Emergent strategies of electricity producers

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Abstract

The EU-funded research project EMELIE (Electricity Market Liberalisation In Europe) wants to provide a sound analysis of the economic and environmental impacts of the liberalisation process of the European electricity markets. The EMELIE model simulates various market scenarios. The companies in the EMELIE model are assumed to have a relatively simple strategy, i.e. profit maximisation, which is constrained by trade limitation, emission quota, and available production capacity for various technologies.

The Institute for Environmental Studies, IVM, Vrije Universiteit Amsterdam, partner in the EMELIE project, took the initiative to start a complementary line of research. At a more detailed level, we investigated business strategies from the perspective of the companies themselves: What is their dominant strategy in the process of liberalisation? Why do they behave like that? *What will be the likely strategy of dominant companies in the years to come? And last but not least: how does this most likely strategy fit into the stylised EMELIE scenarios?*

In our analysis, we use theories about business behaviour, like the *Portfolio Analysis* of the Boston Consulting Group and *Porter's Typology of Business Strategies.* We also consider two theories that relate to company-authority interactions: *Williamson's New Institutional Economics* that compares market failures with government failures and *Tinbergen's Theory of Economic Policy,* that warns for exaggerated expectations of a single policy instrument, in this case market liberalisation.

We observe that the liberalisation process has brought about a wave of mergers and acquisitions, resulting in concentrated markets. Concentration Standards of Competition Authorities decide on maximum concentration levels, not the market itself.

The trend towards market concentration originates because dominant companies want to avoid price competition and consider *strategic market behaviour* in their best interest. These expansionist' companies prefer proven production technologies with low variable costs like coal, lignite, nuclear and hydro. They want to retain an integrated business structure, being active in electricity production, trade, distribution and sales. The dominant players leave it to niche players to experiment with new production (e.g. renewable energy sources) and trade arrangements.

Market concentration remains the dominant trend. Because Regulators will not accept more mergers at the national scale, dominant companies look for international opportunities. We expect that, as soon as public shares become available to private companies, international cross-ownership will increase. To prevent quasi-monopolies, forced splitting of companies comes into the picture. France and Belgium are candidates, but perhaps Germany and the Netherlands as well.

As for environmental protection, separate instruments at the EU and national levels have to remain. As for security of supply, discussions focus on instruments to guarantee sufficient generating capacity. The necessity to introduce new instruments in order to guarantee security of supply is hotly debated, but undecided yet.

1. Introduction

Liberalisation of electricity markets in the EU is in full swing. According to EU Directives, full liberalisation must be accomplished by 2007 in all member states. In the Netherlands, market opening will be completed in July 2004 when households are free to choose their electricity provider. Nordic countries, Germany and UK have liberalised their energy markets earlier, countries like France and Belgium will follow later.

The EU- funded research project EMELIE (Electricity Market Liberalisation In Europe) wants to provide a sound analysis of the economic and environmental impacts of the liberalisation process of the European energy markets. The project investigates various scenarios given the dynamics of the electricity markets, taking into consideration market power and leadership, cross ownership, electricity trading, environmental constraints, and emission permits. In its present form, the EMELIE model includes eight European countries: Belgium, Denmark, Finland, France, Germany, the Netherlands, Norway, and Sweden (EMELIE, 2004).

EMELIE is a computational game theoretic optimisation model. Companies in the model are assumed to have a relatively simple strategic objective, i.e. profit maximisation, which is constrained by trade limitation, emission quota, and available production capacity for various technologies. When EMELIE speaks about companies, it means producers of electricity. Traders of electricity that do not own power plants are not covered by EMELIE.

The Institute for Environmental Studies, IVM, Vrije Universiteit Amsterdam, partner in the EMELIE project, took the initiative to start a complementary line of research. At a more detailed level, we investigate business strategies from the perspective of the companies themselves: What is their dominant strategy in the process of liberalisation? Why do they behave like that? Do they see alternatives? How do they consider their competitors? And last but not least: *What will be the likely strategy of dominant companies in the years to come? And how does this most likely strategy fit into the stylised EMELIE scenarios?*

This report starts by presenting relevant theories about business behaviour. Chapter 2 explains differences between strategic, tactical and operational business management. We focus on strategic and tactical management, because medium and long-term business decisions will be decisive for the future of electricity markets.

Chapter 3 presents *propositions* about business behaviour, derived from *Portfolio Analysis* of the Boston Consulting Group and *Porter's Typology of Business Strategies.* Chapter 3 also considers two theories that relate to company-authority interactions: *Williamson's New Institutional Economics* that compares market failures with government failures and *Tinbergen's Theory of Economic Policy,* that warns for exaggerated expectations of a single policy instrument. Is it realistic to expect that a single instrument, liberalisation, will bring the various societal benefits that the EU expects?

In Chapter 4 we analyse the present business structure in the EMELIE countries and how this structure came into being. Market concentration has been the dominating trend.

Chapter 5 discusses evidence on business strategies, while Chapter 6 discusses evidence on business-government interactions. The focus of this enquiry is on developments in the Netherlands, but lessons from countries where liberalisation is more advanced are included as well.

Based on the evidence presented in Chapters 5 and 6, Chapter 7 draws conclusions on our analysis of business strategies. Chapter 7 rounds off with implications for the use of the EMELIE model.

2. Business strategies and business tactics

In business literature, it is common to distinguish between strategic, tactical and operational management (Keuning and Eppink, 1987). Each type of management focuses on specific aspects of corporate policies (Table 2.1).

Strategic decisions relate to the *long-term* direction of a company. Business strategies relate to fundamental decisions management has to make about e.g. changes in product-market combinations and investments in production capacity. Investments in industrial production capacity typically last 10 years or more, investments in power plants typically last 30 years or more. Business *tactics* relate to *medium term* use of production capacity. In its tactical decisions, a company plans an optimal use of existing production capacity in relation to changes in markets, prices etc. The dominant goal is an *ex ante* optimal timing of business initiatives over several years, e.g. introduction of new products and bringing into operation of new equipment. In a sector with long-lasting assets, like electricity production, the realm of tactical planning can extend up to 10 years. *Operational* management relates to *short-term* implementation of business plans. In the current market turbulence, flexibility in day-to-day operations has become just as important as efficiency in production. A good example of operational management is the necessity to buy and sell KWh on the recently started power exchanges. Operating a dealing room for electricity demands specific skills like analysing price fluctuations and risk hedging (Van Grieken, 2004). In all sectors, also in electricity production, operational management fits within the annual planning–budgeting–monitoring–reporting cycle.

Table 2.1 Types of management decisions.

Type	Focus	Capacity investment	Time span
Strategic	Product- market combinations; Investment in production capacity	Yes	> 5 years
Tactical	Introduction of new products; Use of production capacity	No	1- 4 years
Operational	Marketing actions; Running of production processes	No	< 1 year

Source: Keuning and Eppink, 1987.

It must be kept in mind that borderlines between strategic, tactical and operational management are fluid. Moreover, successful management requires that all management functions are taken care of simultaneously. However, Table 2.1 provides a useful framework to assess the relationships between a multitude of business decisions.

With regard to electricity production in a liberalised market, strategic plans could include goals for the product-market mix (type of clients, service areas, *niche* markets) and for investments (acquisitions, power plants, fuel mix). In contrast, tactical plans contain a plan to use production capacity, a plan to enter new markets and guidelines for contingent responses to unforeseeable developments (equipment failure, power market). Operational management is responsible for day-to-day operations and for flexible responses to emergent problems and opportunities.

For the time being, we assume that a company in a liberalised market strives for conscious use of short-term market opportunities. This can take the form of active participation in newly emerging trading platforms (e.g. the Amsterdam Power Exchange APX), but also of a flexible use of production capacity in response to short-term price fluctuations or of the use of production capacity to induce price fluctuations (e.g. artificial scarcity of electricity in the network). A conscious use of market opportunities assumes a set of guiding principles that ideally are included in the tactical planning. We assume that these guidelines can be inferred from operational business decisions. Therefore, in the rest of this report operational management will not be a separate topic of research. We will distinguish between strategic management and tactical management. The main difference is that while in tactical management production capacity is fixed, in strategic management it is not.

A liberalised market puts much higher demands on corporate planning than planning in the traditional -quasi monopoly- power market. In a traditional setting the product-market mix is given (a homogeneous product is delivered to all clients in the service area) and investments relate to physical equipment only (acquisitions are not allowed; the fuel mix is heavily influenced by national energy policies). A tactical plan of a traditional company typically concerns the technical use of production capacity and emergency planning for equipment failure. Plans to enter new markets and plans to use market power are seen with suspicion. Comparing the demands on strategic planning by liberalised companies with the demands on strategic planning by traditional companies, it is fair to say that market liberalisation requires a *complete re-invention* of electricity companies. Traditional knowledge is insufficient to be successful on the emerging markets. Corporate learning and acquisition of missing knowledge are at the core of success in such changed market conditions.

Table 2.2 provides an overview of the relations between strategic and tactical management and the (sub) models of the EMELIE project.

Table 2.2 Management decisions of electricity producers and EMELIE models.

Type of decision	Capacity investments	EMELIE model
Tactical decisions Transition period 2004-2007	No	Static model
Strategic decisions- Transition period 2004-2007	Probably not	Static model
Strategic decisions- Liberalised markets after 2007	Yes	Dynamic model

NB 1 Mergers and acquisitions, to be discussed in Chapter 4, have both strategic (new markets) and tactical (no investments in new physical capacity) aspects.

NB 2 Operational decisions are not considered separately, because we suppose that tactical plans provide guidelines on how to react to short-run market risks and opportunities.

The static EMELIE model analyses the impacts of liberalisation in the present capacity structure. Investment decisions were not considered. Therefore, the static EMILIE model relates to *tactical* planning of electricity companies.

Even in the short-term capacity decisions play a role, especially at the firm level. For example, if nuclear has to be replaced, investments in new capacity have to be prepared.

Because impact on overall capacity remains limited, it is still acceptable not to consider capacity investments in the 2004-2007 period.

The dynamic EMELIE model -now under construction- takes a longer time horizon and allows for investments by expanding production capacity. Therefore, dynamic EMELIE models relate to *strategic* planning of electricity companies. Because building of new capacity implies use for commercial benefit, *tactical* use of the resulting capacity is included as well.

According to EU Electricity Directive 2003/54/EC, full liberalisation must be accomplished in 2007 (EU, 2003). The period 2004-2007 will be full of uncertainties. Every EU country follows a specific path towards the 2007 targets. This makes it useful to distinguish between business strategies for the *implementation period 2004-2007* and business strategies for *liberalised markets after 2007*. For electricity providers, the *2004-2007* period will certainly be a period of turbulence. In a period of turbulence, companies are inclined to follow a 'wait and see' strategy, postponing big investments and keeping as many options open as possible (Wolmar, 2001). If companies deliberately avoid investments in new equipment, their strategy boils down to tactical use of existing capacity. Therefore, we expect the static EMILIE model be useful to study *tactical* planning but also to study *strategic behaviour in the 2004-2007 period.* The dynamic EMELIE model finds their proper place in an analysis of *strategic planning for the period after 2007.*

EMELIE is a computational game theoretic optimisation model, which considers besides physical aspects also markets, where size and ownership matter as well. Large and super large companies are able to influence market prices. In case of monopoly (a single dominant supplier) and oligopoly (a few dominant suppliers), corporate decisions are important for market results. A continuing dominance of oligopoly in electricity markets seems to be a realistic assumption (AER, 2003). A complication to the standard oligopoly model is cross-ownership, i.e. when large companies own subsidiaries in other markets. Cross-ownership has a potentially large influence on market outcomes, because cross-ownership increases market power (Amundsen and Bergmann, 2002). Chapter 4 analyses the energy markets in the EMELIE countries, the main actors in these countries and the occurrence of cross ownership.

But before we analyse these markets, the next chapter discusses theories about business behaviour and derive some propositions for the electricity market.

3. Theories about business behaviour

In this chapter we present theories that can help us to understand business strategies and business-policy interactions. Theories about business strategies originate from business economic literature. In order to understand business-policy interactions we use economic theories of government policy. The theories are well established in their fields of research. At the end of each section, we will formulate *propositions* on how the theory might work out in the field of electricity companies. In Chapter 5 we will test the *propositions* on business strategies, in Chapter 6 we test the *propositions* on business-policy interactions.

The following two theories on business strategies start from an analysis of product-market combinations. The *portfolio analysis* of the Boston Consulting Group shows dominant business strategies depending on the position of products in their relevant markets. Porter has developed a *typology of business strategies* a company can use to improve its market position.

Since the 1980s, Williamson has developed a set of theories that have become known as *New Institutional Economics.* Basically, these theories present a unified framework to analyse both market and government failures. In his seminal work on the *theory of economic policy*, Tinbergen has shown that a regulatory system must not be over-burdened. We think Tinbergen's principles remain valid to assess the frequently confused discussions that parallel the liberalisation process of EU electricity markets.

3.1 Portfolio analysis of the Boston consulting group

The Boston Consulting Group (BCG) has developed a matrix to assess risks and opportunities of product-market combinations. The two sides of the matrix are overall market growth and market share (Table 3.1). Attractiveness of a product-market combination is not measured with profitability, but with cash-flow (= profits + depreciation). The idea is that in an ideal business Portfolio (= the set of product-market operations in which a company operates) *cash cows* generate enough cash flow to invest in loss-making *wild cats* or *stars* (Keuning and Eppink, 1987).

The 'Internet hype' of 2000 is a beautiful example of an explosion of -externally financed- *wild cats*, of which only a limited number has survived as a *star.* After the dust of the 'Internet Bubble' had drifted down, established companies with a positive cash flow (MicroSoft, IBM, but also mail-order firms) acquired the knowledge collected by the *stars.*

Table 3.1 Portfolio Analysis of Boston Consulting Group.

	Market share	
Market growth	High	Low
High	Star	Wild cat
	Cash flow 0	Cash flow negative
Low	Cash cow	Dog
	Cash flow positive	Cash flow 0

Source: Keuning and Eppink, 1987.

Electricity production is capital intensive, and therefore the annual sum of depreciation is high. This means, on the one hand, that existing equipment is used as long as variable costs are recovered, because in that case the cash flow remains positive. Moreover, established companies with small profits show large cash flows that are available for investments. On the other hand, there is a high threshold to invest in new capacity if it is uncertain whether investments can be recovered over a very long period (10 to 30 years). Making capacity operational takes many years and hence there is a long delay before revenues from the new unit will start coming in. This delay is also too slow for a desired increase in market power. These are the reasons why in the 2004-2007 implementation period of EU liberalisation, companies probably will be hesitant to invest in new physical capacity (Speck and Mulder, 2003). Rather, established companies with a positive cash flow will prefer to acquire other companies, because of the immediate availability of capacity and –of course– market power. A higher market share brings instant additional cash flow, which enables another round of acquisitions, etc.

The dividing line in Table 3.1 between 'high' and 'low' market growth is the structural growth of gross domestic product (GDP; Keuning and Eppink, 1987). It is expected that overall demand for electricity in the EU will increase more or less in line with GDP (EIA, 2000). Because renewables and other non-traditional types of electricity production should get an increasing part of the market, we assume that traditional power plants (fossil fuels, nuclear) fit in the boxes with low market growth. Therefore, we expect that well-established electricity companies will follow a *cash cow strategy.* In the Netherlands, the foreign operators *E-on* and *Electrabel* are candidates for the 'cash cow' category. In Chapters 4 and 5, we discuss their behaviour.

The BCG matrix assumes that companies with a high market share benefit because they can use the 'experience effect'. In the electricity sector, one can think of learning effects of a diversified portfolio of generating techniques and of market experience in diversified markets. We suggest that a minimum amount of 'experience' is necessary to survive in an EU-wide market. This means that companies with a small, strictly national based experience will dwindle to a *dog position.* Being competed at their home markets without being able to acquire a substantial position abroad, in the long run they have no alternative than being bought by a large player on the market. In the Neherlands, the incumbent companies *Nuon* and *Essent*, who have been unable to develop substantial business abroad, run the risk of coming into a 'dog' position. In Chapters 4 and 5, we discuss their position further.

Several authors describe the electricity sector as conservative. The sector misses a drive for innovation (Ederer, 2003; Kunneke, 2003). Innovators are needed at both the production and marketing sides. Innovation is inherently risky, the more so in turbulent markets. In this respect, the 2004-2007 market turmoil does not favour innovation. On the other hand, companies are manoeuvring to get an optimal starting position for the *post 2007* situation. We expect a development similar to the 'Internet-hype' of 1998-2000. This means that in the 2004-2007 period a lot of initiatives will be tested. Several *wild cats* may be financed by established companies. As long as *wild cats* focus on trading and selling, they do not have to invest in generation or networks. Therefore, low investments suffice to start a trading company.

Only after 2007, most of the successful *stars* will be acquired by large players on the electricity market. In the meantime, most *wild cats* will die and be forgotten.

From the BCG Portfolio Analysis we derive the following three *propositions*. In Chapter 5 we will test these *propositions*.

- *Proposition 1: Large players on the European electricity market will show a 'cash cow' strategy. They will invest their cash-flow with the aim to increase market shares. Therefore, large players will acquire smaller companies.*
- *Proposition 2: Small players on the European electricity market will end up in a 'dog' strategy. Their only way out is to be taken over by a large company.*
- *Proposition 3: In the 2004-2007 transition period, innovation will be driven by small companies. Most of these 'wild cats' will not survive. Remaining 'stars' will in due course be acquired by large players in the electricity market.*

3.2 Porter's typology of business strategies

Options for growth of a company are basically twofold: On the one hand a company can aim for expansion (grow in the existing product-market mix), on the other hand a company can diversify (enter into new product-market combinations). Porter has developed the options for growth into a typology of business strategies (Porter, 1985). He distinguishes three types of strategies:

1. *Low cost strategy* : Produce cheaper than competitors;
2. *Differentiation strategy*: Introduce a new product;
3. *Focus strategy*: Focus on specific parts of the market.

Table 3.2 Typology of Business Strategies.

	Dominant strategy		Sub strategy	Characteristics
1	Low cost			Cheaper than competitors
2	Differentiation			New products
3	Focus	3A	Low cost focus	Cheaper than competitors in sub markets
		3B	Differentiation focus	New products for specific target groups

Source: Porter, 1985.

Table 3.2 provides an overview of the Porter typology. What will be promising options for electricity producers? In the traditional setting, a homogeneous product is delivered to all clients. In such circumstances, the *low cost strategy* is the only possible option. The development of 'green electricity' in the1990s brought the other strategies into play. In the Netherlands, green electricity started as a *differentiation focus* (a more expensive type of electricity could be sold to a small group of environmentally conscious consumers). Government support for both production (investment subsidies) and consumption (exemption of eco-tax for renewables) enabled the expansion of green electricity into a *differentiation strategy* (Hofman, 2003). However, for reasons to be explained in Chapter 5, a 2003 policy change introduced eco-tax on renewables and reformulated investment subsidies (Linderhof *et al.*, 2003). As a result, the future of *consumer green electricity* in the Netherlands has become less certain (Van Damme and Zwart, 2003).

Because electricity is a homogeneous good, it is not obvious to find other differentiations on the electricity market.

Full market opening in the EU to non-households (2004) will be earlier than the market opening to households (2007). This opens opportunities for focus strategies aiming at commercial electricity users. So far, competition for industrial users focused on the supply of cheap electricity. In the Netherlands, large industries demand cheap imports of German (coal) and French (nuclear) electricity (Verwer, 2003). In commercial markets, the *low cost focus* seems most promising.

The Porter typology enables us to formulate two *propositions* about business strategies. In Chapter 5 we test these propositions.

- *Proposition 4: The low cost strategy will be dominant for electricity producers, both in traditional markets and in emergent focus markets;*
- *Proposition 5: A differentiation strategy will only be possible with financial support of governments. Without government support, product innovations will be trapped in a differentiation focus, serving fringe markets only.*

3.3 Williamson's new institutional economics

Markets do not always offer the optimal solution for social welfare. *Market failure* can take several forms. Next to externalities like environmental pollution, 'natural monopolies' like electricity production were until recently considered unsuitable for normal competition. On the other hand, government regulations will also come at certain costs. Examples of *government failure* are lack of efficiency and political interference with management decisions.

How to balance market and government failures? How to achieve an optimal regime of governance? And do optimal regimes change over time? These are core questions of the *New Institutional Economics (NIE),* developed by Williamson since the 1970s. The basic question of NIE is: why do institutions emerge the way they do and not otherwise? Since the 1980s, the NIE framework has been extended from business optimalisation issues to public policy issues, for example the development of regulatory regimes (Williamson, 1998). Changes in regulatory regimes are the core of the whole process of electricity liberalisation in the EU. Therefore, the *NIE* may offer guidance in the liberalisation process.

NIE make *transaction costs* explicit and show their role in various organisational settings. NEI assume that for every situation management chooses the organisation with minimal transaction costs. Transaction costs are the sum of contact (information costs), contract and control costs (monitoring costs). According to NIE, various institutions like markets, hierarchies and regulatory agencies differ in information, co-ordination and monitoring costs. As a consequence, each problem has an optimal mode of organisation, supported by a distinctive form of contract law (Williamson, 1998).

The EU Directives provide the principles of a liberalised electricity market. In the implementation phase a major reshuffling of companies *and* institutions will take place. In the old situation, the organisation of the Dutch electricity sector was simple: a limited number of integrated regional monopolies, an operator of the national grid *SEP* and one Ministry for guidance and general supervision (Table 3.1). Because the national grid was

co-owned by the regional monopolies, all business activities were co-ordinated by *hierarchy* and *co-operation.* All companies were in public ownership. There was a free flow of information between the regional producers and the national grid, implying low information and monitoring costs. It was clear that the regional monopolist was responsible for security of supply. This system has brought about a high quality system of electricity supply. Critics, however, argue that the system of regulated monopolies has been unnecessary costly (Groeneboom, 2003).

As a result of EU directives, there will be a plethora of new companies and institutions. The unbundling of transmission from other activities means that integrated companies have to split. New companies will try to enter the market. The Dutch government favours that both national and regional networks remain publicly owned (Energie Nederland, 2004A). Because of inherently monopolistic tendencies in the electricity market, an energy regulator *DTe* will supervise competitive behaviour of networks, while the competition watchdog *NMA* must prevent anti-competitive behaviour of electricity producers, traders and sellers.

Tabel 3.1 Actors in the Dutch electricity market.

	Before liberalisation		After liberalisation
	Companies		
1	Integrated regional monopolies	1A	Production companies
	(production, regional networks, sales)	1B	Regional networks (public ownership)
		1C	Trading and sales
2	National grid SEP	2	National grid TenneT
	(co-owned by regional monopolies)		(public ownership)
		3	Amsterdam Power Exchange APX
			(spot market for electricity)
	Authorities		
1	Ministry of Economic Affairs	1	Ministry of Economic Affairs
		2A	Energy Regulator Dte
		2B	Netherlands Competition Authority NMA

Source: Oosterhuis et al., 2003.

The plethora of new actors also implies that a diversified set of co-ordination mechanisms is emerging. Co-ordination will remain in the network sector only. Between several types of companies, market relations will be dominant. In a competitive market, the flow of confidential information will be reduced. This complicates monitoring of the electricity system (Oosterhuis *et al*, 2003). Finally, energy regulators will introduce a new type of government regulation that will go along with lawsuits. As yet, it is not clear how public bodies can arrange for the security of supply, as stipulated in EU Directive 2003/54/EC.

Markets are a powerful instrument for co-ordination. In case of full competition, transaction costs are less than those in other types of co-ordination (Williamson, 1998). However, the Dutch electricity market changes from regional monopoly into *regulated oligopoly*. As long as costs of networks (national and regional), of market intermediates (like APX), and of regulatory authorities are internalised in electricity prices to customers, a fair comparison between costs *ex ante* and costs *ex post* seems possible. However,

if certain costs after regulation are borne by the public sector (agencies; investments; capacity auctions?), these have to be added to the costs of the private companies.

As yet, consequences of liberalisation for transaction costs are badly understood. That brings us to *Proposition 6*, to be discussed in Chapter 6.

- *Proposition 6: The Dutch electricity markets will change from a regional monopoly into a regulated oligopoly. It is not a priori clear whether social welfare, including transaction costs, in the new situation will be higher than in the old situation.*

3.4 Tinbergen's theory of economic policy

The aim of liberalisation of electricity markets is to increase efficiency of production and supply of electricity by introducing competitive forces into the market, and to create one European electricity market. Increased efficiency would lead to lower prices to the customers (EU, 2003). This connection between policy goal (lower price) and policy instrument (liberalisation) is rather straightforward. However, a low price is not the only goal of energy policies. Security of supply and the promotion of renewable energy are also core elements of EU and national electricity policies (EU, 2003; Groenenboom, 2003). What is the relation between the multitude of policy goals and liberalisation? Table 3.4 shows our preliminary interpretation. We expect that liberalisation is suitable to accomplish market related goals on prices and quality (goals 1,2,3,5), but that wider social goals like security of supply (goal 4) and environmental protection (goal 6) are not automatically catered for.

Table 3.2 Liberalisation and goals of EU electricity policy.

	Policy goals	Liberalisation a suitable instrument?
1	Introduction of competition	Yes
2	Market opening for all consumers	Yes
3	Economical prices	Yes
4	Security of supply	Questionable
5	Service quality	Probably yes
6	Environmental protection	No

Source: EU, 2003.

In his seminal work on *Theory of economic policy*, Tinbergen has shown that, generally speaking, every goal of economic policy requires a separate policy instrument. It is a mere coincidence if one instrument can reach different goals simultaneously (Tinbergen, 1954).

If we apply Tinbergen's principle to the electricity sector, it will be a great achievement if liberalisation results in lower prices and good service. However, it is naive to expect that liberalisation will automatically favour other policy goals such as security of supply and sustainable production. As for introduction of renewable energy sources, both EU and national governments accept that separate policy instruments remain necessary in the foreseeable future (Bongaerts *et al.*, 2003). With regard to security of supply, the belief gets stronger that liberalisation *per se* will not provide the answer. A plethora of additional instruments is now entering the policy discussions (see Chapter 6 for a discussion).

It is interesting to note that in the pre-liberalisation period, policy goals like security of supply and environmental protection were combined because the integrated Dutch electricity companies worked together on a basis of co-operation and hierarchy (=internal co-ordination in Williamson's NIE system). This system enabled a co-ordinated provision of "mothball" capacity and concerted actions to promote renewable energy sources.

Market analysts attribute the high costs of the present electricity system to excessive demands on quality, i.e. they see excessive demands on security of supply. They wonder whether more regular blackouts -compensated by lower costs- could increase social welfare (Groenenboom, 2003; De Joode *et al.*, 2004). A recent survey among Dutch households indicates that Dutch households appreciate the high security of supply (statistically there is one blackout in four years). According to the survey, Dutch households would conditionally –provided that they get financial compensation- accept a deterioration of the quality level to one or two blackouts a year (Baarsma, 2004).

In a theoretical sense, if lower prices go along with lower quality, it is no longer possible to say unambiguously whether social welfare has increased or not. Only in case that costs decrease while quality remains equal, a Pareto improvement of social welfare is unambiguous. In our opinion, minimum quality requirements for captive users (consumers and small companies) must be guaranteed by the government because -contrary to large companies- captive users have no market power to negotiate over quality levels. Therefore, we welcome the plans of the newly established regulatory agencies to implement and enforce new standards for security of supply (Shestalova, 2002).

The discussion on policy instruments brings us to the following two *propositions*. We discuss these propositions in Chapter 6.

- *Proposition 7: The policy goal 'security of supply' demands policy instruments additional to the measures stipulated in the EU Directive 2003/54/EC on electricity liberalisation;*
- *Proposition 8: The policy goal 'environmental protection' demands policy instruments additional to the measures stipulated in the EU Directive 2003/54/EC on electricity liberalisation;*
- *Proposition 9: Public agencies have to provide standards for security of supply for captive users. Public agencies must also get the instruments to enforce these standards.*

4. Market players in eight European countries

In this chapter we describe the 2004 business structure in the EMELIE countries and analyse how this structure came into being. The keyword will be market concentration.

4.1 Market structure in 2004

In April 2004, we collected data about electricity companies in the countries in the EMELIE project: Belgium, Denmark, Finland, France, Germany, the Netherlands, Norway, and Sweden. The following information concentrates on integrated companies that have dominant positions in their markets. All information was collected from the Internet. Most important sources of information were the Annual Reports over 2003, available at the companies' websites.

In total, we compiled information on 17 companies that dominate electricity production in the eight EMELIE countries. Below, we present generic conclusions about the type of companies and their interrelations. Annexes 1 and 2 contain information about the type, production and sales of each company.

In April 2004, in the 8 EMELIE countries 17 integrated companies were active (Table 4.1). The number of dominant companies varied between 1 (Belgium, France) and 4 (Germany, Netherlands).

Table 4.1 Overview of integrated electricity companies.

Country		Company	Subsidiary of
Germany	1	E.ON	-
	2	RWE	-
	3	EnBW	*EDF minority share* (35%)
	4	Vattenfall Deutschland	Vattenfall Sweden
France	5	EDF	-
Belgium	6	Electrabel *	-
Netherlands	7	Nuon	-
	8	Essent	-
	9	E.ON Benelux	E.ON Germany
	10	Electrabel*	Electrabel Belgium
Sweden	11	Vattenfall	-
	12	Sydkraft	E.ON Germany (55%)+ Statkraft Norway (45%)
	13	Fortum	Fortum Finland
Finland	14	Fortum	-
	15	PVO	-
Norway	16	Statkraft	-
Denmark	17	Elsam	-
	18	Energi E2	-

* Electrabel is a subsidiary of the French conglomerate Suez.
Source: company websites April 2004.

Of the 17 companies, 12 companies were independent; the remaining 5 were subsidiaries (Table 4.2). Of the 5 subsidiaries, all had their parent company in another EMELIE country.

Table 4.2 Cross ownership of the 17 integrated companies.

	Parent company	Subsidiaries	
1	E.ON Energie (DE)	E.ON Benelux NL	(100%)
		Sydkraft SE	(55%)
2	Vattenfall (SE)	Vattenfall Deutschland	(94%)
3	Electrabel (BE)	Electrabel NL	(100%)
4	Fortum (FI)	Fortum SE	(100%)
5	EDF (FR)	EnBW DE	(35%)
6	Statkraft (NO)	Sydkraft SE	(45%)

Source: Annual Reports 2003.
Note: % of shares.

Of the 12 independent companies, only 2 were privately owned (E.ON and Electrabel). Four companies were state owned (EDF, Vattenfall, Fortum and Statkraft), while the remaining 6 companies were owned by regional/local authorities.

The 12 independent companies varied considerably in size. Based on production volume, we found big companies in Germany, France, Belgium (*Electrabel)* and Sweden (*Vattenfall)*. Medium-sized companies were in the Netherlands, Finland and Norway and we found small companies in Denmark. The big companies have been able to get market shares in other countries; the small and medium sized companies have so far been unsuccessful to do so.

There is a common opinion that electricity markets are very concentrated. Calculation of both *Concentration Ratios* and the so-called *Herfindahl-Hirschmann Index (HHI)* show that the electricity sector is indeed a highly concentrated market (Speck and Mulder, 2003; Matthes and Poetzsch, 2002; Kemfert *et al.,* 2003). Table 4.3 provides evidence for the EMELIE countries.

The fuel mix differs considerably between the EMELIE countries (Kemfert *et al.*, 2003). Also within countries, the fuel mix can differ between companies. A good example is Germany where the fuel mixes of E.ON, RWE and EnBW are quite different. Whereas E.ON leans heavily on nuclear power, for RWE lignite is most important, while EnBW has a relatively high share of hydropower (Annex 2). In other countries, the fuel mixes between competing companies are almost similar. Sweden is a good example, where as a result of historical agreements the nuclear power plants are co-owned by *Vattenfall* and *Sydkraft,* while the large variety in hydropower offered many opportunities for acquisition.

4.2 Market trends in the 1998-2004 period

When we compare the 2004 situation with the 1998 situation, it becomes clear that electricity markets are concentrating at a fast pace. The 5 subsidiaries in Table 4.2 were independent, publicly owned companies until 2000.

Table 4.3 Market concentration.

Country		HHI	CR1(%)	CR3(%)
Germany	1998, Pre merger	1000/1560	29/22	58/43
	2002, Post Merger	1400/2417	37/25	76/60
Benelux+FR		1500	30	55
Netherlands	2000	1400/1796	30/19	68/49
	2004, corrected for imports	1750	34	81
France		8836	94/90	98/92
Belgium		7396	87/86	95/94
Scandinavia		892/1264	20	39
Sweden		2900	46	87

Explanation: various sources provide different numbers.
The numbers in Table 4.3 show upper and lower limits.
-A HHI greater than 1800 indicates a concentrated market;
-A CR1 (market share of biggest company) greater than 40% indicates a concentrated market;
-A CR3 (market share of 3 biggest companies) greater than 50% indicates a concentrated market.
Sources: Brunekreeft(2002), Matthes and Poetzsch (2002), Pena(2003), Speck and Mulder (2003), EIA (2003), DTe (2004).

From the Top Thirty of European Power Companies in 2001 (www.eurelectric.org), in 2004 8 companies have disappeared as independent companies because of take-overs. A more detailed analysis of the merger and acquisition (M&A) pattern since 1998 reveals the following.

Before 1990s, European electricity markets have been segmented national markets with only voluntary exchange in cross-border relations. Each country had its own historically grown structures: for example the public monopoly of Electricite de France (EDF) in France and almost thousand electricity companies with 9 “big ones” in Germany (Stroebele 2003). Different legal starting points and regulatory approaches, different technical and commercial infrastructures caused various developments and resulted in different market structures:

- One group of “south-west European” countries started from a concentrated, vertically and horizontally integrated industrial structure (United Kingdom, France, Belgium, Switzerland, Italy, Spain, Portugal). From these countries, only the United Kingdom and Italy implemented free market competition. In the United Kingdom, the monopolistic block was fully unbundled and split in a large number of private, independent generation and distributing companies. The other extremes are France and Belgium, where the domestic quasi-monopolies (public in France, private in Belgium) were preserved;
- Another group of “north-east European” countries had a lower level of integration and a large number of operators (Germany, the Netherlands, Scandinavia). Here liberalisation caused the opposite development: a number of mergers and acquisitions (M&A) and a significant horizontal and vertical concentration process, particularly in Sweden, Finland, Germany and the Netherlands. In Germany and the Netherlands 2/3 of the largest producers lost their independence in the first 3 years of the reform.

As we will see, these different industrial cultures and developments affected the direction of business strategies and M&A activities: in the EMELIE countries, we have two quasi-monopolies (France, Belgium) and two countries that experienced concentration (Germany, the Netherlands). In these four countries together, market concentration increased in the 1998-2004 period. In the Scandinavian countries, business concentration competed with market expansion (the separate markets of Sweden, Finland, Denmark and Norway have been integrated into a common *Pool*).

Companies situated in countries that were at the forefront of liberalisation (United Kingdom, Scandinavia, Germany) were particularly active to maximise scale and financial power by integrating municipal companies and to expand scope (multi-utilities) in their domestic arenas. Domestic mergers, therefore, dominated particularly in the aforementioned countries. In the southern countries the few monopolistic, public or private firms were controlled by the central government and municipals, limiting internal mergers, privatisation and market openness. Particularly in France, the governmental control cut France off from foreign deals.

Mergers, acquisitions and intentions to grow are also a question of money: large companies with strong financial power, situated in large markets, but with limited potential for further growth (France, Germany, Belgium, Sweden) invested over-proportionally abroad. In smaller countries or countries with a strong central regulating influence, these opportunities were more restricted, and companies from these countries (Denmark, the Netherlands, but also United Kingdom and Austria) did not invest to a significant degree abroad. Table 4.2 in Section 4.1 already showed the results.

In historic perspective, the number and value of M&A increased dramatically as soon as liberalisation cached most European countries mid 1990s. A number of multinational companies acted as driving force for M&A in Europe, mainly EDF, E.ON, RWE, Vattenfall, Electrabel (Suez) and Endesa. The proactive companies expanded enormously in scale and scope in the recent years and they are still continuing to expand. The gap between the mega-players EDF, RWE, E.ON and the other companies has increased (PwC 2003; Appendix II), and the powerful – in terms of finance and or political protection -- will become even more powerful (integration of gas, multi-utilities). These companies used all categories of integration and expansion to consolidate their market power and to build into multi-national players.

Table 4.4 summarises the number and values of key European mergers and acquisitions (M&A). The actual figures are somewhat scattering, mainly due to individual definitions and data basis of the different sources. However, some general trends and patterns (Codognet 2002, PwC 2003) can be isolated. Most M&A occurred after 1998, with a peak in 2001.

With regard to the motivation for M&A, a qualitative survey reveals that increase in scale is the dominant driver, be it in physical production capacity or in number of customers (PwC, 2003). Scale i.e. a strong capital basis, asset protection and protection of market share is essential in an industry that is infrastructure- and capital-intensive.

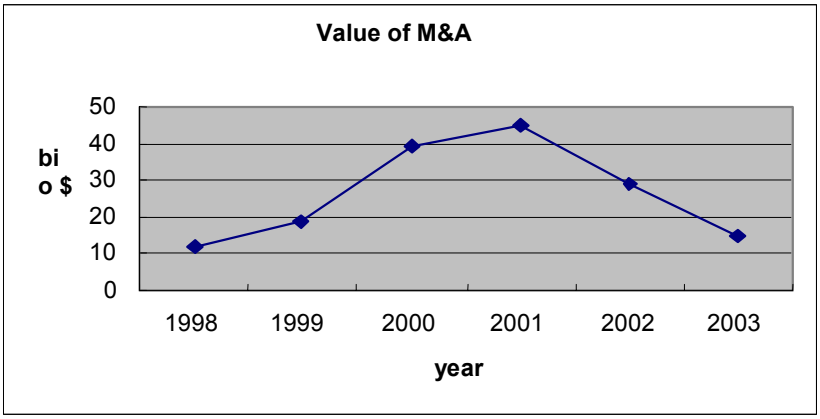

Figure 4.1 Value of M&A (bio $).

Source: Average of Ellul (2001), Codognet (2002) and PwC (2003).

Table 4.4 Number and Value (bio$) of M&A in the European electricity markets.

	Source	90-96	97-02	98	99	00	01	02	03
Number	(Codognet)			8	13	28	31	15	
	(Ellul)			11	17	43	21		
	(PwC)						64	157	118
	(Someren)	400	630						
Value	(Codognet)			3	12	19	38	22	
	(Ellul)			22	26	58	42		
	(PwC)						55	37	15

Sources: Ellul (2001), Codognet (2002), PwC (2003), Someren (2004).

Therefore it is not surprising, that "bigger size" is the key motivator for M&A (the two uppermost factors in Table 4.5). Differentiation (new products) and focus (specific target groups) are considered less important (last three factors in Table 4.5).

Table 4.5 Driving Factors for M&A.

Scale for competitive advantage	3.6
Acquiring new customers	3.6
Geographic expansion	3.4
Creating an inherent hedge	3.3
Strengthen focus on core business	2.9
Broaden product portfolio	2.8

Source: PwC survey (2003).
NB The driving factors are not mutually exclusive.
Note: 5=major driver, 1=not a driver.

Table 4.6 Key markets for expansion.

Eon:	IT	IT no large acquisitions
RWE	DE,UK, CEE, US	no major acquisitions
Vattenfall	DE, Poland, SCAN	consolidate DE business
Electrabel	FR, IT, Iberia, CEE	France 20%share, merge with medium to create key player
EdF/EnBW	K, IT, Iberia, CEE	make EnBW work, gas interest

Source: PwC, 2003.

To conclude, liberalisation introduced competition, but competition raised return to size and market power and mergers are the easiest way to grow: the domination of a few key actors has increased by size, integration and multi-utility (i.e. companies that provide gas, water and waste services next to electricity). Mergers and acquisitions peaked in 2001 and have since dropped to pre-liberalisation levels. A learning and digesting phase has started (Someren 2004, PwC 2003). But a number of EU players are still waiting to invest (PwC 2003). Table 4.6 summarises acquisition intentions and markets of interest of some main players.

We can therefore expect a continuation of the concentration process.

5. Emergent market behaviour

This chapter presents evidence of emergent strategies of electricity companies. In order to focus the discussion, we repeat the five propositions in Chapter 3 that had to do with the *Boston Portfolio Analysis* and with *Porter's Typology of Business Strategies.* For each Proposition, we present the evidence and formulate conclusions. Chapter 7 will summarise all conclusions.

- *Proposition 1: Large players on the European electricity market will show a 'cash cow' strategy. They will invest their cash flow with the aim to increase market shares. Therefore, large players will acquire smaller companies.*

The major conclusion of a recent assessment of business strategies is that the *cash cow* strategy is predominant among the dominant electricity companies. Researchers describe business behaviour as 'autonomy-minded, short-term opportunistic and large-scale globally oriented'. 'The overriding strategic aim has been and still is, to grow in size' (Ederer, 2003). Section 4.2 provided additional evidence for the dominance of growth strategies.

An interesting example is the strategy of E.ON, the third biggest electricity company in Europe, after EDF and RWE. In the 2004-2006 period, E.ON plans to spend 40% of total investments in acquisitions and 60% in equipment. This provides E.ON with an acquisition budget of 5.5 billion euros. If opportunities arise to increase market shares, the company will take them (E.ON, 2004).

An interesting observation is that ownership does not seem to matter. As presented in Chapter 4, only 2 of 12 dominant companies in EMELIE countries are privately owned. However, not only *E.ON* and *Electrabel* are busy acquiring other firms, also state owned *Vattenfall* and *EDF* and regional owned *RWE* are actively buying other companies. Evidently, market structure determines company behaviour. This rule could in the past also be observed with state owned companies in non-regulated markets like oil and chemicals.

Several authors have pointed out that market power rests with electricity generators (Newbery, 2002; Kennedy, 2003). In a more detailed analysis Bergmann, 2002 shows that monopoly profits are likely to appear when the number of independent generators decreases below a critical number. According to his research, a minimum of four independent companies is necessary to enable a proper functioning of the market. In retrospect, Newbery, 2002 argued that two generators in UK in 1992 were too few. Therefore, Newbery welcomes initiatives of the British regulator to enforce a split up of generation capacity among several companies. In line with Newbery, several researchers have warned for too little competition in electricity markets. They favour a split up of generators or to split generators from distributors (Matthes and Poetzsch, 2002; Speck, 2003; De Joode *et al.*, 2004). In an advice to the Dutch Regulator, Newbery *et al.*, 2003, warned for strategic market power of *Electrabel* in case of integration of the Benelux markets.

- *Answer on Proposition 1: Affirmative.*
- *Proposition 2: Small players on the European electricity market will end up in a 'dog' strategy. Their only way out is a sell out to a large company.*

German developments in 1999-2002, as analysed in Kemfert, 2003, are a spectacular example of strong concentration. In 1999, at the start of full market opening, Germany had about one hundred electricity producers. One year later, 10 companies dominated the market, among whom 6 belonged to Europe's Top 30 (Eurelectric, 2003). Another year later, the remaining ten had merged into the *big four* E.ON, RWE, EnBW and Vattenfall (Sweden). Only a veto of the German Competition Authority prevented further concentration (Matthes and Poetzsch, 2002). Lise et al, 2002 showed that small companies had little choice than to sell out to a large company. Indeed, small companies were pushed from the market by large, low cost producers and found themselves trapped in a loss making position.

On a smaller scale, concentration took place in the Nordic markets and in Britain. In Scandinavia in 2001, Birka (Sweden) was acquired by Fortum (Finland), while Sydkraft (Sweden) was acquired by E.ON (Germany) and Statkraft (Norway). Until 2000, the *NordPool* electricity markets showed a healthy level of competition: the five largest companies provided 52% of all electricity. Since the 2001 mergers, 3 companies provide more than 50% of Nordic production. This is at the edge of on acceptable market concentration (Matthes and Poetzsch, 2002). Quantitative information about these developments can be found in Table 4.3 in Chapter 4.

In the UK, various companies came into being after the split up of the two dominant generators (Newbery, 2002). Meanwhile, several of these companies have been taken over by RWE (Germany), E.ON (Germany) and EDF (France). In retrospect, a duopoly at the national level has been replaced by a web of international cross-ownerships. The UK developments show that international cross-ownership has quickly grown in importance on the European electricity markets.

For Denmark and Netherlands the evidence is undecided, as long as public owners are not allowed to sell shares to other parties. In Denmark, the ban to sell more than 15% of shares internationally has recently been lifted (Verseput, 2004). In the Netherlands, the situation is complicated. Electrabel and E.ON have acquired part of the regionally organised electricity providers. For the remaining Dutch owned companies *Nuon* and *Essent*, the national government intends to allow majority ownership by foreign companies, but only after the complete unbundling of production and network operations. Recent publications mention the year 2009 to allow sales of public shares (Energie Nederland, 2004A).

A final word about the meaning of *small.* In this section we discussed the position of the smaller integrated companies that figure in Appendices I and II. Below this group, a lot of very small companies is active in the electricity markets. In the EMELIE model, these *niche players* are consolidated into a *fringe* group, a group of companies that is unable to influence electricity prices. However, experts are convinced that many *niche players* will survive, especially when they have direct access to low cost production facilities, e.g. hydropower (EMELIE Workshop 11 June 2004, Amsterdam). Moreover, *niche players* are important for market transparency and price-making.

- *Answer on proposition 2: Yes in Germany and the Nordic countries. Probably yes in Denmark and the Netherlands, but evidence will only appear after bans on foreign ownership have been lifted.*
- *Proposition 3: In the 2004-2007 transition period, innovation will be driven by small companies. Most of these 'wild cats' will not survive. Remaining 'stars' will in due course be acquired by large players in the electricity market.*

Experts of the electricity sector observe a lack of innovation (Kunneke, 2003). Strategic analysts explain why little innovation is an attractive scenario for major companies. Innovation could introduce a whole range of disturbances in the profitable industry structure. It might create new products, in which the majors do not have large market shares. It might create new markets requiring large sums of investments. Innovation may also introduce product segmentation. A split up of the market means that oligopolistic market power no longer holds, which would diminish profitability (Ederer, 2003). Therefore, Ederer argues that it is against the interest of dominant companies to innovate.

Large hydro power has a long, profitable history and is normally not considered as part of renewable energy sources. With regard to the 'new', as yet unprofitable, renewables wind, biomass and photovoltaic solar, it seems that smaller companies often took a role as pioneer. Danish companies have become a frontrunner in wind power, the Dutch companies *Essent* and *Nuon* have been active for many years in biomass and photovoltaics. Related to these technical experiments, Essent and Nuon have become pioneer in the niche markets of green electricity (Hofman, 2002). In Finland, the smaller player *PVO* has become a specialist in biomass fuels. In contrast, a major company like *Electrabel* seems to be reluctant to take part in wind power experiments (Electrabel, 2004).

With regard to trade, liberalisation brings new traders to the market. In preparation to full market liberalisation in the Netherlands, several new traders have entered the electricity market. In 2003, there was a shock when the fast growing independent player *EnergyXS* went bankrupt. Caused by a price spike on the power exchange spot market, costs overran revenues. Single standing traders, without a back up of own production capacity, are vulnerable to price spikes. So far, the most successful new trader in the Netherlands is *Energiebedrijf.com*, that in its own words chooses for a steady growth. Until now financed by venture capital, the director of *Energiebedrijf.com* does not exclude that future growth demands participation of a large electricity company from abroad (De Heus, 2004).

Traders in electricity need a well functioning power market. A recent article casts doubt on the liquidity of the Amsterdam Power Exchange *APX* : the number of players and the volume of trade remain limited (Van Grieken, 2004). In a recent report, the Dutch regulator DTe observes that market volume stagnates and that in 2003 the number of traders on the APX market actually decreased. DTe urges for additional measures to secure a liquid and transparent market (DTe, 2004A). In the Netherlands, market players can choose between bilateral contracts and trade on the Power Exchange. It has become clear that large players prefer bilateral contracts. As a result, the number of players and the volume of trade on the open power market remain limited. This allows electricity generators to dominate the market and prevent aggressive price competition. This development support Newbery's observation that generators dominate the markets (Newbery, 2002).

- *Answer on Proposition 3: Large market players show little interest in innovation. Small and medium sized players offer interesting innovation in production and trade. It remains to be seen how many innovative companies will survive as independent players five years from now.*
- *Proposition 4: The low cost strategy will be dominant for electricity producers, both in traditional markets and in emergent focus markets.*

The two private majors *E.ON* and *Electrabel* advertise as a low cost provider (E.ON, 2004; Electrabel, 2004). The same applies to state owned *Vattenfall* (Vattenfall, 2004). Table 5.1 shows the list of expansionist' companies from Chapter 4 and their share on fuels with *low variable costs* (hydro, nuclear, coal and lignite). With the exception of Electrabel and Fortum, the percentage of low cost fuels is over 90%.

Table 5.1 Expansionistic electricity companies and share of low cost fuels.

Company	Participations	Low cost fuels (hydro, nuclear, coal, lignite)
E.ON	E.ON Benelux (100%); Sydkraft (55%)	93%
Electrabel	Electrabel Nederland (100%)	55%
Vattenfall	Vattenfall Deutschland (94%)	90%
EDF	EnBW (35%)	91%
Statkraft	Sydkraft (45%)	99%
Fortum	Fortum Sweden (100%)	54%

Source: Appendix 1 and 2.

With regard to trade, Germany and the Netherlands have seen massive imports of 'cheap' nuclear electricity (Eurelectric, 2004). In this way, German and Dutch producers try to benefit from the abundantly available nuclear capacity in France.

As for niche markets, the 2002-2004 market for green electricity in the Netherlands experienced spectacular developments. Triggered by a government subsidy for every 'green KWh' sold to end customers, electricity companies searched markets for cheap green electricity. In the end, they bought hydropower from existing plants in Germany and Austria. Transmission to the Netherlands caused congestion in the interconnectors (Van Damme and Zwart, 2003). Because the subsidies did not bring many new investments in renewables, the liberal scheme was partly abolished in 2003: Investment subsidies for renewables have been reformulated and an eco-tax on renewable consumption has been introduced (Linderhof *et al.*, 2003).

- *Answer on Proposition 4: Yes;*
- *Proposition 5: A differentiation strategy will only be possible with financial support of governments. Without government support, product innovations will be trapped in a differentiation focus, serving market at the fringe.*

As discussed under Proposition 3, it is of major importance for large companies to prevent market segmentation. Any initiative towards product differentiation brings risks of market segmentation, which may result in unforeseen market developments and in a break down of the *cash cow* strategy.

The discussion under Proposition 3 also showed that expansionist' companies pay limited attention to renewables. Major players want to get involved in interesting initiatives, but they leave it to smaller companies to act as pioneers.

How can small, innovative companies (Denmark, Holland) break out of their niche markets? In general, new technologies cost more than well-established low cost technologies like hydro, nuclear, coal and lignite. Substantial and predictable support schemes are necessary to accomplish learning effects. Support schemes for wind (Denmark; Germany), renewables in general (Holland) and CHP (Holland) enabled them to gain significant market shares.

- *Answer on Proposition 5: Yes.*

6. Regulatory innovation?

Chapter 6 presents evidence of new strategies in business-government interactions. All actors involved in the process of liberalisation concede that some type of regulation will always be necessary. Re-regulation certainly applies to transmission and distribution networks; opinions diverge when it comes to regulation of electricity production, trade and sales. In order to focus the discussion, we repeat the four propositions in Chapter 3 that had to do with *Williamson's New Institutional Economics* and with *Tinbergen's Theory of Economic Policy.* After presenting evidence on each Proposition, we formulate our conclusion. Chapter 7 summarises all conclusions.

- *Proposition 6: The Dutch electricity markets will change from a regional monopoly into a regulated oligopoly. It is not a priory clear whether social welfare, including transaction costs, in the new situation will be higher than in the old situation.*

With the EMELIE model as it stands, it is not possible to make a full impact analysis on social welfare. A complete cost-benefit analysis includes four types of effects: direct effects, indirect effects, external effects and distribution effects (De Joode *et al,* 2004). Leaving complex discussions on distributional effects aside, EMELIE produces direct (economic) effects and physical environmental effects. With the help of shadow prices, it is theoretically possible to convert physical emissions into monetary external costs (ExternE, 2003). The calculation of indirect effects demands an additional, macro-economic model.

If a full calculation of social welfare is not possible, what can we say then of a partial analysis? Direct transaction costs of liberalisation seem to be limited (see actor list in Table 3.3): Infrastructure costs of the Amsterdam Power Exchange *APX* amount to 5 million euro, the new Energy Regulator *Dte* costs 7 million euro annually (De Joode, 2004). According to one author, experiences suggest that the limited *APX* costs are of a much smaller magnitude than welfare benefits resulting from increased competition (Speck, 2003). In contrast, another author of the same institute *CPB* suspect that full transaction costs of electricity liberalisation may not always outweigh efficiency gains (Mulder, 2004). To answer this question, additional research is needed.

Results of EMELIE scenarios show an interesting paradox: a scenario with strategic behaviour of companies (STRA) shows better environmental results than a scenario with competitive behaviour (COMP) (Lise et al, 2002). Lower emissions in STRA means that external costs are lower. However, higher electricity prices in STRA mean that consumer surplus is less than in COMP. For a full comparison between STRA and COMP it is necessary to balance higher consumer surplus versus lower external costs. A complicating factor is that the pre-liberalisation situation, as depicted in the reference scenario (REF; cost minimisation), differs from both STRA and COMP. Only additional research, not planned in EMELIE, can shed light on welfare differences between the STRA, COMP and REF scenarios.

- *Answer on Proposition 6: Direct transaction costs caused by the Power Exchange APX and the Regulator DTe are limited. Benefits probably outweigh direct costs.*

A full cost-benefit analysis is not possible within the EMELIE framework and has not been tried elsewhere;

- *Proposition 7: The policy goal 'security of supply' demands policy instruments additional to the measures stipulated in the EU Directive 2003/54/EC on electricity liberalisation.*

The EU goals of electricity liberalisation, efficiency, security of supply and environmental improvements, are potentially conflicting (Speck and Mulder, 2003). Therefore, a careful analysis is necessary to assess whether goals are mutually compatible or not. The EU Directive 2003/54/EC acknowledges that security of supply may not be guaranteed in liberalised markets. Because it is not possible yet to clearly define the risks, member states have become obliged to monitor generation capacity and to prepare actions to ensure security of supply (EU, 2003).

The emergent discussion has brought a lot of suggestions for specific measures to secure supply. Table 6.1 presents an overview. Measures 1 to 3 aim to maintain sufficient capacity for electricity generation (supply side). Measures 4 and 5 aim to influence demand, in order to maximise peak production (4) or to limit peak demand (5).

Table 6.1 Potential policy measures to guarantee security of supply.

	Measure	Effective and efficient?
1A	Tender for Capacity Investment	Effective (Knops)
1B	Tender for mothballed Reserve	Effective, but not efficient (De Joode)
2	Capacity Requirements & Markets	Effective, but not efficient (De Joode)
3	Capacity payments to producers	Not effective (De Joode, 2004)
4	Reliability Contracts (Call Options)	No judgement found
5	Subscriptions on maximum peak demand	Technically not yet feasible (Knops)

Source: Knops, 2003 and De Joode et al., 2004.

Most attention in the Netherlands goes to measures to guarantee sufficient capacity. The economic think tank CPB recently analysed three measures on effectiveness and efficiency in the Dutch situation (De Joode *et al.*, 2004). They assessed a Tender for mothballed reserves (1B), Capacity markets (2) and Capacity payments (3). About capacity payments (3), their opinion is negative: Payments that amount to 10 €\MWh will cost 105 million euro annually, but bring almost no new capacity. The Tender for mothballed reserves (1B) and Capacity Markets (2) are potentially effective and cost 129 respectively 145 million euro annually. In the economic framework of a cost-benefit analysis based on historical risks for blackouts, De Joode et al. consider none of the three measures to be efficient. However, public policies that strive for maximal risk avoidance could find costs acceptable. Recently, the Dutch authorities announced to opt for Measure 1B: They plan to tender for a mothballed reserve of about 750 MW, expectedly costing 43 million euro annually. Although critical about this type of measure in general, the *CPB* think tank considers the proposed measure as acceptable in the ongoing process towards a liberalised electricity market (Energie Nederland,2004A).

Next to capacity availability and capacity utilisation, information and organisation of the electricity market demand attention as well. An EMELIE expert meeting underscored the importance of transparent and liquid electricity markets (EMELIE Workshop, 11 June

2004, Amsterdam). Information requirements on the availability of spare capacity are crucial to secure supply. In absence of instantaneous information about actually used and mothballed capacity, generators can strategically withhold capacity and network operators cannot dispatch optimally. In many countries, information requirements on electricity generators are insufficient at this moment (Kennedy, 2003). The Dutch regulator DTe worries about market transparency caused by insufficient information available to all market parties. DTe proposes to publish information about electricity traded on future markets and about electricity actually being produced, be it with some time delay. Without such additional information requirements, a proper functioning of the market is doubtful (DTe, 2004A)

- *Answer on Proposition 7: At this moment, most attention goes to information requirements on production capacity and capacity utilisation. Measures to guarantee capacity are intensively debated, but implementation -if any- will not be forthcoming on short notice.*
- *Proposition 8: The policy goal 'environmental protection' demands policy instruments additional to the measures stipulated in the EU Directive 2003/54/EC on electricity liberalisation.*

The EU and national governments have a long tradition of policy measures to reduce the environmental impacts of electricity production. These policies include on the one hand measures to reduce pollution from fossil fuel plants, on the other hand policies to support use of renewables (hydro, wind, biomass, solar) and use of CHP (Combined Heat and Power production).

The EU has specific Directives on Large Furnaces, renewables and CHP, that will not become redundant once the Liberalisation Directives have been fully implemented. At the national scale, one finds a plethora of schemes to support renewables and CHP. Most of these schemes support supply: they subsidise investment costs or give price guarantees for electricity delivered to the public network. Schemes to increase demand are rare, but potentially more powerful (Bongaerts and Dogbe, 2003). As described under Proposition 4, a 2002-2004 demand support scheme for 'green electricity' in the Netherlands showed a tremendous success in terms of increased demand. Unfortunately, the expected investments in renewables did not materialise, so the scheme was partly abandoned (Van Damme and Zwart, 2003).

In the literature, one can regularly find pleas for a premium on decentralised power, in EMELIE terms a premium on the production *fringe*. The argument runs that decentralised power or distributed generation (DG) must be subsidised because it limits capacity requirements on distribution networks. As a result, in the long-term network costs can be avoided (Matthes and Poetzsch, 2002). In practice, decentralised power will mostly consist of CHP and renewables. According to Groenhuijse, 2004, a generic plea for subsidy on decentralised power is there, but time and place dependent studies must show whether avoided network costs really occur.

- *Answer on Proposition 8: Yes, separate instruments for environmental protection at EU and at national levels will remain.*
- *Proposition 9: Public agencies have to provide standards for security of supply for captive users. Public agencies must also get the instruments to enforce these standards.*

Electricity liberalisation typically has several phases, starting with large electricity users and ending with households (EU, 2003). Large customers (industries) have countervailing market power and can opt for alternatives to the public grid like CHP. In negotiations between electricity companies and large customers, the power equilibrium may result in acceptable agreements on security of supply: minimum standards, penalties etc.

Households and small business have much less bargaining power. At the same time, they have no alternative to the public grid. Therefore, we expect that equitable rules for security of supply will not automatically emerge. Public agencies, for example the Regulator, could play a role here.

From an economic theory perspective, Shestalova, 2002 favours heavy penalties on electricity distributors in case of network failure. The Dutch network Regulator DTe prepares plans to implement such a common incentive scheme, where the level of the penalties must be based on consumer preferences for security of supply (DTe, 2004). A survey has shown that Dutch households appreciate the historically low number of blackouts (one blackout in four years on average), but could accept deterioration to one or two blackouts a year (Baarsma, 2004). In the months to come, DTe has to decide what to do with these results.

- *Answer on Proposition 9: The Dutch network Regulator plans to implement a scheme to publicly penalises distributors in case of non-delivery. In general, the role of public agencies in security of supply is undecided.*

7. Conclusions

Appendix 3 summarises our *nine propositions* and answers. From the answers, we derive the following conclusions:

The trend towards market concentration remains. Concentration Standards of Competition Authorities decide on maximum concentration levels, not the market itself. The number of firms in the European electricity market is typically endogenous, with a minimum number per country set by the competition authorities (*propositions 1 and 2*).

Expansionist' companies strive for a secure, low cost production of electricity. They want to retain their integrated business structure, being active not only in electricity production and trade, but also in distribution and sales. Niche players experiment with new production and trade arrangements (*propositions 3 and 4*).

Only well structured, lasting policy arrangements can bring a secure footing for alternative energy sources like renewables and CHP. Wind is successful in Denmark and Germany, but unsuccessful in the Netherlands and UK. The Netherlands and Denmark have promoted CHP successfully (*proposition 5*).

Direct transaction costs of electricity liberalisation can remain limited and benefits probably outweigh costs. However, a full assessment of costs and benefits of liberalisation is not available (*proposition 6*).

As for environmental protection, separate instruments at the EU and national levels will remain. As for security of supply, discussions focus on instruments to maintain sufficient generating capacity. The necessity to introduce new instruments for security of supply is hotly debated and undecided (*propositions 7 and 8*).

The role of public agencies in setting standards for security of supply is controversial. The Dutch Regulator DTe plans to introduce penalties for non-delivery (*proposition 9*).

From our conclusions, we derive the following implications for the use of the EMELIE model:

- Companies try to avoid full COMPetition at any prize, they work towards STRAtegic market behaviour;
- In model terms, the game played by the electricity firms looks a bit like "strategic entry deterrence through capacity choice", analysed by Spence, 1977 and Dixit, 1980;
- Market concentration remains the dominant trend. To prevent quasi-monopolies, forced splitting of companies comes into the picture. France and Belgium are candidates, but perhaps Germany and the Netherlands as well;
- Because Regulators will not accept more mergers at the national scale, dominant companies look for international opportunities. As soon as public shares become available to private companies, international cross-ownership will increase;
- Liberalisation will not automatically accomplish environmental targets. Separate environmental instruments remain necessary;
- Opinions diverge about specific measures to guarantee security of supply. Some argue that 'clever' privatisation will accomplish security of supply, others argue that investment schemes must guarantee sufficient generation capacity.

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Appendix I. Integrated electricity companies in EMELIE countries

Table I.1 Integrated electricity companies in EMELIE countries.

Name	Website	Ownership[1]	Independent?[2]	Activities[3]
Germany				
E.ON Energie	Eon.com	P	Yes *Owns:* *Sydkraft 55%* *Benelux100%*	P,D,T,Tr (integrated)
RWE	RWE.com	L + P (shares 51% Institutions 33% L	Yes	P,D,T,Tr (integrated)
Vattenvall	Vattenfall.com	S (=Sweden)	S =Sweden	(integrated)
EnBW	Enbw.com	R + S (52% regions, 35% EDF, 13% mixed)	Yes	P,D,T,Tr (integrated)
France				
EDF	Edf.com	S	Yes *Owns:* *EnBW 35%*	P,D,T,Tr (integrated)
Netherlands				
E.ON Benelux	Eon.com	P	S =Germany	(integrated)
Electrabel	Electrabel.com	P (51% Suez, 4%municipalities 45% free float	S of Suez (FR)	P,D,T,Tr (integrated)
Nuon	Nuon.com	R + L	Yes	P,D,T,Tr (integrated)
Essent	Essent.nl	R + L	Yes	P,D,T,Tr (integrated)
Sweden				
Vattenfall	Vattenfall.com	S (owns 100% of shares)	Yes *Owns:* *Deutschland* *94%*	P,D,T,Tr (integrated)
Sydkraft	Sydkraft.se	P (55% E.ON, 45% Statkraft)	S of E.ON (DE)	P,D,T,Tr (integrated)
Fortum	Fortum.com	S (=Finland)	=Finland	(integrated)
Finland				
Fortum	Fortum.com	S	Yes	P,D,T,Tr (integrated)

PVO	Pvo.fi	P (owned by companies)+L	Yes	P, D, Tr
Norway				
Statkraft	Statkraft.no	S	Yes *Owns: Sydkraft45%*	P,D,Tr (national grid separate)
Denmark				
Elsam	Elsam.com	R	Yes	P,D,T (no trade)
Energi E2	Energie2.com	L, R	Yes	P,D,T,Tr (integrated)

Note: In italics, companies are owned by another company in this table.
[1] Ownership: P = private, S = state, R = regional, L= local gov.
[2] Independent? Yes = yes, S= subsidiary from.
[3] Activities: P = production, D = distribution, T = transport, Tr = trade.

Appendix II. Production and sales of integrated electricity companies

Table II.1 Production and sales of integrated electricity companies in EMELIE countries.

Name	Countries[1]	Sales (Billion euros)	Sales (TWh)	Production[2]	Fuel mix[3]
Germany					
E.ON Energie	**DE, NL, SE,** FI, (UK,HU)	19.5 (11.6 electra)	262	156 (25.2 GW)	N 51%, C 24%, Lignite 7%, G 7%, H 11%.
RWE	**DE, (UK),** (PL,SL,HU)	44	268	184 (36.5 GW)	N 23%, C 18%, Lignite 42%, G 12%, CHP 2%, W 3%
Vattenvall	=Sweden				Lignite + CHP
EnBW	**DE** , (CH,ES)	8.6 (6.2 electra)	97	53	N 50%, C 33%, H 17%
France					
EDF	**FR, DE**, (UK,IT,HU, PL)	48.6 FR26.7	525	486 (121 GW)	N 86%, C 5%, H 8%
Netherlands					
E.ON	=Germany		14	(1.7 GW)	C + G
Electrabel	**BE, NL,** DE, FR, (PL, ES, IT, HU)	14.853 (8.979 electra)	104	107 (25 GW; NL 4.6 GW) 108	N 45%, G 33%, C 10%, L 3%, CHP 8%, H 1%, W 0%
Nuon	**NL,** BE, DE	4.7	38	31 (3.8 GW)	N 3%, C 22% G 34%, CHP-G 17%, W 24% (20% import)
Essent	**NL,** DE	6.9 (electra 3.0)	48	18 (3.2 GW)	N 5%, C 35%, G 18%, CHP 40%, W 2%
Sweden					
Vattenfall	**SE, DE,** FI, PL, DK, NL	12.307	185	156 (SE78 , DE 75)	SE: N 50%, H 45% DE: C, CHP
Sydkraft	**SE,** FI, DK, NO	2.2 (1.1 elec-tra)	33	25 (31 in 2001; 6.4 GW)	N 55%, G 5%, H 40%, W 0%
Fortum	=Finland	PM		(6.3 GW)	
Finland					
Fortum	**FI, SE,** NO, (UK, ES)	11.4 (1.9 electra)	54	52 (5.3 GW)	N 47%, C 7%, CHP 7%, H 39%

PVO	**FI**	0.67	21	16 (3.9 GW)	N 50%, C 25%, G 3%, H 9%, Biomass 13%
Norway					
Statkraft	**NO**	0.55	34	39.2 (8.9 GW)	H 99%, W1%
Denmark					
Elsam	**DK,** PL, UK	0.95	13	16 (4.2 GW)	CHP 85% (C 71%, L 1%, G 14%), H 9%, W 5%.
Energi E2	**DK,** SE, SP	0.9	13	13	C 40%, Orimulsion 22%, L 2%, G 22%, H 8%, W 6%.

In italics: Companies are owned by another company in this table.
[1] Countries: bold = core countries.
[2] Production: own production in TWh.
[3] Fuel mix: N/C/L/G/O/CHP/H/W.

Appendix III. Propositions and answers

Proposition 1
Large players on the European electricity market will show a 'cash cow' strategy. They will invest their cash flow with the aim to increase market shares. Therefore, large players will acquire smaller companies.

Answer on *proposition 1*: Affirmative.

Proposition 2
Small players on the European electricity market will end up in a 'dog' strategy. Their only way out is a sell out to a large company.

Answer on *proposition 2*: Yes in Germany and the Nordic countries.

Probably yes in Denmark and the Netherlands, but evidence will only appear after bans on foreign ownership have been lifted.

Proposition 3
In the 2004-2207 transition period, innovation will be driven by small companies. Most of these 'wild cats' will not survive. Remaining 'stars' will in due course be acquired by large players in the electricity market.

Answer on *proposition 3*: Large market players show little interest in innovation. Small and medium sized players offer interesting innovation in production and trade. It remains to be seen how many innovative companies will survive as independent players five years from now.

Proposition 4
The low cost strategy will be dominant for electricity producers, both in traditional markets and in emergent focus markets.

Answer on *proposition 4*: Yes.

Proposition 5
A differentiation strategy will only be possible with financial support of governments. Without government support, product innovations will be trapped in a differentiation focus, serving market at the fringe.

Answer on *proposition 5*: Yes.

Proposition 6
The Dutch electricity markets will change from a regional monopoly into a regulated oligopoly. It is not a priory clear whether social welfare, including transaction costs, in the new situation will be higher than in the old situation.

Answer on *proposition 6*: Direct transaction costs caused by the Power Exchange APX and the Regulator DTe are limited. Benefits probably outweigh direct costs. A full cost-benefit analysis is not possible within the EMELIE framework and has not been tried elsewhere.

Proposition 7
The policy goal 'security of supply' demands policy instruments additional to the measures stipulated in the EU Directive 2003/54/EC on electricity liberalisation.

Answer on *proposition 7*: At this moment, most attention goes to information requirements on production capacity and capacity utilisation. Measures to guarantee capacity seem to be most popular, but implementation will not be forthcoming at short notice.

Proposition 8
The policy goal 'environmental protection' demands policy instruments additional to the measures stipulated in the EU Directive 2003/54/EC on electricity liberalisation.

Answer on *proposition 8*: Yes, separate instruments for environmental protection at EU and at national levels will remain.

Proposition 9
Public agencies have to provide standards for security of supply for captive users. Public agencies must also get the instruments to enforce these standards.

Answer on *proposition 9*: The Dutch network Regulator plans to implement a scheme that publicly penalises distributors in case of non-delivery. In general, the role of public agencies in security of supply is undecided.