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Large industrials and electricity sourcing during the process of liberalization

Power sourcing strategies according to different market structures

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Abstract

Power sourcing for large industrials has changed since many countries began to restructure their electric sectors. Before, energy sourcing was limited to a set of products offered by electric companies under regulation. Nowadays, deregulation of electricity markets provides industrials significant choice in energy sourcing for the first time, changing the way how electricity is purchased, and increasing the need for sourcing strategy development. In this paper it will be presented how changes as consequences of market reforms affect the way electricity is procured. Different type of market and the power price structures will be explained. The increasing demands of energy, the ambitious goal of increasing electricity supply from renewables and the recent blackouts in different parts of the world suggest the need for a new and different approach to energy supply which could be self-generation. Self-generation has gained attention given that it can contribute to achieve the goals of the EU Energy Policy. In the past, self-generation was considered only as backup, mainly to improve the reliability of supply and partly, when it was possible, to reduce the cost. Now, since the process of liberalization progressed and large industrials gained the right to sell generated power on the market, it offers more possibilities for its use.

Table of content

1. LIBERALIZATION PROCESS AND NEW SOURCING CONDITIONS

Electricity liberalization in Europe is part of the trend towards the deregulation of network industries around the world, and its performance can be measured in a number of ways. However, its effect on power sourcing options is the one of more important indicators to assess the effectiveness of the reforms. As the power sourcing option is evaluated through electricity price and diversity of supply options, we will do the same evaluation for the effectiveness of the market reforms. Since only a few countries have fully completed their deregulation process, the available evidence is not yet sufficient to build a comprehensive judgment how are these two factors affected.

The increasing oil, gas and coal prices are responsible for much of the increase in power prices. However, as that impact can not be quantified, it is also impossible to determine how prices would have moved otherwise, i.e. the real impact of deregulation. The really impact of deregulation can not be assessed without taking in consideration the unusual characteristics of electricity as a product, which make the industry very different from other network industries. This implies price volatility on power exchanges and makes the security of the system more vulnerable to climatic conditions.

In this chapter it will be presented how changes as consequences of market reforms affect the way electricity is procured or supply. Different type of market and the power price structures will be explained. The increasing demands of energy, the ambitious goal of increasing electricity supply from renewables and the recent blackouts in different parts of the world suggest the need for a new and different approach to energy supply which could be self-generation. In recent years, self-supply has gained attention given that it can contribute to achieve the goals of the EU energy policy (Skytte and Ropenus, 2005). Before liberalization process started, self-generation was considered only as backup, mainly to improve the reliability of supply and partly, when it was possible, to reduce the cost. Now, since the process of liberalization progressed and large industrials gained the right to sell generated power on the market, it offers more possibilities for its use.

1.1 More competition on Supply Market

The main goal of first market reforms was to introduce competition in the segments in which competition in the market could work. Thus, vertical monopolies have been unbundled, wholesale competition has been introduced, and power sectors have been radically transformed throughout the world.

The results have been ***wholesale power market*** which permitted the operation of non-utility firms and self-generators able to produce cheaper electricity, and established free-access to the transmission network to all generators, large consumers and distribution companies. However, on the demand side, only distribution companies and large industrial consumers benefited from that

first stage of electricity markets' journey away from monopoly and competition. Medium and small consumers remain captured of their local utilities. Small and medium consumers have not obtained the right to use markets on an equal basis with large consumers, distribution companies and generators. Large industrials, even if they had the right to use markets, they did not have the possibility to re-sell the power. To provide equal rights to all market participants, retail competition was required, and it was considered by second generation of market reforms.

Implementation of ***retail competition*** is underway in a host of countries. This has become a major challenge of second-generation reforms. Due to this fact, different market structures could be found, depending on the level of market openness. The retail competition is achieved in few countries, where the rest of EU is still at the beginning phase of market opening. However, once full retail choice is at work, the liberalization of power markets will be completed. In countries, where the process of liberalization is already finished, commercial and domestic customers become equal privileged customers, able to choose the electricity supplier best able to provide the bundle of products and services that best suits each customer's needs. By introducing choice at the retail stage, through retail companies or direct consumer access to wholesale markets, market competition ensures quality of supply and appropriate pricing. Regulators will no longer have to set quality and prices, only retailing market rules.

The advantage of competition in retail sector is characterized as transforming the monopoly utility culture into a normal competitive business culture. Hence, the benefits of implementing retail competition in power sector are similar to those attained when introducing competition in any industrial sector. First, retail competition reduces the regulatory burden because full retail choice schemes are expected to progressively replace regulators in many fields. The pace and scope of the replacement process will depend on, among other factors, the political will of the regulatory authorities and on the technological and institutional features of the sector. Second, these schemes favor efficient pricing. Retailing allows consumers price arbitrage when costs are not properly reflected in prices, therefore favoring efficient pricing. Third, economic agents face the appropriate incentives to develop new technologies. In order to increase market shares and profits, retailers will attempt to differentiate their services and offer a wide range of products and services.

Nevertheless, the most important benefit of a retail competition model is its ability for enhancing consumer’s , in our case large industrials` attention and increasing their freedom to leave the traditional way of purchasing, being lock in long-term supply contracts, without possibility to change the contract conditions and price of power. There is no doubt that large industrials` ability to choose and change retailers constitutes the most efficient regulatory mechanism. The industry reacts to the new scenario, in which previously franchised subscribers are placed at the center of the stage, by way of becoming sophisticated clients of a diversified and dynamic retail market. Additionally, new entrants and information technology are expected to reshape and update the entire retailing business.

1.2 Electricity Price Structure

The power industry is under a fundamental change from a regulated monopoly to a competitive industry where market forces prevail. The performance of liberalization process can be measured in a numbered ways; however the effect on electricity prices is the single the most important performance indicator.

Traditional electric service provided by a utility consists of a group of separate electrical products and services, combined into a single "bundled" product under tariff structure (i.e. electricity price was consist of energy price plus delivery charges). Liberalization started with rebalancing of tariffs for different customer groups, and as a result of cost-reflective pricing, not all consumers are experiencing the same price changes. Regarding the price of electricity before liberalization, predictable-fixed prices were provided by long-term arrangements with power suppliers. The cost of electricity was divided into the price of energy and the cost of delivering that energy whenever demanded (i.e. delivery charges). Since the process of liberalization started, energy and delivery will take on new meanings and could be purchased independently or together. Therefore, large industrials are allowed to competitively source its purchase of various unbundled "products" (i.e. energy and delivery) from different suppliers, choosing the best combination of products and services according their needs.

The number of consumers that have switched suppliers or have renegotiated their traditional supply contracts shows considerable variation across member countries. As expected, large industrials have been more active than other groups and have taken advantage of the market opening. This is result that during the market opening process, large industrials were the first group of customers having possibility to change supplier and contract arrangement.

1.3 New technologies brought various options for power supply

The electricity marketplace is changing rapidly as the government deregulates the nation's power systems to introduce consumer choice and foster competition. Self generation is encouraged by power markets evolution as a consequence of market opening, and advancing technology, by driving down the costs of installing and operating generation set. Two key drivers are influencing the promotion of self generation: the increasing demand for secure supply of electricity and the prominence of environmental issues on the political agenda. The result: large industrials can now ensure electricity availability at a far more competitive cost.

Financial risk management is often high priority for industrials in deregulated electricity market due to substantial price and volume risks (i.e. risk of not being supplied) that the markets can exhibit. During the process of deregulation the quality of service experienced by power consumers depends on the extent of cooperation between regulated and liberalized stages. In deregulated electricity markets reliability becomes an economic marketable good, taking a special position in electricity bills. With deregulation, customers could benefit making trade-offs between price and reliability of

supply. That means that, in some situations large industrials are ready to pay more, reducing the risk of not being supplied.

Unstable and uncertain energetic situation forced companies to take self-generation as strategic decision, positioning itself on the supply chain in order to develop consistencies in terms of attaining competitive advantage over the other firms. Therefore, self-generation could be regard as a result of the vertical integration strategy, allowing company to get closer to its inputs (i.e. electricity), reducing the power costs and increasing reliability of supply. The electricity user should not depend only on "outside" sources to receive electricity (i.e. being supplied by intermediary or going directly to the market to purchase it). By supplying its own electricity it has a reliable power supply and even the option to sell unconsumed power by placing it in the grid. Using self generation as supply option, large industrials have a relatively stable power cost and might not be subject to the variations of market price.

Vertical integration and consolidation within the industry has created a playing field containing several larger and better capitalized competitors. Thanks to ability to better manage operating cost, they are in position to gaining competitive position according to other players in the same industry. More and more, the small company, without backward integration is placed at a disadvantage. The decision should company do integration, i.e. self-generation must go beyond an analysis of costs and investment requirements to consider the broader strategic issues of integration versus use of market transactions, as well as some administrative problems in managing a vertically integrated entity that can affect the success of the integrated firm. For example, if a company decides to invest in power generation, several concerns appear: the long term payback period which will be presented once it has decided to invest in necessary technology; than, the other concern could be reflected that energy prices go down in forward years and will not be profitable to produce power due to the lower price that is offered in the market, forcing the company to generate power in less profitable conditions, and so on.

In theory, self-generation is available in all three market structures. However, in practice, the situation is quietly different. Depending on market structure and relevant position, large industrials will be able to take different approaches to be self-supplied. In the next sections, self-generation will be consider as an offer to large industrials to change traditional power sourcing (e.g. long-term supply contract with intermediary) and choose the other way for power supply.

1.3.1 Renewables versus Fossile-based technologies

Today available technologies give the choice of supplying electricity from fossil fuel sources or from RES. Fossil fuels were normally seen as a cheaper generating option than renewables since they have the advantage that investment costs are usually lower. However, operational costs for fossil-based technologies might be higher because of the fuel component. The price volatility of fuels, the emission of CO2, and the fact that they are mostly larger projects are some disadvantages of fossil fuels. Therefore, even if large industrials chose to generate power using fossil fuels, apart

the other things, they are able to choose different technologies according to the related CO2 cost (e.g. natural gas is less CO2 emitting than coal, so related cost is lower).

Renewables, on the other hand, are not subject to the European Transmission Scheme. With the start of the EU ETS, large industrials as self generators added an additional cost element to their production processes in the form of CO_2 emission allowances. With self owned renewable energy, firms can avoid paying the market for emission allowances. On contrary, renewables are promoted by financial mechanisms which make their use more cost acceptable, and their smaller size is suitable for industrial sites.

Most importantly, besides considering the arguments related to the cost of supply and reliability issue that give large users reasons to consider their supply from RE, the thought of the environment and of sustainability are strong points for RE. Under the requirement from the Renewables Directive, the national governments use promotion mechanisms to make the investments more feasible for companies to produce RES-E. Such is the case of feed-in tariffs, which have been implemented in Spain, Germany, and Denmark and have proved successful for the development of wind technology and the increase in the electricity generation by wind in the last years. Other support mechanisms include tendering systems, tradable green certificates, and tax incentives.

2. POWER SUPPLY ACCORDING TO MARKET STRUCTURE

The supply formulation process often includes an analysis of the external environment and an assessment of the internal factors of the organization (Pearson and Gritzmacher, 1990; Carr and Smeltzer, 1997; Virolainen, 1998). To help in taking decision, an organization must make a forecast about the environmental conditions that will be encountered in the future to achieve its goals and procurement should know the suppliers' environments that affect corporate goals (Carr and Smeltzer, 1997).Therefore, procurement cannot operate in isolation from its environment, including the supply market and other elements of business.

The optimal option for supply may be sensitive to changes in the market environment because complex systems, such as supply networks, which are embedded in the environment and interact with that option. Thus, in the case of power supply, the company is advised before make any decision about the sourcing to analyze the electricity market in the country where it operates. This is important because certain sourcing approaches, appropriate in the past period, now should be re-evaluated due to important changes in the marketplace, and suddenly it could find them obsolete. This is exactly the case of power market before and after the process of liberalization started. Supply options, shown to be very successful several years ago, today cannot be considered as a good way of supply.

In order to understand the process of supply, according to market structures different market conditions will be presented in this dissertation as knowledge basis, helping to understand the connection between specific market structure and behaviour of large industrials within them. Since

a strategy is directly affected by market conditions, I decided to start my research looking for the factors that characterize the market structure where the large customers have operations. As electricity market is dependent on human behaviour and behaviour changes, qualitative methods have been the best well-matched approach for this type of study. I organized several discussions and observations in order to gather as much as possible data on electricity market characteristics. Also, I complemented these techniques with interviews and surveys, which are conducted with all market participants. The results of the research helped me to build a general picture about different market structures and relevant supply strategies.

2.1 Research process and relevant methods

This study began with the review of literature related to sourcing strategy building cycle. The main purpose of this was to enrich my existing knowledge concerning the way or approach how a strategy should be built. Recently published papers related to the same topic were systematically analyzed and since the interest of the dissertation is to explore the way for power sourcing, an attention on electricity market trend was required. As a consequence of these, I examined the most essential theoretical dimension of the concept of power sourcing strategy, analyzing earlier findings related to specific sourcing strategies according to different electricity market.

In order to gain additional perspectives on key issues of the development of sourcing strategy, I studied specific electricity markets and related power sourcing options. To gain a better understanding of the topic, I choose to apply a qualitative research approach that is best suited to situations where the existing knowledge base of the phenomenon under study is limited. Additionally, as a certain sourcing strategy in one business environment may not be as successful when transplanted elsewhere (Virolainen, 1998) and, especially as the research questions of this dissertation are focused on an under-researched area, it is necessary to seek a deeper understanding through qualitative research. For this purpose survey based research for data gathering is selected as the suitable one. In the dissertation, the surveyed data was aimed at generating data on supply, comparing market trends according to the relevant parts of the existing market structure. According to the goal of the study, for me was very important to gain an understanding on all external factors, resulting from electricity market features, which could affect the sourcing decision-making. These factors are considered as key drivers for the strategy building.

In order to recognize and understand the main features of the market structure, and what is the typical behaviour of its participants in compliance with them (i.e. generators, suppliers, traders, end users), I laid out two different cross-sectional surveys, based on a standardized written questionnaire. As simple draft containing the main topics for the questionnaire to be sent to market participants is provided in Annex 1 and 3. Since there are two different questionnaires, one designed to learn about the features of three basic market structures (regulated, transitional, competitive) and the second one, designed to gather data on supply options used by large industrials in each of previously stated market structures. The questionnaire, with mostly multiple-choice questions was sent to companies. The returned questionnaires are coded for further data analysis.

The aim of the first survey (***Survey on Market Structure*** *found in Annex 1)* is to provide participant's feedback on the factors, determining different electricity market structures in EU countries. This would help me to better understand how liberalization process progresses under different circumstances in each country. The survey is organized through three different segments, gathering info about Regulatory Framework of the energy sector in the country under the study, than presenting main players in Generation and Supply sectors. My intension was to recognize the following issues:

- Issues related to the process of liberalization (i.e. eligible customer, eligible producer, RES promotion, CO2 restrictions);
- Issues related to the sector organization (i.e. who are the main players, who has the market power; existence of competition or not; etc.);
- Electricity market issue (i.e. existence of an organized market; which organization is in charge to manage it; market players; level of openness; etc.);
- Issues related to the networks (i.e. existence of central institution responsible for network problems; independent TSO; access to the network; network charges; etc.).

All these issues, stated above are regulated by laws issued on country level, therefore they could imply advantages or disadvantages for large industrials to position themselves on supply market (i.e. large industrials are considered here as customers, and then in some market structures as market players). This means that depending on market organization and market openness, large industrials would be in different positions for power sourcing.

After the survey was conducted and data collected, the ***Porter`s Analysis*** *(See Annex 2)* was used in order to organized data for each market structure. In order to gather better understanding on market characteristics, I found useful to do independent analysis on Generation and Supply sectors. Doing this I will be able to learn who has a bargaining power in supply chain, according to different market structures. In this way, I could be in position to assess the potential restrictions on behaviour of market participants and the way how they could be or how they are obliged to be supplied, building the knowledge base for further analysis.

The next step was to determine the way how large industrials source power according to the market they belong to. In order to gain data on this topic, I prepared three independent surveys (i.e**. *Survey on behalf of Large Industrial***) for each market structure, based on data gathered through survey conducted before (Annex 3). The purpose of the second survey was to collect data, relevant to present an explicit and comprehensible picture how large customers source their power in current market conditions, complemented by data on techniques and approaches used to manage their demand. The position of large industrials on the particular market and the way how they source and mange the demand of power are very important for the following analysis, presenting basis for methodology building process. Asking companies how they supply power today, offers me possibility to recognize all options they could deploy according to market structure or which options market offers them. The difference could be an alternative for them to improve their position in

supplier-customer relation. Also, as market structure allows, large industrials can join the other market participants, behaving as self-supplier at the same time.

2.1.1 Diagram structure

As the main goal of the research is to design a methodology or propose an approach for power sourcing, first an understanding on how the energy intensive industry has been operating and managing their energy needs to date need to be built. According to the results, provided by surveys I started from the assumption that groups of businesses in the same market conditions should be clustered together because they share similar advantages and disadvantages of the market. Examination of country clusters over time reveals both the classification of countries along the dimension of overall liberalization, as well as shifts between groups of countries as they undertake regulatory reforms and change their relative positions. So I decided to select data according to the market structure, from regulated through transitional to competitive market (data based on info gathered by the second survey, Survey on Market Structure).

The same method will be used within each market structure, according to the two main topics: ***demand*** and ***supply***, based on data provided by the second survey (Survey on behalf of Large Industrials presented in Annex 3). In order to achieve this, first explaining the way the company is being supplied (e.g. using the service of intermediary, going directly to the market to buy electricity, or self-generating); and second, elucidating how companies, manage their demand (e.g. frequency of actions related to load management, energy conservation and energy efficiency).

In order to clarify all differences and similarities between market structures, I found very useful to put all data in "*diagram structure*". The Diagram for each market structure can be found in Annex 4. Each market structure consists of two main layers, supply and demand, where sub-layers (i.e. related to the price and contract structure, then activities used for demand management, or available supply options) are different. Each sub-layer is customized according to the market conditions.

This approach helped me to analyze which market structures are poorly or strongly connected to each other, presenting "inter-structural" linkages. In this way the recognition of the similarity between clusters in different market structures could be achieved. After all differences and similarities between market structures are determined (according to previous analysis) and all available supply strategies used by large customers are known, emerging opportunities as new options for electricity sourcing are recognized, which was also the main goal of this step. In the next section I will try to present market feature of each market structure, highlighting main players of the market, than, describing the way how large industrials source power, and the steps or actions they deploy to manage their demand, and relevant cost.

2.2 Power sourcing in different market structures

The electricity industry in Europe was characterized up until a few years ago by monopolistic economic structures due to technical-economic circumstances as well as politico-economic reasons.

In the electricity system before the liberalization, the spheres of activity electricity procurement, transport, distribution and as well as the balance between collection of electricity into the network and supply of electricity were realized in an integrated system. Looking for a dynamic and promising view, a fully liberalized electricity market starts emerging as an opportunity for large customers to have an open marketplace where diverse generator and suppliers exist and satisfy their power sourcing requirements. Consequently, each customer has a possibility to choose the best electricity provider in order to procure the electrical energy they require.

One characteristic of energy intensive users is that their profitability varies strongly according to production costs; thereby the interest of each industrial is to minimize the cost's components` volatility. The electricity or power cost as cost component depends on electricity consumption pattern of the company and company's flexibility to manage this cost, as well as on market price of the power. Supply contract and price settings vary according to electricity market structure in country where a company operates (e.g. before liberalization, predictable prices were provided by long-term contracts with power suppliers; however, since the liberalization started, the possibilities of such contracts have been limited due to increased instability of energy markets (EC 2006)).

Depending on the electricity market structure, energy intensive industries may be in a position to negotiate the details of their contract and the level of suppliers` and/or generators` margins (i.e. in the case of monopoly on the supply side, customers will not be able to negotiate with the supplier unless they have the possibility to purchase electricity on the market themselves). To counterbalance players in the upstream electricity market, industrial facilities can increase their negotiation power by aggregating their demand. Thus, one can be concluded that depending on how is the electricity market organized, large industrials could deploy various ways to manage power supply.

To give an overall picture of industry's different electricity purchasing methods, we can distinguish three main electricity purchasing options or strategies:

1. The energy-intensive users purchase indirectly on the electricity market (i.e. being supplied by intermediary) through either short term or long term supply contract;
2. The energy-intensive users produce the majority of their electricity consumption (i.e. self-supply);
3. The energy-intensive users purchase directly on the electricity market (either organized or bilateral), through either short term contracts or long-term contracts.

These supply options could be applied independently or combined, which depends on the level of market opening in a country where the company has the operations; than, on company's operational and financial flexibility to manage selected strategy or strategies. The interest of each company is to have a very reliable supply at minimum cost.

The purpose of this chapter is to present how large industrials handle power supply strategies through different contract structures. For each market structure (e.g. from Regulated through Transitional to Competitive), frequently applied contract and price structure will be explained.

Summarized options for power supply based on market structure are presented in Annex, while more detailed data could be found below down.

2.2.1 Regulated electricity market

The main characteristic of regulated structure is that the primary components of electricity supply - generation, transmission, distribution, and retail supply – are integrated within individual electric utilities. Traders and generators are vertically integrated and they are the only ones who can import and export electricity from and to neighboring countries. These firms have in fact exclusive franchise to supply electricity to residential, commercial and industrial retail consumers within a defined geographic area. The rates for supply and transmission in electricity industry are set under a control regime of regulation. This market structure could be found in many EU countries, even the process of liberalization started a long time ago.

All customers in this market – industrial and residential – are treated in the same way, paying regulated price according to the level of consumption they have, arranged through long-term contracts. They are obliged to purchase electricity directly from the national or regional distribution at a price that is fixed by the government. The regulated rate structure is both bundled and skewed. A bundled rate combines all of the various charges associated with electric service (generation, transmission, and distribution) into a single rate or charge. Skewing refers to the fact that regulated rates for rate classes (residential, commercial, and industrial) are not set at actual cost, rather, some rates are intentionally set above cost to allow others to be set below cost. Price of electricity is organized within “tariff structure” that could be “flat” or “peak”.

A fully regulated system offers very little in the way of consumer choice. For industrial consumers options for reducing price risks through normal market mechanisms, such as hedging are either very limited or non-existent. It provides limited incentives for greater efficiency – either for consumers or for suppliers.

In regulated market, large industrials primarily use the operational approach to change their consumption patterns in order to manage the cost of power. Frequently used initiatives are ***peak-hour power generation***, ***load management activities***, and ***energy efficiency actions***. Before a company decides which of available initiatives is suitable to be implemented, it must be sure that the company’s core operations have an operational flexibility to approach them. Also, as complement, an economic analysis must be made in order to assess required investment and potential savings. In Figure 1 shows graphically position of large industrials in this market structure.

Load management actions are usually complemented by interruptible contract arrangement and self generation. Recently, since the process of liberalization started, a few countries allowed large industrials to use ***interruptible contracts.*** These contracts allow power suppliers to interrupt part or all of the supply of electricity to the customers, over some period of time. They are favorable if the price of electricity is arranged according to “peak tariff structure” (i.e. the price of electricity varies according to the time of day and seasons). Otherwise, where the flat tariff structure is adopted, these

contracts are not useful for cost reduction. During the time of interruption, large industrials use the self generated power, or implement load management measures to shed the load.

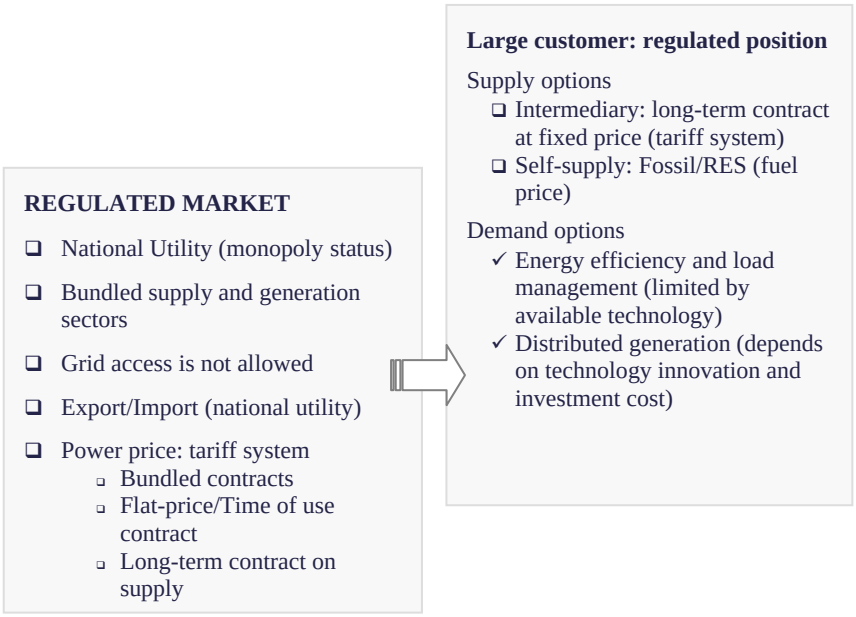

Figure 1. Supply options in regulated market.

In many countries within regulated regime, ***self-supply*** presents more expensive option compared to being supplied by local supply company. Thereby, the self-generation is mostly used to secure reliable supply in countries where this problem is common; and to reduce the cost of power during peak rate. Additional benefit that company could have is selling exceed of generated power. The main constraint is that the generated power must be sold to the national company, not directly to the market, because the market does not exist. Usually, the price is arranged according to purchaser's perception. Due to this, sometimes large industrials can not find economical benefit to sell the power. This situation was changed in many countries since environmental issue gained its importance. Thanks to this, the position of private power producers using renewables is more favorable now.

2.2.2 Transitional market

At the beginning of market opening, only generators operated in competitive environment, where distributors/suppliers could found many alternatives for electricity procurement. While suppliers have many options, consumers are still supplied under tariff system structure and they are excluded from competitive environment. Free access to distribution network and more competition in supply sector were priorities. These two actions started allowing large end users to choose freely their retailer and negotiate the price of electricity (A.Al-Sunaidy, R. Green, 2006).

However, at the beginning of market opening, generation is still characterized as oligopolistic (i.e. few market players keeping dominant position), and the energy supply chain is highly vertically

integrated (i.e. emerging suppliers are not strong enough to compete with national company); thereby the demand side is under-represented in the market. For the first time large industrials gained a right to switch to another supplier in theory, but in practice, large industrial consumers have discovered that this may yield, at best, a slightly lower trading margin on balancing costs. For large volumes, independent suppliers were unable to manage the trading risk and to compete with suppliers that are integrated with generators. It is clear that further work is required to ensure the effective functioning of the semi-liberalized or transitional market. In Figure 2 you can see summarize options for power supply for large industrials.

Due to the fact that the process of market opening progressed differently, going from traditional to more flexible markets, diverse supply contracts (i.e. supply contract arranged with intermediary) could be found at different level of flexibility. In Europe, many countries have maintained regulated tariffs for large industrials during the transitional period - although the second directive on liberalization did not explicit their removal. Doing this, government has planned tariffs to prevent intensive energy users to relocate in countries where the electricity is cheaper, due to fact that many large users have found themselves paying more, since leaving regulated tariffs for market price. One can say that in this phase of market opening there is no real free market, but the "privileged status" brings a possibility for large industrials to switch supplier and negotiate the price of energy.

Large consumers which accepted the status of privileged consumers could choose either a ***new tariff structure***, paying all-included price of electricity through long-term arrangement or to ***negotiate the price of energy,*** paying separately energy and delivery charges through new shorter-contract arrangements.

The price of energy in ***new tariff structure*** is based on "*real time pricing*", where prices vary hour by hour. The price of electricity is still all-included price taking energy and delivery costs, accompanied with different charges regulated by laws. Consequently, cost-based energy price in regulated tariff structure is replaced by market-based price. Real time pricing includes day ahead pricing with hourly costs, day of pricing with hourly costs, and voluntary load changes on part of the customer. If prices skyrocket not only for a few hours but for many days, there is a real financial risk. In order to limit related expenses, large consumers could arrange various contracts to manage the price risk. In this situation, large industrials could arrange their contract for supply including the ***call on interruptability***. Using it, industrial facilities may have their power consumption cut off by a determined quantity if market prices reach a certain level – specified in the contract[1].

Large industrials, accepting the privileged status, have a possibility to ***negotiate the price of energy,*** while delivery and other charges will stay regulated. In theory large industrials can negotiate the

[1] The reduction or cut off may be announced before, and the duration of the interruption is fixed. Also, on this way large industrials can reduce the cost, due to fact that they are compensated for each MWh they declared interruptible. Before arrange this type of contracts, large industrials must have operational or financial flexibility to apply them. This type of contract is usually signed with national companies, but as market liberalization progresses it will be available to independent suppliers.

price of energy, while in some countries this price is set by supplier. In order to reach the better price of energy, large industrials can increase their negotiation power by aggregating their demand. This type of contracts is known as ***load aggregation contract*** and primarily is used to reduce the cost of power. With this contract a large industrial can not manage its demand, but it can affect the final cost.

The reliability of supply again depends on supplier's power and market position, while large industrials can not affect it a lot. Very similar to traditional electricity market, large industrials can use self-generation as a way to improve reliability of supply. Now since liberalization progressed an industrial facility can do so either by investing in the majority of a generation asset or in only a share. By integrating vertically, industrial facilities are able to manage the supply reliability and price volatility.

Beside self generation, large industrials still use load management practice to reduce and change power consumption. Load management, interruptible contracts and self generation are complemented actions used by large industrials to manage demand. In this phase of market opening they neither have possibility to use different contracts to hedge the price of power nor can sell generated power on the market. The main reason lies to the fact that large industrials are not equal with other market participants and their role on the market is still passive. As market opening progresses, large industrials become more active players, involved in many market activities.

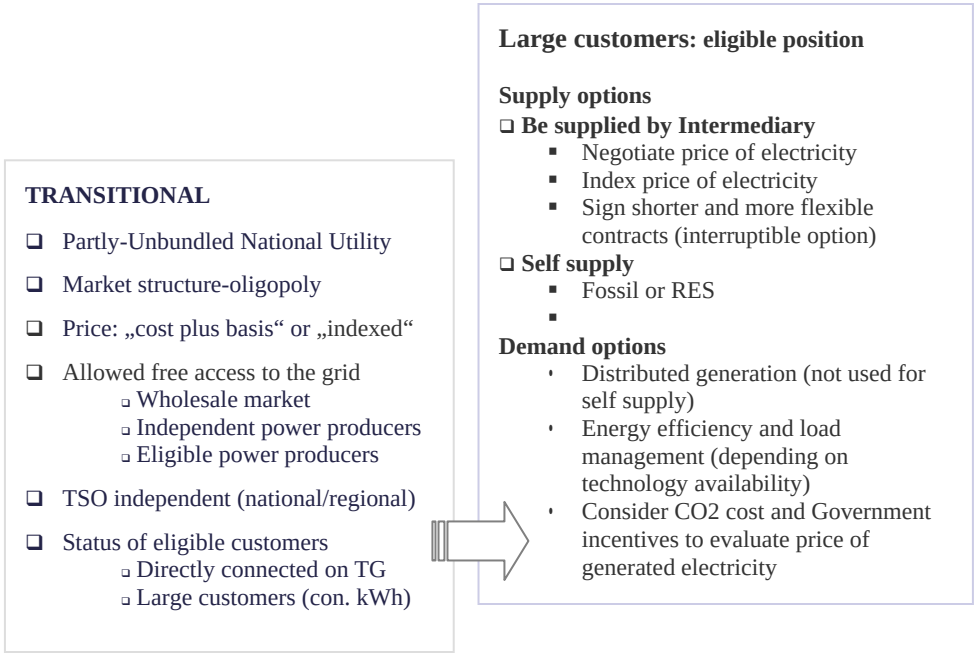

Figure 2. Power supply in transitional market structure.

2.2.3 Competitive market structure

In competitive market structure, for the first time a large industrial has possibility to be active player on the market. In previously explained market structures their role is passive, due to fact that they were allowed only to purchase electricity to cover their needs without possibility to re-sell it. In competitive market structure the energy intensive users has a possibility to use the market to purchase the power either directly or using an intermediary (i.e. supplier). Moreover, industrial facilities are allowed to purchase for their own use only or for a group of companies.

In regulated and transitional market structure, in majority of EU countries, large industrials are allowed to generate power in order to cover their needs. If they generate more than they need, that quantity of electricity could be sold to the vertically integrated company based on several reasons (e.g. maintain balance, peak hour's generation, renewables promotion, etc.). The main difference and a new possibility brought by market opening is that in competitive market, large industrials are allowed to sell generated power on the market, being equal to the other market participants. Thus, in competitive market, self-generation will not be considered only as a way for supply or back-up, rather than one option more for electricity price hedging.

One can say that for the first time large industrials are allowed to employ all of three available methods for power supply (Figure 3):

- being supplied by intermediary,
- going directly to the market,
- being supplied by self generation.

The final energy price quoted to the consumer will depend on whether the industrial consumer is able to negotiate with a supplier (i.e. how strong is its market position according to other industrials) or whether it purchases its electricity directly through the market. On a centralized market exchange (e.g. spot or forward market), the consumer may be price taker, whereas on a brokered market, he may be able to discuss the price for bulk consumption with the electricity supplier or trader.

The final price of electricity to an industrial contains other components apart the price of energy such as balancing cost, distribution cost, or/and supplier's own profit margin, if an industrial purchases electricity using supplier. In the case of self-generation, the final price of electricity is related to the cost of generation, which again depends on technology used (e.g. Apart the investment and operational costs, fossil based technologies are surcharged by CO2 cost, while using renewable based ones, large industrials could be incentivized). Which of proposed methods are applied by a large industrial depends on an operational and financial assessment made by the company.

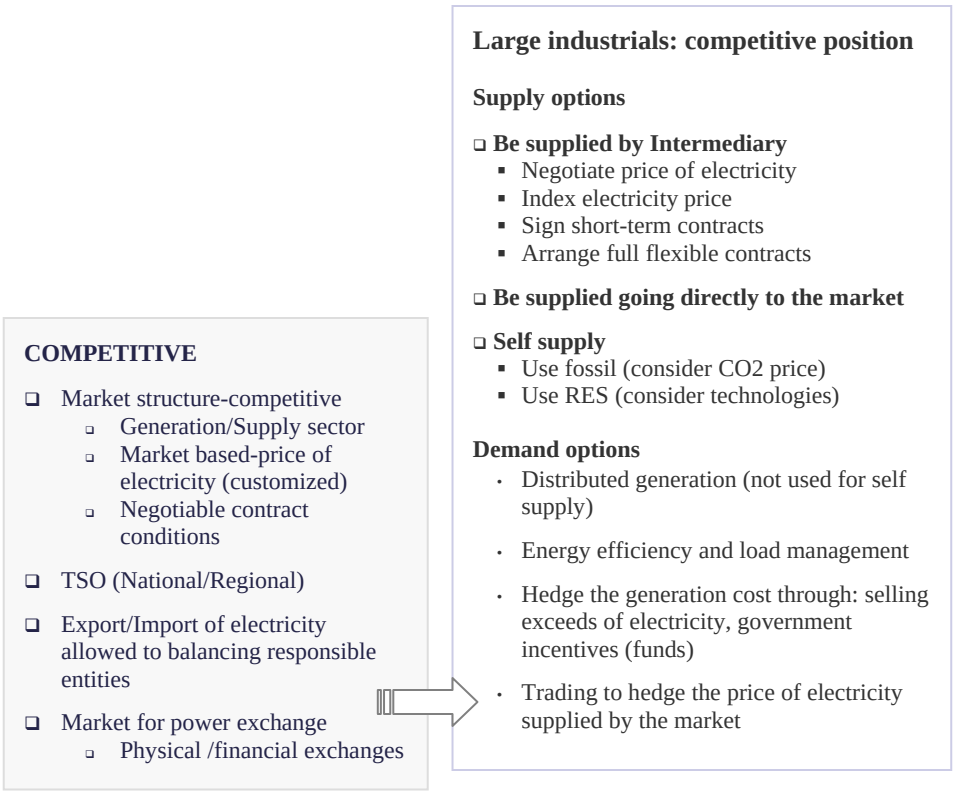

Figure 3. Power supply in competitive market structure.

Being supplied through intermediary

In competitive market, large industrials are at first time allowed to use ***the indexed contracts*.** These contracts can have fixed or flexible prices, indexed on specific elements such as fuel prices or the industrials' product prices. The contract can cover a customer's entire consumption, or only a share of the consumption. Contractual arrangements can also be based on a specific technology or on a mix of technologies. Usually, the price of electricity is linked to the price of fuel, mainly to the international coal price since the price of coal is less volatile than electricity or gas price among others. The final price offered by the supplier is based on facility's historical or forecasted consumption pattern; nevertheless, there is still uncertainty in the final electricity consumption.

Many times large industrials sign "special" short term contracts with suppliers as complement to the main contract for supply. These contracts could be contracts with interruptability option[2]; than,

[2] Using it, industrial facilities may have their power consumption cut off by a determined quantity if market prices reach a certain level – specified in the contract. The reduction or cut off may be announced before, and the duration of the interruption is fixed. Also, on this way large industrials can reduce the cost, due to fact that they are compensated for each MWh they declared interruptible.

contract for adjustment[3] or they can leave open contractual position to renegotiation[4]. Usually, these contract options are used to help large industrials to mitigate the price risk related to the selected supply option.

Direct purchasing from the Market

Large industrials, who relate the future consumption patterns on their past ones, usually purchase their electricity directly on the market (i.e. exchange or brokered platforms). Their consumption could be generally divided on base load consumption[5] (both peak and off-peak), and their flexible consumption. According to the fact that companies have a difficulty to forecast the electricity needed to cover their flexible consumption, they usually use day-ahead or balancing market for this purpose. The use of balancing market creates the need for risk management arrangements, since balancing market prices are more volatile than forward market prices. The risk related to the prices volatility is usually spread by contracting a certain share of their anticipated consumption in one form of contract and other shares in other forms.

On a brokered market, large industrial are able to discuss or negotiate the price for bulk consumption with the electricity supplier or trader. They can increase their negotiation power by aggregating its demand. Large industrials usually become an "aggregator", multiplying retail customers or single customers with multiple sites or both into one or more buying groups for the purpose of purchasing power. The load aggregation is usually used to help companies to reach the best price for power supplied and somehow to mitigate the price risk.

Self-supply as supply option

Self-generation does not represent a new way of supply, found in competitive market structure. Self-supply was used by large industrials for long time, mainly as back-up supply, to reduce the cost. Generated power was used only for internal purpose. Investment and operational costs were relatively high, and in some cases, generated power was more expensive that electricity delivered from the grid. Exceeds of generated power might have been sold only to the grid.

In competitive market, large industrials start to be more interesting for self-generation. They recognized the ownership as a physical hedge against fluctuations in electricity prices, not excluding the possibility to use self-supply to improve the reliability of supply. The main reason is that this market structure brought them an opportunity to sell the electricity on the market instead of to an

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[3] The industrials can buy block directly on the market, while at the same time sign the contract with supplier for adjustments between blocks of electricity bought directly and its real consumption. In such cases, the supplier can offer to buy the adjustments at the market price (e.g. day-ahead) and charge a commission.

[4] Where the industrial facility is not risk averse to price volatility, the contractual positions can be left open to renegotiation (e.g. clauses can be introduced whereby prices are re-quoted every three months).

[5] Base-load is defined as the minimum amount of electricity delivered or required over a specific time period at a steady rate, it includes consumption during peak and off-peak hours. Peak hours are referred to as the hours of the day where the demand is highest, e.g. from 8am to 8pm in France, and off-peak where the demand is low, e.g. from 8pm to 8am in France.

identified end-user (e.g. grid or national company in regulated and transitional market, or within RE program). The market price is considered, therefore, as the opportunity cost of selling to existing user.

The industrials do so either by investing in the majority of a generation asset or in only in share. By integrating vertically to ensure the supply of base load electricity at low cost, industrial facilities are able to manage the supply of their base load needs and the price volatility, while they can go to the market to purchase the rest of the power needed. Investing in power generation, usually they sign contract on power supply at production cost according to their contribution to the investment. This structure of investment will ensure stable electricity price and become a physical hedge towards fluctuations in electricity prices. The downside to this agreement lies, nevertheless, in the fuel price volatility over the life-time of the investment.

It can be concluded that, in competitive market structure large industrials have much more possibilities to arrange different supply options than in previous two ones. The advantage of this market structure lies in the fact that large industrials have more freedom to organize power supply escaping to be locked with the same supplier for long period of time.

3. PRICE HEDGING AND DEMAND RESPONSE MEASURES

A sourcing strategy can help a company to increase its value by obtaining lower prices, more favorable warranties and better terms or conditions (Newhart, 2006). Since energy purchasing depends upon a number of factors and functions in regards to the electricity market and the liberalization process; energy sourcing strategies must take into account specific factors, risks and possible benefits such as cost savings. Traditionally, large industrials have been satisfying their electricity needs under heavily regulated markets. Flexibility and opportunities to optimize its costs were limited to one single supplier and perhaps few options for load management. However, changes, brought about by deregulation have been partly considered in previously used strategies. Environmental regulation that introduces CO_2 costs isn't taken into account either, nor incentives for renewable generation, which could be very important in the case of self supply.

From general point of view, the main concern of large industrials is to find a way to manage the risks related to the price fluctuation and reliability of supply. Large industrials with their facilities are exposed to power price risk applying one of the purchasing strategies, with the exception, to some extent, of regulated prices and agreement signed with suppliers on the basis of fixed prices. However, regulated tariffs also carry a risk, as they are subject to unpredictable governmental decision. Also, at the time when the contract expires and market price exceeds the contract prices, the large industrials could be exposed to a rate shock upon the termination of the contract.

If a large industrial is supplied through a supplier, generally, a risk premium is included in the final contract price. Since, the supplier already took into account the price volatility; a large industrial may not need to manage the price risk. Therefore, a risk that should be managed by the company is

the risk of not being supplied. The reliability of supply could be managed using different types of contracts or applying different technologies in order to secure power supply when the company needs it. Due to financial and technical reasons, the self-generation is the most frequently used approach to backup power supply, since power conservation is technically, but not financially feasible yet. Today, many of technologies for power conservation are still in developing phase, and it will take a time until they become standardized ones.

In the case where large industrials cover their needs by self-generation, they should consider the price risk through fuel price volatility. This is not a case if large industrials are tied with long-term supplying contracts for the fuel purchase; or those that uses market prices as a benchmark for the valorization of their production. In this case, the cost of CO2 as additional cost component should be taken into account. If the self generation is based on renewables, large industrials could manage their cost of power (i.e. generation cost) using different subsidies or selling the generated power on the market. Reliability of supply could be managed on two ways: signing backup-supply contract with local supplier, or going to the market and buy electricity to cover additional needs.

Large industrials, owning self-generation facilities tend to play a more active role in their purchasing strategies. They build more complex supply strategies, compared to those which do not. Usually, they are willing to accept supply offers by suppliers as a complement option to self-supply. Thus, it is very common for large industrials to combine several purchasing options in order to reach the best combination – the price of power and reliable supply.

Large industrials could employ two different approaches to manage their demand: to reduce the cost of power and to reduce demand, changing their consumption pattern. For this purpose, they could use different types of contracts, in order to hedge the price of power, or they could use the operational activities to change consumption pattern, in order to reduce demand, and related costs. For example, self generation is consider as operational activity, and it could be used for many purposes such as backup supply, complement to load management for cost reduction, then, option for price hedging, etc. Managing demand, using different contracts and/or technologies, are two approaches used in complemented way. However, their appliance depends on the level of market opening. For example, in regulated market, many of contracts, which could be used for price hedging, do not exist, because large industrials do not have access to the market (i.e. they are not considered as agent of the market).

3.1 Financial instruments: price hedging

Knowing that the price of electricity directly affects the profitability of the company, large industrials are forced to apply various financial contracts in order to hedge the price of power. These contracts are available to large industrials only after they gain access to the market and become equal to the other market players. In previous two market structures, this option was not possible. Large industrials have been observed as passive players, having possibility only to be supplied. The basic idea is to transfer the price risk to other market players who could benefit from taking the risk.

Hedging products (i.e. type of contract) can be standardized (e.g. futures), traded at power exchanges, or custom-made according to the large industrials` needs (e.g. forwards), traded on a bilateral basis. Apart the price risk, they can cover also the volume risk if the volume needs to be managed.

Beyond different future and forward contract which allows hedging of short term/medium term selling and buying of electricity, more tailor-made hedging contracts have emerged in parallel with liberalization. For example, contracts with fixed prices and quantities are for physical delivery, and they protect large industrials from market price volatility. Then, indexed contracts are used to hedge the price volatility indexing the price of electricity to the output price. So, the electricity price that large industrial pays is determined by an index based on the price of different commodities. Frequently used contract is a contract with a fixed quantity but floating price. This is long-term contract where the buyer pays a short-term price in each period – often the day-ahead price. The floating price can be seen as an indexed contract, where the index is the day-ahead market or any other short-term reference price.

Large industrials, which use self generation as supply option use cross-market contracts linking fuel prices with electricity prices in order to offset the spread risk (i.e. difference between electricity prices and fuel costs). This is very common since the fuel costs amount the dominant share of generation costs, and large industrial as power producer wants to hedge the fuel price uncertainty.

It is not possible to hedge against price risk in every European country. The reason is that, in many countries traders are not yet active, this role belongs to the National Company, or large industrials are not allowed to gain status of active market players, even if the market is officially open. Along with introducing competition in electricity market, price volatility exposure created demand for commonly understood and accepted risk management procedure. This has entailed new business opportunities, taking attention on energy consumption and electricity purchasing.

3.2 Operational Flexibility: managing demand and related cost

The cost for electricity most often vary considerable over the day, the week and the seasons of the year depending on the size of the total load. The demand is changing continuously due to customers` habits, weather conditions and industrial activities. As the cost of producing electricity varies, than the rates vary accordingly to demand changes. This means that large industrial always has a free choice: reduce the load or demand by some appropriate technique or technology or pay for the electricity at actual price.

As response to “price settings” that reflect the cost changes, large industrials started to implement activities designed to influence their consumption and load patterns. All available techniques could be analyzed depending on what large industrial wants to achieve by their implementation. According to this we can differentiate techniques designated to:

- Reduce peak demand, i.e. maximum power required by the facility;

- Reduce the total energy consumed in the facility;
- Shift energy consumption to a time when energy costs are lower.

There are many approaches how large industrials can change load pattern and reduce total power consumption, but today available and frequently used are load management actions, than self generation and recently very popular energy conservation or energy storage. These activities are usually accompanied with energy efficiency initiatives. Some of these activities are also used to improve reliability of supply, knowing that reliable power supply is equaled important as the price of power.

3.2.1 Load management actions

In most electrical rate schedules, the largest components of the total charge for electricity are the charge for total electrical energy (kWh) and the charge for the peak electrical demand (kW). Thus, it may be possible to substantially reduce the total charge for electricity by reducing the peak demand charge, even if the total electricity use during the billing period remains the same.

Usually used method by large industrials for reducing power demand is rescheduling operation by moving operations from first shift, when the peak demand typically occurs, to second or third shift. In that way, large industrial is allowed to mitigate the payment for kW installed capacity at higher rate. Of course, the operational flexibility of the core operations is needed in order to be rescheduled. The other possibility used frequently is the installation of simple control equipment that ensures that specific pieces of equipment do not run simultaneously. In that way, large industrial can escape the peak of consumption or to reduce the total consumption at that time. Finally, installing energy management and control systems, programmed to strategically shed loads to keep the peak demand within a specified range. Avoiding the demand over the quantity set in the contract, large industrial will evade paying designed penalties. Load management activities are often complemented by interruptible contracts[6] in order to achieve better savings. In this case, interruptible contracts are considered as "incentives" for large industrials to manage their load, and in that way to reduce the cost of power.

In general, large industrials look for opportunities to reschedule operations to reduce peak demand in the cases when plant operates more than one shift per day; electrical demand is higher during one

[6] Allow the electricity supplier to interrupt a given percentage of an industrial customer's load a fixed number of times over the life of the contract; in exchange, the customer receives a discount on the price of electricity for the customer's entire load; the second form of an interruptible contract, which is called a *pay-as-you-go* contract, allows the electricity supplier to interrupt part of a customer's load a fixed number of times in exchange for compensation, per unit of load interrupted (Baldick, R. Kolos, S. Tompaidis, S. Interruptible Electricity Contracts from an Electricity Retailer's Point of View: Valuation and Optimal Interruption. Vol. 54, No. 4, July–August 2006, pp. 627-642).

shift than the others; and plant has electricity-using operation(s) that currently run during the shift with peak demand, but not during off-peak shifts. Usually, if after the implementation of all peak reducing measures, the peak demand still continues to be unacceptable high, large industrials consider installing on-site, engine-driven generators to kick in and help shave the peak load.

3.2.2 Self generation: backup or hedge

Generation and sale of electricity is not the primary business of the industrial entity but, rather that the facility uses self generation as a complementary adjunct to normal operations. For example, an industrial facility may acquire an emergency generator to provide backup power in the event of a grid outage. Nevertheless, the recent restructuring of the electric utility industry has created opportunities for large industrials to participate on the electricity marketplace buying and selling the power. This situation offered new ways how self generation could be used apart the backup purpose.

Whether a large industrial decides to participate on the market will be heavily influenced by the physical and operational requirements for connecting and interacting with the grid imposed on that customer by the utility system. In general, the large industrial will make that decision on the basis of an economic comparison between staying the course (i.e. doing nothing different) and using self generation unit to participate on electricity markets. Depending on market structure where the large industrials operate, they have several options how to use a power generation unit:

- Buy energy for the facility from the grid, and use the unit as backup (i.e., to improve the reliability of supply);
- Buy energy for the facility from the grid and use the unit as cost reduction option (i.e., as support to manage the demand);
- Self-supply and sell any excess in the real-time energy market (i.e. hedging the price of the power).

In the case when large industrials generate power to cover their needs (i.e. self supply), self generation is used as a less cost-effective approach to power supply, where electricity is generated at the point of use, allowing the placement of customized power plants on the large industrial's site. In this way, large industrials reduce the cost related to the electricity procurement, avoiding transmission and distribution expenses for power delivery. Besides that, power units could be used as backup systems. They are used as less-expensive power sourcing during peak price periods, reducing the total cost for electricity consumed. Apart the cost reduction, large industrials use power generation as a way for making the system more secure and less vulnerable to widespread service disruptions.

Improved Reliability of Supply

Reliable and quality power for critical process protection and standby applications are strategies where large industrials use self generation. As large industrials count on uninterrupted electric service 24 hours a day, seven days a week, week in and week out, self generation is used as an alternative solution. Customers who need highly reliable power install generators, and use them as

an answer to energy supply shortfalls, in the case when the traditional electricity grid is not able to satisfy needs for quantity or quality of power. This is especially case when the traditional grid is vulnerable to damage or interruptions, which last anywhere from a few seconds to several hours.

Reductions in the Volatility of Prices

The costs of power vary hour by hour depending on the demand and the availability of generating assets. In the regulated market, large customers pay time-of-use rates (TOU) that convert these hourly variations into seasonal and daily categories such as on-peak, off-peak, or shoulder rates. With the advent of wholesale and retail market competition, these variations are transmitted directly as price signals. Both, large customers under TOU and those participating in competitive power markets select distributed generation as an option to reduce the cost of power during high-cost peak periods. Using distributed generation for peak shaving, the customer could reduce overall cost of power, in some cases realizing that their self generation systems are cheaper than the peak TOU rates for much of the year. Of course, the cost of generation and other related expenses depend on selected technology. In this case, self generation is used as a complement to load management practice.

Hedging the Price of Power

However, hedging the electricity price implies the use of self generation when generation costs are less than buying electricity from utilities. As an extra advantage of this strategy is when revenues can be obtained from the sales of electricity to other utilities or customers. These options are interesting as long as the cost of procuring electricity is higher than cost of running the generation set. Re-selling option is used only in competitive market due to fact that large industrials are allowed to sell the power on the market only in this market structure. In previous two market structures, large industrials are allowed to sell the power only to the grid, if the grid is interested to purchase it, or if they are part of renewable energy (RE) regime of the country (e.g. feed-in tariff system).

Self generation faces a challenge due to generally higher specific capital costs and production costs than larger generating systems. These challenge is balanced against positive factors such as opportunity for increased reliability at the site, avoidance of peak load constraints and price spikes, reduction of transmission and some distribution charges, avoidance of energy line losses, improved power quality, and greater flexibility to react to market changes. The key success factor for self generation in a competitive situation can be best described as “providing the customer with the lowest cost solution to meet his particular needs”. According to the internal assessment, in some cases, this may be lowest investment or production cost, in others; it might be the lowest cost after considering site-specific or strategic factors. The process by which an industrial customer determines whether a distributed generation is of strategic value in its operations is complex and multifaceted.

3.2.3 Energy Conservation

Unlike any other successful commodities market, the electricity market has little or no storage component. This is major weakness that means that electricity must always be used precisely when it is produced. Based on balance of supply and demand, its monetary value also changes continually with time over a day and across a season (Baxter, July 2002).

Energy storage technologies are used by large industrials to produce and store electricity for later use. This has obvious benefit to the large industrials as consumers of energy as a means to enable them to manage their demand and the cost of power consumed.

Energy storage could be very helpful in the case of self generation, helping the large industrials to operate in a more cost effective manner. These facilities that supplement existing generation facilities are the largest of the energy storage technologies, with their primary focus being to provide energy to the industrial facility in long duration discharges on a daily or hourly schedule. Although the desire to reduce the cost of power is very important to large customers, the desire to prevent disruption in their energy service from affecting their manufacturing process is even stronger. Therefore, energy storage systems in this market are primarily designed to improve the use of power at a customer's site rather than generate income. These facilities do not necessarily have the discharge endurance of some of the larger systems, but rather focus on response time and power deliverability.

Energy storage facilities are used through three primary roles by large industrials: reducing energy costs through peak shaving; improving the quality of power; and providing increased reliability of service. The size of the facility is wholly dependent upon customer's demand. Generally, it is designed for repeated, small discharges for power conditioning service with the ability to provide limited bridging power to essential equipment during an outage. Energy storage is complemented by techniques such as better resource forecasting, demand management and importantly, innovative financing solutions to overcome the high capital cost barrier to entry for storage subsystems.

4. CONCLUSION

The regulatory environment of the energy industry in many countries has begun to change, modifying it from a monopolistic industry structure to a more competitive one. This movement has affected particularly industries with high energy costs and their energy sourcing methods.

Before liberalization, energy sourcing was limited to a set of products offered by electric companies under regulation. Customers had no other choice than to respond reactively to what happened in the market (i.e. to reduce electricity use in peak hours and accept the tariff-based prices). However, deregulation of electricity markets provided the customers with significant choice in energy sourcing for the first time, changing the way electricity is purchased and creating a need to develop energy sourcing strategies.

According to the results, provided by the surveys it could be noticed that the energy deregulation has created an opportunity for large industrials to add electricity procurement to their overall strategic sourcing program. Securing contracts through competitive energy markets resulted in significant cost avoidance. In deciding on an energy sourcing strategy, the user has a wide range of options. We noticed that the existing sourcing strategies applied by large industrials already consider new market conditions. Summarized market conditions and their effects could be presented in the following way:

1) The new regulatory framework - the sourcing of electricity depends upon the specific legislation in each country;
2) New technologies (load management, energy storage) - must be seen by industry as an important option to save power costs, reducing consumption from the grid during peak hours;
3) Self-generation - describing how it can be an important alternative for industries to self generate their electricity and to promote the development of renewable energy;
4) The EU Trading System (ETS) - adding the new cost component to the generation cost using fossil based technologies; affecting the price of power and accelerating the development of CO2 free technologies.

According to the Survey on behalf of Large Industrials, it could be realized that challenges and opportunities for energy supply and procurement exist in regulated as well as in deregulated markets. However, depending on the electricity market structure, large industrials are in position to diversify their power sourcing strategies. Therefore, as market becomes more competitive, large industrials benefit having more possibilities for electricity supply. These advantages include the fact that, large customers have the possibility to choose between many suppliers, as well as being supplied under more flexible contracts. Then, they can use different markets for being supplied, and finally, they can generate power covering their needs. Also, in more competitive market, large industrials are allowed to benefit the different price structure, i.e., they can index the prices of power to the price of other commodities in order to reduce impact of price fluctuation (fuel, oil, coal, etc.).

During the process of liberalization, self generation has gained attention given that it can contribute to achieving the goals of the EU energy policy, and suggesting the need for a new and different approach to energy supply. Self generation has been always more-less considered as backup option, either to improve reliability of supply or to reduce the cost of supply. But, in today’s market conditions, self generation is considered as very serious approach for power supply.

Another aspect that has gained attention over the past years is load management and energy storage. The high demand of electricity affected congestion on the electric transmission system, especially during peak periods. This drove the energy suppliers to take measures such as the increment of the electricity price during these times. As a result, large industrials were obliged to find the ways either to reduce their consumption during peak hours or to store energy, in order to be used during these hours. These approaches are not dependent on market structure, but the quality of usage is different.

In regulated market, these technologies are quite expensive and can not be profitable, while in more competitive market, they have become standardized ones.

According to recent changes one can say that as energy markets deregulate and become competitive, the price of energy is expected to remain dependent on many factors; then electricity users face uncertainty in the electric power prices and their planning decisions become more difficult. Thus, it is becoming extremely important for large industrials to have a flexible sourcing strategy that can handle electricity price changes. There are several factors that must be considered, such as supply and demand, CO2 allowances, fuel prices, participation on the market, interconnector availability, weather conditions, etc. Thus, current power sourcing strategies should be monitored over the time to recognize market condition changes; which changes could represent potential opportunities for new strategy formulation.

REFERENCES

[1] BENSAOU, 1999. Portfolios of Buyer – Supplier Relationships, *Sloan Management Review*.

[2] HANDFIELD, Robert, 2004. The Impact of Energy Deregulation on Sourcing Strategy, *The Journal of Supply Chain Management*, p. 38.

[3] HAGY, James and FLYNN, Chris, 2001. Energy procurement in a deregulating United States. Key considerations and criteria in long term energy commitments, *Journal of Corporate Real estate*, Vol. 4, No. 1.

[4] LYONS, Richard, 2007. Ten steps to a Strategic Energy Plan, Alumni – *ABI/INFORM Global*.

[5] VENTOVUORI, Tomi, 2006. Elements of Sourcing Strategies in FM Services, *International Journal of Strategic Property Management*.

[6] RIBEIRO, Paulo; CROW, Mariesa; JOHNSON, Brian; ARSOY, Aysen; LIU, Yilu, 2001. Energy Storage Systems, *Proceedings of the IEEE*, Vol. 89, No. 12.

[7] SONG, HAili; FELLOW, Chen-Ching Liu; LAWARREE, Jacques, 2001. *Decision Making of an Electricity Suppliers' bid in a Spot market*, Department of Electrical Engineering, University of Washington.

[8] STEINER, Faye, 2000. Regulation, Industry structure and performance in the Electricity Supply industry, *Economics Department Working Papers*, No. 144.

[9] POYRY, *Electricity Sourcing Strategy: Analysis of Electricity Markets and Competitors' approaches*.

[10] KUMAR, David, 2001. Market Power in Electricity Supply, *IEEE Transactions on Energy Conversion*, Vol. 16, No. 4.

[11] TURNER, Suzanne, 2002. *Tools for Success - a manager's guide*, McGrow-Hill Professional.

[12] HORNGREN, Charles; SUNDEM, Gary, and STRATTON, William. Introduction in Management of Accounting, *Pearson Education International*.

[13] MEEUS, L.; PURCHALA, K., and ESPOSTI, C.D., 2005/2006. Regulated Cross-Border Transmission Investments in Europe, Transmission and Distribution Conference and Exhibition, IEEE PES, pp. 1285-1290.

[14] BELMANS, Ronnie, 2006. CO_2 trading scheme report, IEEE.

[15] PURCHALA, Konrad, 2006. Regulation on Cross-Border exchanges in electricity, IEEE.

[16] DANWITZ, Thomas Von, 2006. Regulation and liberalization of the European electricity market, *Energy law journal*, Vol. 27.

[17] EC, 2004. Analysis of Cross-Border Congestion Management Methods for the EU Internal Electricity Market, Final Report, *Consentec /Frontier Economics*.

[18] LEVEQUE, François; GLASHANT, Jean-Michael, 2005. *Electricity Internal Market in the European Union: What to do next?*, University of Paris and Ecole des mines de Paris (CERNA).

[19] BOISSELEAU, Francois; HAKVOORT, Rudi, 2002. The liberalization of the European Electricity Market(s): An Unstructured Restructuring process?, *The Energy Studies Review*, Vol. 13, No. 2.

[21] HASS, R.; AUER, R., 2005. The prerequisites for effective competition in restructured wholesale electricity markets, IEEE.

[22] MADLENER, Reinhard; STAGL, Sigrid, 2004. Sustainability-guided promotion of renewable electricity generation, *Ecological Economics*.

[23] FEBEG, EnergieNed, 2006. *Action plan for market transparency in the North West European electricity market*.

[24] TALLURI, 2004. Purchasing electricity for the cement industry in regulated markets and deregulated markets, *Cement Industry technical Conference*, IEEE – IAS/PCA.

[25] FABER, Scott, 1996. Unbundled Products and the Potential Role of Superconducting Magnetic Energy Storage in a Competitive Electric Marketplace, IEEE.

[27] SCHULER, Richard, 2004. Self- Regulating Markets for electricity: Letting Customers into the game, *IEEE Power Systems Conference and Exposition*, IEEE.

[28] BONNEVILLE, Eric, 2006. Demand Side management for residential and commercial end-users, *AERE*.

ANNEX

Annex 1: Survey on Market structure

SURVEY I

Survey on market structure

Since we are currently conducting a research study on the electricity market in EU, I would like to invite you to participate in this research and would be very grateful if you agree to help us by taking in the study.

The purpose of the survey is to obtain your feedback on the factors affecting different electricity market structures in EU countries. This would help us to better understand how liberalization process progresses under different circumstances in your country.

Before you start filling up the form, please state the data related to your company.

Country:……

Company's name: ……

Contact email address: ……

Choose one of proposed functions that describe your position on the energy market: (Multiple answers possible)

a) *Regulator*
b) *Supplier*
c) *Generator*
d) *Trader*
e) *Consumer*
f) *Other: ……*

Objective: To understand Regulatory Framework of the energy sector in the country

1. Do you recognize any institution in your country as Energy Regulator?

- Yes
- No

2. Can you state that in your country an institution is in charge as <u>Transmission System Operator:</u>

- Yes
- No

3. Do you recognize any institution in your country as <u>Market Operator</u>:

- Yes
- No

4. How could you characterize Generation and Supply sectors in your country:

- Bundled (belong to one single company)
- Unbundled (separated)

<u>Objective</u>: To gain an overall picture about generation sector in your country

5. Please describe the type of generators in your country:

- National/state-owned company
- Private companies
- State owned plus private companies
- Other, state: …….

6. Do large industrial users have a possibility to generate power?

- Yes
- No (go to 10)

7. If so, do they have a possibility to sell generated electricity?

- Yes
- No (go to 10)

8. Could you choose the answer which describes the way how generated power by large industrials is sold (multiple answers possible):

- To the National Company
- On Wholesale Market
- On Retail market
- Other

9. Generated power is priced at (multiple answers possible):

- Fixed price (cost based)
- Market based price
- Other, state: ……..

***Objective**: To gain an overall picture on power supply in your country*

10. How many companies are in charge of power supply:

- One dominant supplier
- Many suppliers
- Other, state: ……..

11. Could you please choose which of proposed characteristics describe the contract structure for power supply:

Length of the contract:

- Long-term contract
- Short-term contract

Price structure:

- Fixed price
- Indexed price

Interruptability of the contract is possible:

- Yes
- No

12. Does anyone in the country have the possibility to negotiate the contract structure:

- Only privileged consumers
- Anyone
- None

13. Does anyone in the country have a possibility to choose power supplier:

- Privileged consumers
- Anyone (households, commercials, industrials, etc.)
- None

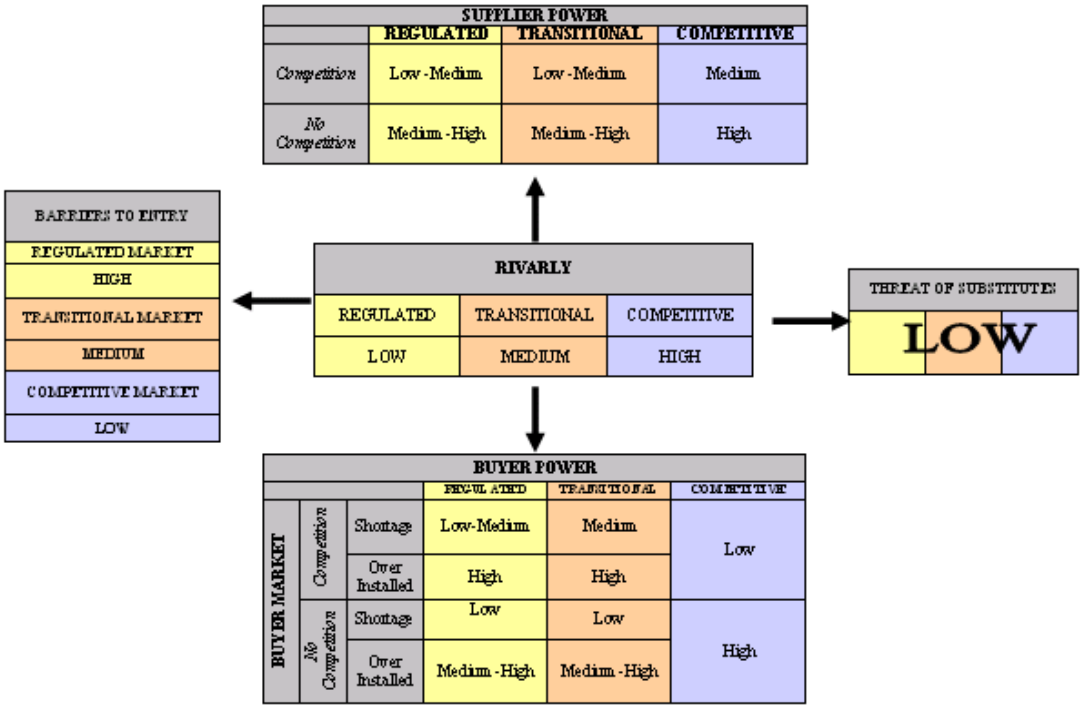
14. Can a large industrial gain the status of "the Agent of the market" (buy & sell):

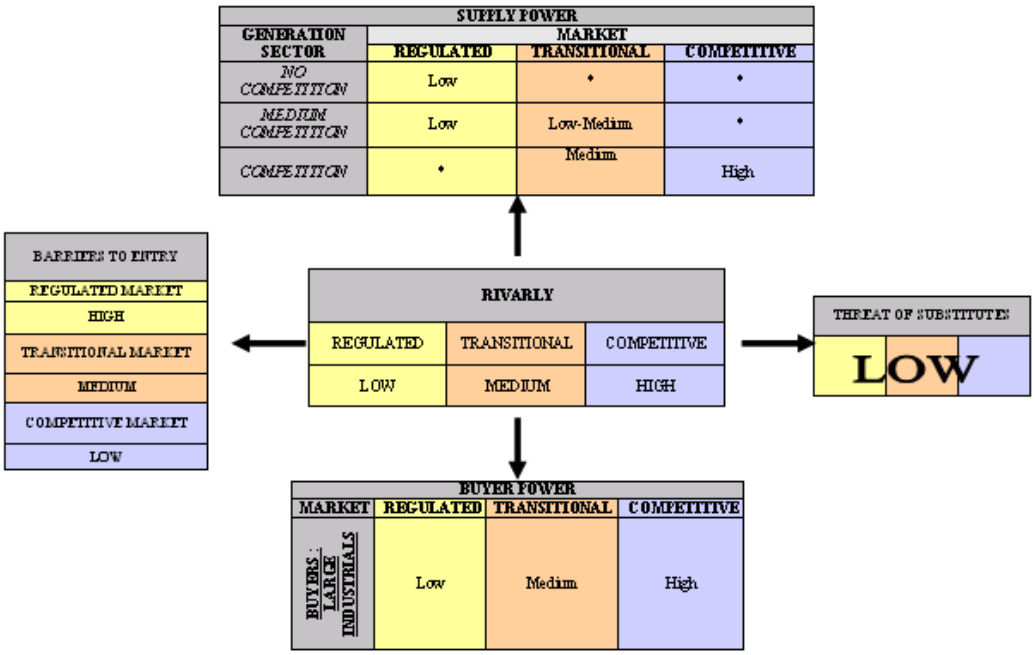
- Yes
- No

15. If they act as Agent of the market, do they have the possibility to import power to be supplied?

- Yes
- No

Annex 2: Porter Analysis on Electricity Industry: Generation and Supply sectors





Annex 3: Survey on behalf of large Industrials

SURVEY II

Survey on behalf of Large Industrials

Since we are currently conducting a research study on the electricity market in EU, I would like to invite you to participate in this research and would be very grateful if you agree to help us by taking in the study.

This questionnaire consists of three parts according to three different market structures, which could be found since the process of liberalization started. The company's representative is asked to provide answers according to the market structure, which could be found in the country where your company has its operations.

A: Regulated Market Structure

B: Transitional Market Structure

C: Competitive Market Structure

Before you start filling up the form, please state the data related to your company.

Country: ……

Nameof the company: ……

Company's representative: ……..

Contact email address: ……..

A Purpose: To provide information on supply options used by large industrials in regulated market structure

1. Could you state how does the company supply electricity?

- Using intermediary (National Company) (go to 2)
- Self-generating (go to 11)

2. As the company pays all-included electricity price, could you please state how is the price defined:

- Peak Tariff (go to 4)
- Flat tariff price (go to 3)
- Other tariffs (go to 4)

3. Can company switch from flat to peak tariff structure?

- Yes (go to 4)
- No (go to 4)

4. Is power supply reliable?

- Yes (go to 5)
- No (go to 5)

5. Which of the following best describes how does the company manage demand?

- Interruptible contract (go to 6)
- Doing nothing (go to 7)
- Load management (go to 8)
- Self-generating (go to 11)

6. Could you please provide the contract conditions (e.g. max hours daily/ annually, etc.)?

_____ (go to 9)

7. Does the company have an operational flexibility to change the consumption pattern?

- Yes (go to 8)
- No (go to 9)

8. Can you arrange interruptible contract?

- Yes (go to 9)
- No (go to 9)

9. Is company in position to generate power?

- Yes (go to 10)
- No (Finish)

10. If the company decides to generate electricity, is it possible for the company to sell it?

- Yes (Finish)
- No (Finish)

11. If the company generates electricity (backup or main supply option), could you please provide some data concerning the power unit?

- Installed capacity: …….
- Power output vs. company's demand (%): …….

12. Which of the following best describes the way generation unit is used:

- To cover all needs (self-supply) (go to 13)
- Only in peak hours (cost reduction) (go to 13)
- Back-up to improve reliability of supply (go to 13)

13. Please select the type of fuel used for power generation:

- Renewables energy sources (RES) (go to 16)
- Fossil fuel (go to 14)

14. As the company uses fossil fuel for power generation, which of the following actions describes the way how is the CO2 cost managed?

- using CO2 allowances (go to 15)
- through CO2 capture projects (go to 17)
- In the country there are no regulations on CO2 emission (go to 17)

15. The company is allocated with CO2 allowances using one of two proposed methods:

- Free allocation (go to 17)
- Purchasing allowances (go to 17)

16. Does company use some subsidies to generate power using RES?

- Yes (go to 17)
- No (go to 17)

17. Does the company sell the produced electricity?

- Yes (go to 18)
- No (go to 19)

18. How does the company sell or could sell the power generated?

- The company has an arrangement with the Government (fossil or renewable based)
- The company sells RE according to the RES promotion regime
- They can not sell the power at all

19. Could you state why the company does not sell or can not sell generated power?

- Grid connection is not allowed
- Government is not interested to purchase the power
- Profitability reasons (low price)
- Power purchase is a new option appeared recently

B Purpose: To provide information on supply options used by large industrials in transitional market structure

1. Could you state how does the company supply electricity?

- Using intermediary (National Company) (go to 2)
- Using intermediary (supplier is private company) (go to 2)
- Self-generating (go to 17)

2. Could you please select the contract structure arranged?

- Bundled contract (go to 3)
- Unbundled contract with fixed energy price(go to 7)

3. As the company pays all-included electricity price, could you please state type of tariff structure used?

- Flat tariff (go to 4)
- Peak Tariff (go to 5)
- Real time pricing (market based tariff) (go to 5)

4. Does the company have right to switch the contract structure and negotiate the price of energy?

- Yes (go to 5)
- No (go to 5)

5. Is power supply reliable?

- Yes (go to 6)
- No (go to 6)

6. Which of the following best describes the energy cost reduction strategy taken by your company? :

- Doing nothing (go to 8)
- Load management actions (go to 9)
- Contract arrangement (go to 10)
- Self-generation (go to 14)

7. Apart the energy price negotiation, could you please state activities used in order to manage the cost of power? :

- Load management actions (go to 9)
- Contract arrangement (go to 10)
- Self-generation (go to 14)

8. Does the company have operational flexibility to change load pattern?

- Yes (go to 9)
- No (go to 9)

9. Does the company have a possibility to arrange "aggregate load option" in supply contract?

- Yes (go to 13)
- No (go to 13)

10. Do you have interruptible contract?

- Yes (go to 12)
- No (go to 11)

11. Does the company have operational flexibility to manage load?

- Yes (go to 12)
- No (go to 12)

12. Do you have aggregate load option in supply contract?

- Yes (go to 13)
- No (go to 13)

13. In case the company generate power, is it allowed to sell it?

- Yes (Finish)
- No (Finish)

14. If the company generates electricity (backup or main supply option), could you please provide some data concerning the power unit?

- Installed capacity: …….
- Power output vs. company's demand (%): …….

15. Which of the following best describes the way generation unit is used:

- Self-supply (go to 16)
- Only in peak hours (go to 16)
- Back-up to improve reliability of supply (go to 16)

16. Please select the type of fuel used for power generation:

- Renewables energy sources (RES) (go to 17)
- Fossil fuel (go to 18)

17. Does company use some subsidies to generate power using RES?

- Yes (go to 20)
- No (go to 20)

18. As the company uses fossil fuel for power generation, which of the following actions describes the way how is the CO2 cost managed?

- using CO2 allowances (go to 19)
- through CO2 capture projects (go to 20)
- In the country there are no regulations on CO2 emission (go to 20)

19. The company is allocated with CO2 allowances using one of two proposed methods:

- Free allocation (go to 20)
- Purchasing allowances (go to 20)

20. Does the company sell the produced electricity?

- Yes (go to 21)
- No (go to 22)

21. How does the company sell or could sell the power generated?

- The company has an arrangement with the Government (fossil or renewable based)
- The company sells RE according to the RES promotion regime

22. Could you state why the company does not sell or can not sell generated power?

- Grid connection is not allowed (finish)
- Market power (finish)
- Profitability reasons (low price)

C Purpose: To provide information on supply options used by large industrials in competitive market structure

1. Could you state how does the company supply electricity?

- Using intermediary (supplier or generator) (go to 2)
- Going to the market (go to 7)
- Self-generating (go to 17)

2. Could you please select the contract structure arranged?

- Bundled contract: tariff structure (real time pricing)) (go to 4)
- Unbundled contract (go to 3)

3. How is the price defined?

- Fixed price (go to 5)
- Indexed price (go to 5)

4. Which is the type of market used?

- Spot (go to 5)
- Forward (go to 5)
- Wholesale (go to 5)

5. Which of the following best describes how does the company manage demand?

- Self-generating (go to 8)
- Load management (go to 7)
- Contract management (go to 6)

6. Do you use "interpretability " as an option in power supply contract?

- Yes (go to 7)
- No (go to 7)

7. Do you have "load aggregation option" in supply contract?

- Yes (go to 28)
- No (go to 28)

8. Which of the following best describes the way generation unit is used:

- Back-up to improve reliability of supply (go to 9)
- To manage the price of power (go to 9)

9. As the company generates electricity, could you please provide some data concerning the power unit?

- Installed capacity: ……
- Power output : ……
- Company's demand: ……

10. Please select the type of fuel used for power generation:

- Renewables energy sources (RES) (go to 11)
- Fossil fuel (go to 12)

11. Does company use some subsidies to generate power using RES?

- Yes (go to 14), State: ……
- No (go to 14)

12. As the company uses fossil fuel for power generation, could you state the way how does it manage CO2 emission cost?

- The company is allocated by CO2 allowances (go to 13)
- The company implemented CO2 capture projects (go to 14)

13. The company is allocated by CO2 allowances through:

- Free allocation (go to 14)
- Purchasing allowances (go to 14)

14. Does the company sell generated power?

- Yes (go to 15)
- No (go to 16)

15. How does the company sell the produced electricity?

- The company sells RE according to the RES promotion regime (go to 27)
- On retail market (Finish)
- On wholesale market (Finish)

16. If the company does not sell generated power, could you state reasons?

- Grid connection is not allowed (go to 27)
- Price of generated power is not competitive (Finish)
- "Agent of the market" status is not available yet (go to 26)

Set of questions related to the self-supply

17. As the company is self supplied, could you please provide some data concerning the power unit?

- Installed capacity: ……
- Power output vs. company's demand (%): ……

18. Please select the type of fuel used for power generation:

- Renewables energy sources (RES) (go to 19)
- Fossil fuel (go to 20)

19. Does company use some subsidies to generate power using RES?

- Yes (go to 22)
- No (go to 22)

20. As the company uses fossil fuel for power generation, could you state the way how does it manage CO2 emission cost?

- The company is allocated by CO2 allowances (go to 21)
- The company implemented CO2 capture projects (go to 22)

21. The company is allocated by CO2 allowances through:

- Free allocation (go to 22)
- Purchasing allowances (go to 22)

22. Does the company sell exceed of generated power?

- Yes (go to 24)
- No (go to 23)

23. Why does the company do not sell exceed?

- Grid connection is not allowed (go to 27)
- Price of generated power is not competitive (Finish)
- "Agent of the market" status is not available yet (go to 26)

24. How does the company sell the produced electricity?

- The company sells RE according to the RES promotion regime (go to 25)
- On retail market (got o 25)
- On wholesale market (go to 25)

25. How does the company secure supply?

- Signing the contract on supply with local suppliers (go to 26)
- Going to the market (Finish)

26. Is company allowed to go to the market to buy power?

- Yes (finish)
- No (finish)

27. As power producer, is company allowed to go to the market to buy power?

- Yes (go to 29)
- No (Finish)

28. Since the company is supplied by an intermediary, is it allowed to go to the market to buy power?

- Yes (go to 29)
- No (go to 30)

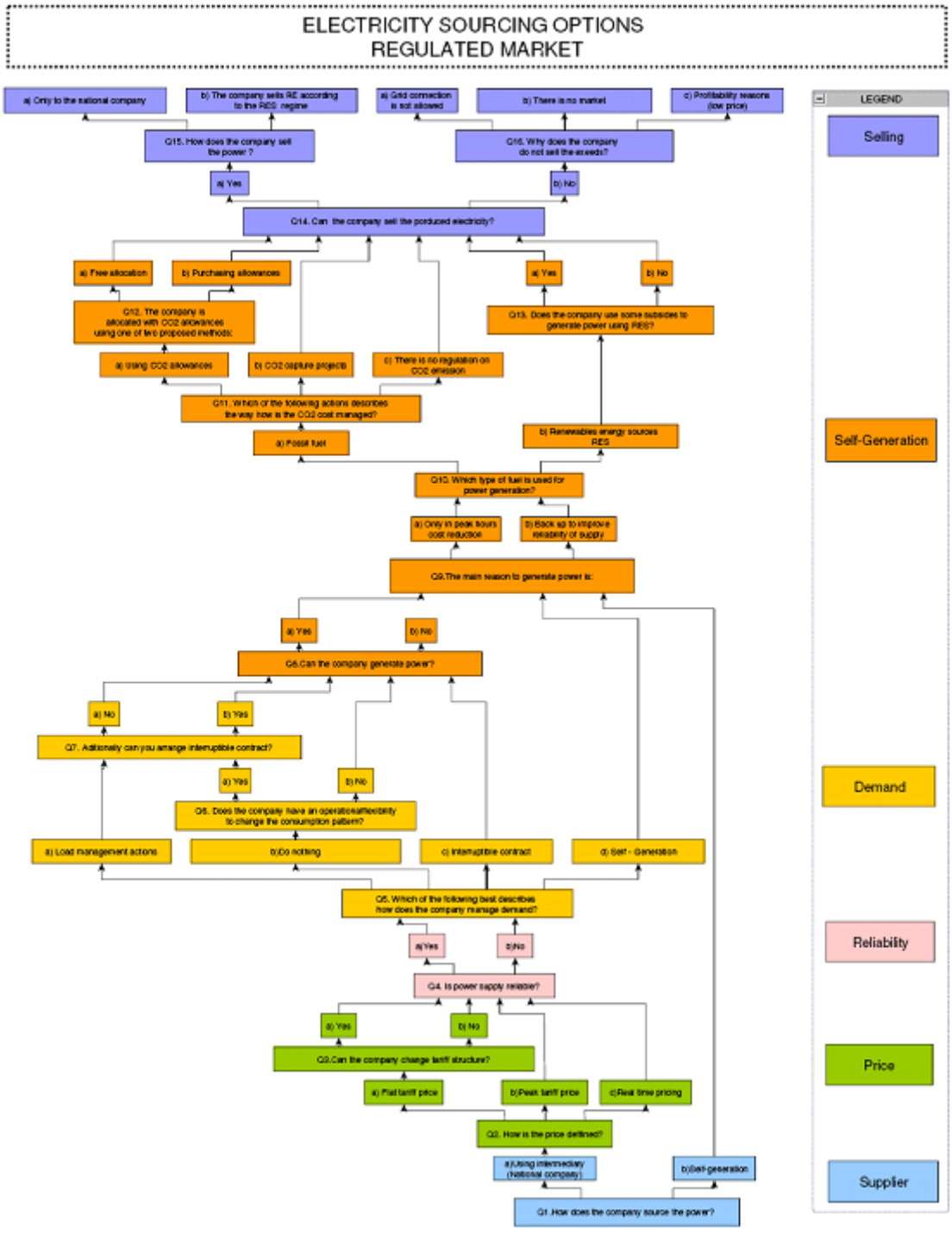
29. Can the company re-sell the power (bought on the market) (i.e. be an agent of the market)?

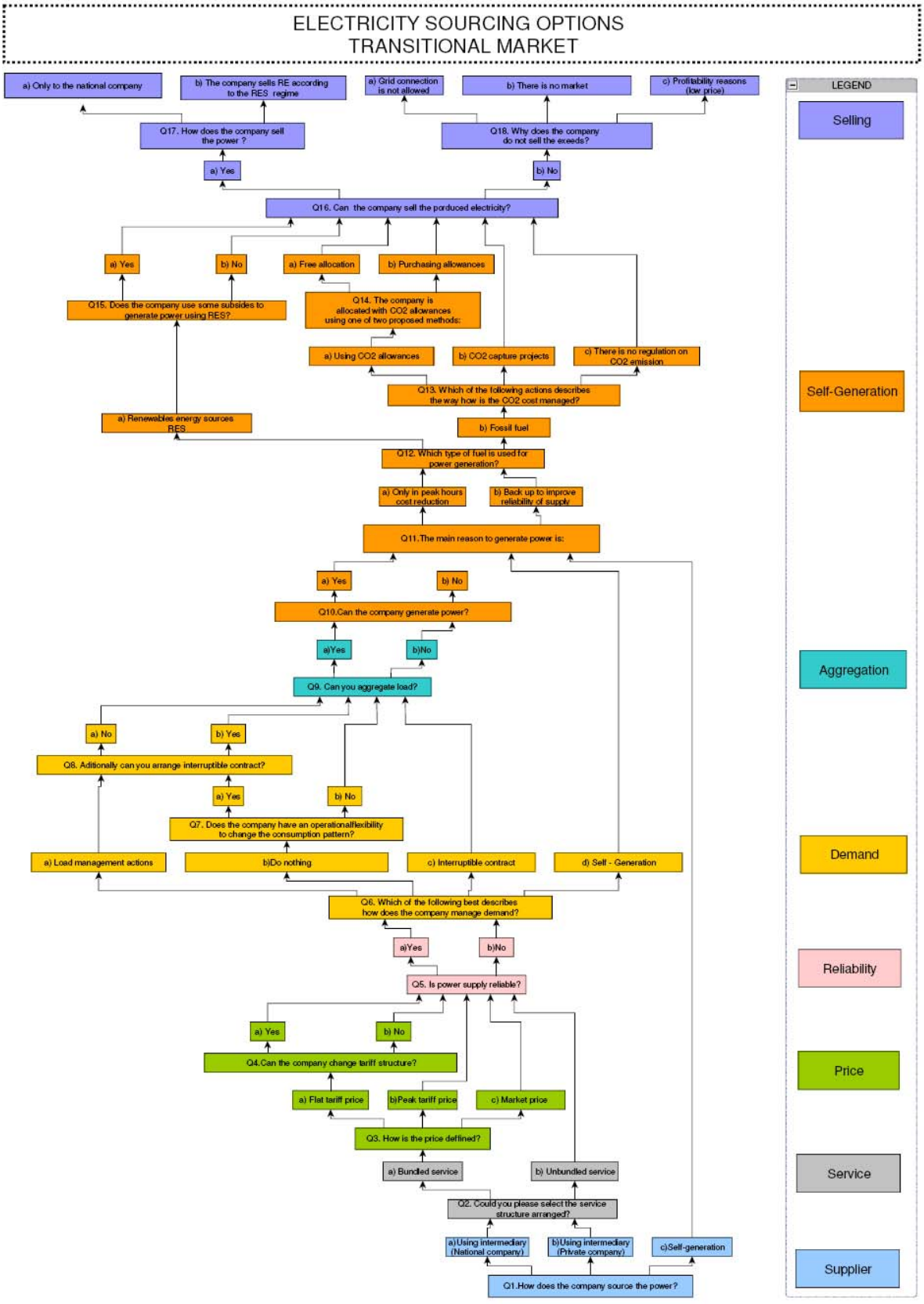
- Yes (Finish)
- No (Finish)

30. In the case the company generates power, is it allowed to sell it?

- Yes (Finish)
- No (Finish)

Annex 4: Diagrams on Regulated, Transitional and Competitive Market Structure




ELECTRICITY SOURCING OPTIONS
TRANSITIONAL MARKET
LEGEND
Selling
Self-Generation
Aggregation
Demand
Reliability
Price
Service
Supplier
a) Only to the national company
b) The company sells RE according to the RES regime
a) Grid connection is not allowed
b) There is no market
c) Profitability reasons (low price)
Q17. How does the company sell the power ?
Q18. Why does the company do not sell the exeeds?
a) Yes
b) No
Q16. Can the company sell the porduced electricity?
a) Yes
b) No
a) Free allocation
b) Purchasing allowances
Q15. Does the company use some subsides to generate power using RES?
Q14. The company is allocated with CO2 allowances using one of two proposed methods:
a) Using CO2 allowances
b) CO2 capture projects
c) There is no regulation on CO2 emission
Q13. Which of the following actions describes the way how is the CO2 cost managed?
a) Renewables energy sources RES
b) Fossil fuel
Q12. Which type of fuel is used for power generation?
a) Only in peak hours cost reduction
b) Back up to improve reliability of supply
Q11.The main reason to generate power is:
a) Yes
b) No
Q10.Can the company generate power?
a)Yes
b)No
Q9. Can you aggregate load?
a) No
b) Yes
Q8. Aditionally can you arrange interruptible contract?
a) Yes
b) No
Q7. Does the company have an operationalflexibility to change the consumption pattern?
a) Load management actions
b)Do nothing
c) Interruptible contract
d) Self - Generation
Q6. Which of the following best describes how does the company manage demand?
a)Yes
b)No
Q5. Is power supply reliable?
a) Yes
b) No
Q4.Can the company change tariff structure?
a) Flat tariff price
b)Peak tariff price
c) Market price
Q3. How is the price deffined?
a) Bundled service
b) Unbundled service
Q2. Could you please select the service structure arranged?
a)Using intermediary (National company)
b)Using intermediary (Private company)
c)Self-generation
Q1.How does the company source the power?

ELECTRICITY SOURCING OPTIONS
COMPETITIVE MARKET