Indeed, Rudnick et al. (2005) and Sioshansi (forthcoming), respectively, refer to "second stage" and the "reform of the reforms."

The impact of related policies, such as environmental policies, upon market design appears to be limited. These policies are typically achieved through other means, such as standards or taxes. The main exception is security of supply of primary fuels, which may run counter to the drive to create a market with many small competitors, as the perception may exist that the market power of large firms is needed to secure good fuel import contracts.

In summary, with respect to the motives for restructuring, empirical analysis shows that governments may or may not:

- support a *neo-liberal program* in order to enhance the efficiency of public sector management in the broadest sense by privatization and restructuring;
- seek to *enhance the efficiency of their power systems specifically*, to achieve lower supply prices, to improve quality of supply, and to diversify their fuels;
- seek *private investment* in their electricity industry, to facilitate an expansion of their supply potential and therefore accept some degree of restructuring, most likely involving higher prices to (groups of) consumers;
- seek to *achieve market integration* with (groups of) adjoining countries and accept some degree of reduction in their autonomy over “public interest” sectors, in exchange for advantages for other economic sectors;
- support integration with neighboring markets, for the purpose of *exploiting (potential) advantages in exporting or importing power*, or by engaging in the electricity industry of associated countries;
- restructure merely to *satisfy requirements of other authorities*, such as the EU, the FERC, the IMF, or the World Bank.

Of the *exogenous factors* that were proposed in Section 2.2.1, two, apart from the cultural and ideological commitment to competition as a means of maximizing welfare, stand out. The first is the level of economic development, in which a high income per capita generally correlates with a lower rate of growth in electricity demand and the presence of a relatively stable legal and policy framework. Lower income countries often experience higher rates of growth in their electricity demand, but also experience higher risks of economic and institutional instability. Consequently, investment risk is higher and they face greater difficulty in attracting sufficient investment capital. Indeed, a competitive energy-only market significantly raises investment risks. To reduce this risk, the introduction of competition can be limited to wholesale competition or be accompanied with a capacity mechanism (De Vries, 2007).

A second important exogenous factor is the availability of indigenous primary energy resources, like hydropower, coal, petroleum, or gas. Hydropower fundamentally changes the dynamics of the market, as peak capacity is cheap, but the total amount of energy stored in the reservoirs needs to be spread out over the dry season. Coal exploitation is often associated with employment and social issues. Petroleum production generally yields high revenues to the state, thus reducing financial pressures to restructure, while supporting particular political interest coalitions in maintaining the status quo. The presence of (un)tapped natural gas reserves may support pressures to restructure the power industry, as it promises low (capital) cost and an efficient expansion of generation capacity. Here geopolitics and the organization of the gas industry are important variables. Countries that are endowed with sufficient indigenous energy sources show a stronger tendency to pursue effective competition with a number of smaller players. In contrast, in Europe, resistance to privatization and horizontal unbundling is sometimes linked to concerns about fuel import dependency, in particular with respect to natural gas (Correljé and Van der Linde, 2006).

Due to path dependency, history matters. Decisions made in the past affect future options. Therefore, the *situation at the start of the restructuring process* has a significant impact upon the restructuring process and its outcome. Most important is whether at the outset of restructuring there is a national monopoly in the power sector or a number of regional firms. Glachant and Finon (2000) consider the presence of an incumbent monopoly

the “Achilles’ heel” of restructuring as it will be difficult for a government to split it up in order to create competition, especially if the company is privately owned. A likely outcome is the facilitation of “competitive” entry alongside the incumbent. Empirically, this situation is observed in developing countries, where IPPs were encouraged, and in some EU countries. If the alliance between the (public) monopoly and the state is continued, new institutional arrangements and a regulatory body develop only slowly. To mitigate the market power of the monopoly, price regulation needs to be maintained, but this often harms the interests of (potential) new entrants. Also, with respect to vertical unbundling, ownership is an important factor. If incumbent, vertically integrated firms are publicly owned, unbundling, the introduction of access rules and tariffs, and wholesale and retail competition are more or less easily established through the political process. In addition to opposition by the incumbents, the main sources of resistance to restructuring may be public bodies at different levels and with different interests, consumer protection interest groups, environmental advocacy groups, and, last but not least, trade unions.

When a government wishes to restructure private firms, the situation is much more complex. Unbundling often involves a struggle over compensation payments for “stranded cost.” Moreover, the incumbent firms will try to maintain their oligopolistic position by obstruction of the market or by mergers, or they may be taken over by foreign firms. On the other hand, if the state only halfheartedly pursued liberalization in the first place, it may try to protect the interests of the “national” firms, for instance because they are presumed to serve the country better than foreign parties, the more so if these firms have other public tasks. This situation causes inconsistencies, on/off policies, and a very slow development of an effective market.

Taking all these issues into consideration, what is the prospect for agreement upon a single market design? To the extent that exogenous factors or fundamental differences in policy objectives are the causes of differences in the market design, they will likely have a lasting effect and multiple market designs are likely to continue to coexist. Examples are markets in which concerns for security of supply, particular physical conditions, or high investment risk have prompted government intervention. On the other hand, when variations in market design are due to differences in opinion regarding the means, in a context of similar policy goals and similar exogenous conditions, one would expect that mutual learning would eventually lead to convergence of the market design. North (1990), however, warns that this may be a slow process. The bounded rationality of the actors contributes to path dependency in which preexisting patterns are replicated with only modest alterations. This may explain, for instance, the preference for integrated markets (with mandatory pools) in the United States versus the decentralized markets of Europe, as well as the presence of capacity markets in the United States and their absence in Europe.

2.5. Conclusions

This chapter has presented a framework for explaining the many differences in the approach to electricity market restructuring around the world. A number of policy objectives exist with regard to power market restructuring; the particular *institutional context* has a strong influence upon which policy objectives are chosen and how they are prioritized. Implementation of these objectives takes place through two main policy areas: the market design process and competition policy (including the policy with respect to horizontal unbundling of dominant incumbent firms). This process is constrained by external factors such as the economic climate and the physical situation in a country. In addition,

the situation at the outset of the restructuring process influences the process itself. Due to path dependency, this influence may be long-lasting.

Feedback exists in the sense that governments observe the performance of the electricity market and respond by adjusting their policies. This feedback is limited by time lags, incomplete data, bounded rationality, and the fact that much of the feedback represents the perspectives of lobbyists. The limitations of the information feedback loop give rise to path dependency: given uncertainty about the best direction for policy, decisions that generate the least resistance are favored, which means those that depart the least from the status quo. A second cause of path dependency may be that the government is not able to overcome resistance to change by vested interests.

This framework has helped to explain the diversity of restructuring processes and market designs that can be observed. The prospects for future convergence of these different market designs hinge upon a number of factors:

- The policy goals and their relative weights vary. A key factor is whether the restructuring of a country's power sector is ideologically and politically motivated or whether it is more or less forced upon a country by a higher authority, the latter often leading to a half-hearted and unstable approach.
- Due to path dependency, the situation at the start of a process of restructuring significantly influences the potential for competition, especially the degree of concentration and whether or not the industry is already privatized.
- Exogenous factors, such as physical scale, endowment with natural resources, and macro-economic conditions, may have a dominant influence upon the design of the market. Countries that are endowed with sufficient indigenous energy sources tend to be more inclined toward pursuing effective competition with a number of smaller players than countries that are severely dependent upon imports of fossil fuels.

When exogenous factors or fundamental differences in policy objectives are the causes of differences in the market design, there is little prospect for convergence of market designs. Otherwise, if the circumstances and policy goals are similar, mutual learning should lead to convergence, but this process is limited to similar markets and will be slow due to the imperfections of the policy feedback loop.

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