

THE CONVERGENCE OF ELECTRIC POWER AND NATURAL GAS INDUSTRIES IN THE UNITED STATES AND IN EUROPE

Sophie MERITET

Researcher Associated

C. G. E. M. P. *Centre de Géopolitique de l'Énergie et des Matières Premières*

University Paris - Dauphine

Place du Maréchal de Lattre de Tassigny, 75775 Paris Cedex 16, FRANCE

Smeritet@aol.com

The views presented in this paper can be referred only to author whom is sole responsible for them.

ABSTRACT

The word 'convergence' of natural gas and electric power industries is used at least in North America, yet progressively in Europe. The meshing of these two value chains has resulted of deregulation reforms and technological advances. It has obvious implications on the whole energy industry organization: emergence of an integrated market and merger wave between utilities. As competition has intensified in both electricity and gas value chains (inter and infra energy), it has become noticeable that all actors are seeking to develop market shares in both industries by making use of benefits of synergies between the two markets. Nevertheless, convergence is more than simply the integration of common gas and electricity business processes to form one entity. In this paper, we will focus on convergence of electric power and gas value chains. We will present the main drivers of gas-electricity convergence and its impacts on the market organization. Then, we will wonder which lessons of the American energy industry experiences can be useful for the current European market evolution.

INTRODUCTION

Worldwide, energy network industries are undergoing a transition from regulated to competitive markets. Deregulatory initiatives have been taken in natural gas and electric power industries to eliminate traditional constraints and protectionism. An new era has begun: in some segments of value chains, monopoly activities are now open to competition. The pace of liberalization and the route towards it geographically varies. The European electric power industry is in its early stages of transition towards a competitive energy market. In the United States, for the last two decades, electric and natural gas industries have progressively experienced major changes in terms of organization and competitiveness. All over the world, the move seems to speed up.

The word '**convergence**' of **natural gas and electric power industries** is used at least in North America and progressively in Europe. The deregulation process and technological changes are inducing growing links between these two energy value chains. This phenomenon is obvious with the **wave of mergers and acquisitions** among American electric power and gas utilities, and it tends to invade Europe. These corporate operations are seen as strategic combinations of assets, skills and markets to form an 'energy company', competent in various energy activities. In the most obvious manifestation, gas and electricity companies have been merging to form full service energy corporations. Nevertheless, other signs of convergence exist too. For example, both industries rely on each other to fuel their future growth. Moreover, both industries need to expand transmission capabilities and face similar environmental and legal constraints.

Within ten years, the electric power sector, as we know it in Europe, will cease to exist. It is still unclear what kind of industry will emerge from this period of transition. The meshing of electric and gas value chains seems to be highly relevant to study in the era of changes in Europe (CHEVALIER J-M, 1999). There are lively discussions about how the American experience of electric power sector could be used.

In this paper, we will focus on a specific characteristic of the emerging competitive energy markets: the **convergence of electric power and gas value chains**. To begin with, we will present the **main drivers** of the growing link of gas and electricity industries. Then, we will analyze **several impacts** of the convergence of electric-gas value chains on the new energy market organization. Finally, we will wonder which **lessons of the American experience** can be helpful for the current European market evolution.

MAIN DRIVERS OF GAS-ELECTRICITY CONVERGENCE

With the liberalization reforms, the creation of more efficient markets and price transparency is inducing the meshing of both gas and electricity supply chains. Technological innovations combined with a growing demand for commercial choices are **accelerating** this movement. More precisely, the **main drivers** of this convergence have been:

- **Ongoing deregulation** of the gas and electricity markets.

The greatest parallel between the two industries is probably in the area of regulation. Begun at the same period¹, their regulatory histories are closely intertwined in the United States and in Europe. This is perhaps not surprising considering the many similarities between the electric power and gas industries². In North America, both sectors are regulated by the same commission, which creates a natural tendency to converge of regulation. F. E. R. C. 's (Federal Energy Regulatory Agency) recent restructuring of the electric power industry is based on the precedent model of the gas industry. There is already a form of deregulatory convergence between electricity and natural gas at a federal level. The F. E. R. C. Order 889 in the electric industry mirrors its earlier Order 636 in the gas industry. This parallel trend seems to continue at the state level with progress towards retail competition (JESS M. 1998). In Europe, the European Commission works on the deregulation using the same approach for both industries (see European Commission's reports and Directives).

Moreover, the process of unbundling energy utility business is facilitating the link along both value chains. By separating energy activities and liberalizing some of them, utilities are allowed to go beyond their markets to penetrate others. Nevertheless, the opening to competition reforms appear **necessary but not sufficient** to electricity-gas convergence.

- **Upstream linkage** of gas and power generation.

Technological progress, regulatory factors and environmental concerns, combined to encourage the use of natural gas for the generation of electric power. Advances in turbine efficiency have been made in the last decades with some combined-cycle gas turbine (C. G. T.) units now capable of achieving 65-75% efficiency compared to the 35 % efficiency for coal fired plants. Low polluting and less capital risked, C. G. T. units are more efficient method of producing electricity than traditional coal plants. Recent innovations in power generation have resulted in the emergence of so-called "distributed generation" units. This is a term for a diverse group of technologies³ aimed at generating electricity close to the place where it is used instead of generating at large centralized power plants and transmitting the power to users over long stretches of wire. One of the latest distributed generation options is gas microturbines. Small, flexible, environmentally clean, and relative maintenance free, gas microturbines can compete favorably with traditional units at the current low prices of natural gas. With environmental protection decisions, a few recently improved and new technologies based upon natural gas pay important roles in competitive power generation strategies (COOKSEY J. 1998).

- **Midstream synergies** between gas-power trading and risk management.

Technology advances are transforming the perception of electricity towards a commodity as it has occurred in the gas sector. The "*commoditisation*" refers to the move in both gas and electricity away from long term fixed price contracts to contracts based on spot process or some other market-related price. Gas and electricity are now considered as two commodities with a physical spot market⁴ and a "financial paper" market. With the emergence of electric spot markets, energy buyers and sellers have become exposed to financial risk caused by volatile spot prices. Commodity risk is familiar to energy market participants. The volatility in electric prices during June 1998 and July 1999 in the North East area in the US, in July 2000 and December 2000 in California, and natural gas prices in 2000 are recent examples. Natural gas and electricity are the two most volatile commodities. A \$ 1 change in the July / August electricity forward contract generates profit and loss swings of approximate \$ 70 000 per 100 MW. The traditional approach to mitigate commodity risks is to execute a hedging strategy to buy or sell forward energy derivative contracts. This has led to the development of derivatives markets and the entrance of a wide range of traders and risk management providers. The introduction of electricity futures has raised possibility of trading spreads between gas and electricity futures. It is interesting to notice that last year, nine of the top-ten US based power marketers have originated from the gas sector. Energy trading is now exploding in Europe with several new actors and the development of new trading places.

- **Downstream opportunities** to eliminate duplication costs.

Transmission and distribution, wires and pipes, are natural monopolies in most instances, which therefore merit strong regulation. In contrast the supply (in this sense meaning the marketing) can and should be competitive. The various suppliers using the same infrastructure to deliver the product and differentiating themselves on the basis of service or efficiency or indeed price. Once supply is separate it becomes clear that it is a business with relatively low investment requirements and it becomes a high volume, low margin operation. In the United States, combined distribution utilities of gas and electricity have always existed. With the deregulation of power retail function, an increasing number of utilities are now combining their gas and electricity marketing activities to offer consumers a bundled energy service as one package. They are testing new technologies: on-line billing, remote appliance scheduling and control, and energy-usage monitoring. Significant synergies are perceived as offering customers one-stop-shop energy services (similar to the approach of supermarkets to food retailing). Some utilities are trying to leverage their customer relationship to cross-sell products and services⁵ like water delivery, telecom, technical advice, home-security systems and electrical appliance maintenance contracts. In Europe, it seems to be too early: we are at the first steps in the deregulation process.

- **Web - based** gas and electricity exchange at wholesale and retail level.

In this era of transformation of the gas and electric power value chains, everyone involved in energy recognizes that the evolution of e-commerce is compelling greater changes in the way energy units are marketed and purchased in both wholesale and retail markets. The combination of the existing market size for a standardized and essential commodity, with an exponential growth rate as more states and / or countries open to electric and natural gas competition has drawn an array of energy service providers aiming to the Web-based energy exchange. Electricity and gas, are ideal commodities for e-commerce. They are delivered by wire and pipeline and controlled electronically. The **technology of e-commerce** is well suited to the real time matching of supply and demand required by electric power and natural gas markets.

Currently, the number of sites dedicated to buying and selling energy online or that offer new services to downstream energy companies is proliferating. More than a dozen new or expanded online energy e-commerce ventures were reported in the last quarter 2000 alone. While several shops have increased the percentage of their business executed electronically, a smaller pool of players is responsible for the most of the gain. The industry is still in the emergence phase of the product life cycle. It is now the beginning of the entrance of many new players. The challenge facing providers both on the national and regional level is differentiating their service from a competitor's.

E-business has yet to fully take root in utility operations. While most companies believe it will ultimately have a profound effect, particularly in customer facing parts of their business, not all have the same view about e-business benefits across other parts of their business. A distinction in energy segments must be realized : the e-commerce has **not the same role in trading operations and in retailing activities.**

- Deregulation of the energy industry is creating opportunities for energy distributors. By 2005, in the United States, 28% of online households will be using the Net to trim their energy bills, spending \$ 10 millions to do so. Still even this amount is small compared with the total market. In surveying the field of service providers in this segment, utilities, power marketers and energy service consultants have joined the fray offering products ranging from on line energy cost management, bill auditing, and energy procurement tools.

- Wholesale electricity trading has been a "*strat-stop affair*", as players moved in, then out of the market. Extreme volatility, illiquidity, complaints of inaccessibility to electric transmission system, and unlike the opening of the natural gas market, short supply have proved to be major hurdles. Many observers predict the number of combined gas and power companies with large-scale trading operations could shrink to just a dozen as the industry consolidates. Underscoring a growing shift to electronic commerce, the NYMEX suspended open outcry electricity trading at the end of business in favor of its Access electronic trading system. And, for the first time, the giants of the industry are making a direct investment in e-commerce.

The meshing of gas and electricity industries have resulted of the **liberalization reforms** towards competitive power generation and retail sectors, and the powerful disruptive effects of **technological changes**. Deregulation combined with important innovations has induced growing links between these two energy value chains at different levels of activity. The convergence is breaking over the electric power industry organization, sweeping away traditional utility structures and creating new business opportunities in an increasingly competitive market environment.

IMPACTS OF THE CONVERGENCE ON THE EMERGING ENERGY MARKET

The move towards convergence has been primarily driven by a need to reduce costs and to take advantage of the various synergies that might occur between electric and gas businesses. Electric power and gas industries are clearly connected along deregulated segments:

- In **power generation**, the use of natural gas is leading to the emergence of a new market place where gas and electricity will be sold together and compete together.

Many energy utilities view convergence as a means of managing commodity price volatility, by providing them with the opportunity to arbitrage⁶ between the various commodities and their respective markets (CHEVALIER J-M, 1999). A number of players are seeking deliberate convergence of gas and electricity trading. This is generally motivated by intention of cutting costs by combining trading operations and exploiting arbitrage opportunities. Of particular importance to the convergence of the gas and electricity industries, is the development of arbitrage related use of gas-fired power generating units. In the USA, over 200 new entrants have filed the necessary paperwork to become power marketers including potentially powerful players such as major oil companies (e. g. *Amoco*), gas marketers (e. g. *Enron*), and Wall Street firms (e. g. *Morgan Stanley*). As might be expected, players who are now entering the commodity marketing-trading game position themselves with either financial or physical dimensions (if not both). At present, the United States offers the most developed gas-electricity arbitrage worldwide. However, exploitation of arbitrages still varies from region to region due to differences in the structure of markets and trading mechanisms.

One of the problem with introducing convergence in power generation is that from a financier's point of view, there are increasing risks. Anyone financing a new CCGT project seeks a strong fuel contract and a power sales agreement to back up purchase and construction of the plant. At this stage in the development of the market, competition is a barrier as is convergence, as we know it. Convergence implies unbundling with each element of the supply chain being on its own, exposed to the full forces of competition. This may be what we would wish to see in the long term but in the short term it increases risk and this can kill development or at the very least increase the final cost of electricity to reflect the risk perceived by the developer and bankers. The classic PPA (power purchase agreement) of the international independent power project (IPP) does in fact provide, on one definition, convergence as the gas price and electricity prices are fully linked (but it is in no way convergence as discussed above). The

classic IPP also consists of long term fuel and electricity contracts (the opposite of the short term trading). Therefore we can wonder if convergence could hinder financing (SHEARD R. , 1998).

Furthermore, with technological advances and the loss of significant economies of scale in production, a new generation market has emerged and is about to revolutionize the electric power industry's organization. These new generating systems can do more than reduce the costs of electricity. Distributed generation units have changed the fundamental premise that shaped electricity systems for more than a century. The long trend of large expensive central power plants which take years to build, require miles of distribution wires and they take decades to pay off (see the discussions on stranded costs) is replaced by new highly efficient distributed generation units closer to end users (SHEPHERD W. , 1997). The optimism regarding microturbines may be premature because they still have to be commercially proven. However, they have frightened some traditional utilities accused of suppressing researches and strategically delaying deployment of distributed generation (B. ALTHOUSE 1999).

- **Energy retailing** will continue to see increased competition with consumers having a greater choice of suppliers.

"*Beyond the meter*" is a widely used expression in the literature to describe business opportunities that may provide customers with greater services. A comparison of an electricity supply company and a gas supply company quickly show a massive overlap in functions and it becomes natural to combine them into a multi-energy company. The convergence of the electricity and gas value chains in the marketing-supply segment has led companies to offer both fuels, and maybe till to become home services providers. In an effort to add value, many energy suppliers are seeking to "*decommoditise*" electricity: they are providing 'value-added' services to attempt to increase their margins. Energy companies, using the same infrastructure to deliver energy, are looking for differentiating themselves on the basis of service. Three basic models of energy supply retailer have emerged: basic company supplying gas and/or electricity with few added services ; combined energy company offering a total energy package ; and a multi-utility services for customers. As the market for energy services evolves, utilities need to make careful strategic choices on paths to follow in attempting to build a distinctive value proposition for customers they wish to target in the long run.

The much-talked-about convergence of electric power and gas industries is continuing, pushing toward an increasingly integrated energy market. The United States are moving from an electron and molecule energy system to a **BTU one** (the BTU is the British Thermal Unit of heat formerly used in the UK and currently used worldwide in many gas and power projects). Electricity and gas markets are disappearing with the emergence of the BTU market where it would be possible to buy and sell energy units (with or without owning electric assets). Players could make arbitrages: geographic arbitrages commodity arbitrages and grade arbitrages. Energy companies are looking to "enhance the value of the BTU" by becoming the least costs energy supplier and enhancing the convenience of the commodity with services beyond the meter. They are looking beyond the confines of the segments of the value chain in which they operate to form links with end-users, via companies in others segments.

The BTU new concept mainly arises from the fact that both markets are potentially driven by a single price: the gas price. In an open market where gas and electricity are freely traded, and gas is the predominant fuel, the price of wholesale gas in effect can set the price of wholesale electricity. The relationship is however not that simple. Even where a particular fuel is not predominant it may set prices. For example in the UK, nuclear and gas-fired CCGTs run at base load and coal plant, and to a lesser extent, oil-fired plant provides the peak. Thus the price setter is coal (or oil) and full convergence of gas and electricity has not happened. Insofar as 'full convergence' can be defined, it might be said to be when the market price of gas generating power in a gas-fired plant defines the marginal price of electricity in the market. Equally, there can be a degree of convergence when the gas price drives up the price of electricity particularly in times of peak demand in both markets. The key issue here is that the electricity generator is free to sell his gas in the gas market rather than generate. If the result of this is that the price of electricity goes up to reflect the opportunity cost of gas, there is no problem economically speaking⁷ (SHEARD R. 1998).

Since 1995, a **wave of large electricity and gas mergers** has arisen, illustrating this phenomenon of convergence. The merger mania in the United States is impressive: if the hunt goes on, half of the main actors, the Investor Owned

Utilities (IOUs), could disappear in the next years. To survive in this new competitive environment, power companies are seeking partners to join forces: they naturally looked for gas companies to exploit synergies. Numerous merger, acquisition and joint venture activities between the electric power and natural gas industries have occurred: *Houston Industries / NorAm Energy, Enron / Portland General Electric, Duke Power / PanEnergy, Puget / Washington Energy Texas Utilities Corporation / Enserch...*). Where the gas and electricity markets have been exposed to competition, the profit margins have been progressively eroded. Consequently, most gas and electricity utilities see a need to minimize costs and take advantage of the economies of scope and scale⁸ provided by convergence strategies. The next stage is to see a series of energy companies combining to obtain geographic economies of scale.

According to the E.I.A.'s report (Energy Information Administration - 2000) energy industry combinations include:

- 1) electric utilities acquiring pipelines, local distribution companies and coal mines
- 2) major oil companies acquiring midstream natural gas and electric generating assets,
- 3) pipelines acquiring electric utilities and independent power producers,
- 4) pipelines acquiring gatherers, processors and marketers, and other pipelines.

For example, with gas now chosen by many electricity generators as their first choice as fuel, many electricity companies begin to take an active interest in the gas companies from which they purchase their fuel. And reciprocally, there is significant vertical integration with electricity utilities owning generating capacities and gas distribution companies owning upstream assets. In the supply activity, the ability to market both gas and electricity using the same infrastructure and branding by offering a total energy package, has provided a strong reason for many gas and electric companies to horizontally merge. The strategy of merging two separate energy commodity businesses (gas and electricity), to form a single business focused at providing a comprehensive energy service to all users (both wholesale and retail), is a prevalent strategy of important companies today. The concept behind these mega-mergers is to create global energy companies rather than specifically gas or electric utilities.

Merger activity in the United States has involved the regulatory agencies: they try to ensure that consumers benefit from the savings derived from any operation, that there will be an adequate supply of information for regulatory purpose post-merger and, most important, that there will be no market distortions resulting from the merger (P. JOSKOW 1999 in J. E KWOKA Jr). We can wonder if this move towards larger and larger utilities will ultimately be to the detriment of customer choice and true competition. In its discussions, the European Commission is looking with attention at the FERC's decisions.

LESSONS FOR THE EUROPEAN ENERGY MARKET

With the move toward deregulation, electricity and gas value chains convergence is coming to Europe **more slowly** than in the United States due to the progression of deregulation. Creation of a single European energy market is inevitable with European law requiring it. Liberalization destroys the old pattern of European energy markets, characterized by country specific models, inherited asset positions, simple one-to-one contracts, and isolated gas and electricity industry. An unstoppable need to reduce prices ; triggered by both the European Union Electricity Directive and technological innovation, is now in motion, transforming the industry and the company serving it. The Electricity and Natural Gas Directives will fragment the traditional industry structure and provoke a complete reorganization. Competition has been driven into a traditionally monopolistic market approach, appearing first in the more receptive generation and supply segments.

In February 1999, European Community⁹ member states had to open up a minimum of their electricity market (see Table 1). The Electricity Directive will restructure the industry by forcing EU member countries to increase transparency and "unbundle" their integrated monopolies. It was introduced to reduce electricity prices in Europe, through market liberalization, forcing a shift in economic thinking from a monopolistic to a free market approach (CHEVALIER J-M, 1999). The gradual liberalization process in Europe is finally accelerated, even if till now the situation is different from one to another¹⁰. Convergence activity will pick up: most near-term activities are likely to

take place in the UK, Spain and Nordic countries whereas other markets are likely to be attractive in the medium term. The wording of the European Union Gas Directive is extremely vague and that considerable interpretation is needed if the member States are interested in implementing these provisions properly into national legislation (AUDIGIER P. 2000, PERCEBOIS J. 1999, HANCHER L. , 1997).

Table 1: Requirements for market opening under the European Electricity Directive.

19/02/1999	<i>Minimum market opening calculated by the share of total electricity consumed by final consumers with annual consumption > 40 GWh (covers roughly 25% of the EU as a whole)</i>
19/02/2000	<i>Threshold lowered to >20 GWh (implied market opening of 28%)</i>
19/02/2003	<i>Threshold lowered to > 9 GWh (implied market opening of 33%)</i>
19/02/2006	<i>Directive will be reviewed, full competition envisaged thereafter (as in the UK, Finland, Sweden and Norway)</i>

Source: Rider G. (1999)

Liberalization in tandem with technology driven convergence of gas and electricity markets, stockholders' influence over executives desire to internationalize, together with a maturing of risk management skills, is shaping the new European energy market. The European energy map will be redrawn to comprise a network of physical and virtual hubs, corridors and market centers. These hubs, corridors and market centers, are already emerging. The IPE and the Nord Pool perform a key function in providing an increasingly liquid market. We can also look at APEX, GEX and the Spanish pool to continue this development. Increasingly, value will assume a level of transience and unpredictability not seen in today's market place. This volatility results from the convergence and fragmentation of gas and electricity value chains and markets, together with the influence of new entrants.

While some comparisons can be drawn with the American federal electricity market, there are differences. While 250 potential players are counted in the new liberalized US market, the number of European players is restricted because of the traditional dominance of national monopolies. The reaction of the main European electric utilities to deregulation has been twofold: to protect their home markets and simultaneously to seek specialized opportunities out of their core business. Forming all type of alliances either between themselves or with other companies, power utilities have developed links with gas companies to control the entry into their industry (*Shell Electricity Company, Iberdrola / Repsol, ...*).

Nevertheless, across Europe like in the United states, the electricity and gas industries will converge significantly at different levels of operations. Technological advances, economic considerations and environmental concerns are combined to change European electric power generation (as it is the case in North America). There have been numerous examples of utilities partnerships to build new cogeneration plants across Europe (*Total - EDF* in Normandy). Public resistance on environmental grounds to construction of large power plants or high voltage grid lines, and technological generation advances make it easier for new players to enter the generation market. The use of natural gas in power generation is also growing across Europe. The European Community has projected 18% of electricity generation to come from cogeneration by the year 2015¹¹. At present, gas-electricity arbitrage has not developed in Europe due to the lack of spot markets (and therefore, reliable prices index in most of the European gas and electricity markets). In retail supply, pooling customer management capabilities, leveraging economies of scale and scope, and bundling of energy services will allow suppliers to improve their margins and get closer to their customers (RIDER G. 1999).

Unlike North America, in Europe, the gas market is not a real driving factor for more competitive electricity market because it has not yet been fully liberalized. The growth of gas in power generation and environment concerns will define the single European market¹². American electric utilities have focused mainly on gas upstream supply, midstream expertise and downstream synergies. The positioning of European power firms in gas sector differs:

- Multi services strategies exploding in Europe (*Vivendi, Lyonnaise des Eaux ...*)

- Rare multi utilities except in the UK (*United Utilities, Hyder and Scottish Power*)
- Diversification with a position in upstream oil and gas or integrated gas (*RWE, E. On...*)
- Generation or supply oriented with dedicated reserves (*PowerGen, National Power...*)

These degrees of participation have been determined more by historical factors than by a view to the future.

The experience in the UK and the Nordic region, where deregulation efforts began nearly a decade ago, provides clues as to what it might happen across Europe. Eight of the UK's 12 regional electricity companies were taken over by US companies early in the deregulation process (since many of them sold out of the Britain market). In the UK, re-integration is emerging in new deals with *Powergen - East Midlands, Southern Electric Scottish Hydro and Scottish Power - Pacificorp*. This move of consolidation will create difficulties for regulators in monitoring the sector. As competition intensifies, vigilant enforcement of antitrust laws will be essential for the preservation of an open competitive industry. In the United States, utilities supplying both energy commodities are not uncommon and this is reflected in the regulatory regimes with joint state committees. The possibility of a common European regulator is currently under discussion. There is a clear challenge that the regulators will need to rise to, or their credibility will diminish both in eyes of the company they are seeking to regulate and in the eyes of the consumer they are seeking to protect.

CONCLUSION

The energy utility sector is undergoing a fundamental transformation around the world as markets are deregulated and governments owning utilities are privatized. The European electricity landscape continues to be characterized by diversity rather than uniformity. Some markets will be liberalized faster than others while still retaining their national differences. There is still considerable resistance from the existing incumbent monopolies, and a firm degree of ignorance from many end-users who are unaware of the potential savings that competition might bring to their energy costs. However, a **shock in the European energy markets** is beginning to appear as more customers seek to below their energy costs¹³ with access to cheap sources of gas and electricity.

In the United States, the value chains for gas and electricity supply are becoming meshed together as a result of the deregulation process and technology changes. As competition has intensified in both electricity and gas value chains, it has become noticeable that all parties are seeking to develop market shares in both industries by making use of benefits of synergies between the two markets. **Convergence is more than simply the integration of common gas and electricity business processes to form one entity.** It involves: exploiting and sharing common activities to reduce costs, as well as exploiting synergies and substitutability at each end of the value chain (wholesaling and retailing). The development of competition clearly provides progressively thinner profit margins. Some U. S. utilities believe that is a case of "*converge or die*". And it is coming to Europe¹⁴ where changes are accelerated thanks to utilities strategies.

Traditional energy industry's organization is altered by nimble competitors, new technology and freely traded energy. A number of players from the US and some liberalized European countries are seeking ways to gain a physical presence in Continental Europe, should the circumstances allow it. As G. RIDER (1999 pp. 19) underlines "*the slowest to move are often the first to fall*". Established companies have to adapt quickly if they want to survive. The "energy company" has emerged. A good illustration is Enron's vision to become the "*world's leading energy company*" where the focal point is gas and electricity convergence.

In European Community like in North America, while there has always been competition it is only now in the deregulated energy markets that gas and electricity can be traded interchangeably: the competition is becoming inter and infra energies. **History is repeating itself:** emerging global market is coming back to the old structure vertically integrated (along different value chains) and concentrated (see the merger mania).

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FOOT NOTES

¹ In the United States, federal regulation of both industries was established when the Federal Power Act and the Natural Gas Act were incorporated in the Public utility Holding Company Act in 1935. In Europe, regulation of both industries often began after World War II

² However, although demand for gas and electricity is reasonably well correlated and technical similarities exist, there are significant physical differences between the two commodities.

³ Some of the technologies that can be placed near users include microturbine generators, windmills, solar cells, photovoltaic and fuel cells.

⁴ The emergence of spot markets has been the result of regulatory reforms and the introduction of competition into markets which were formerly monopolies. Emerging spot markets are largely physical, they serve as a market in which to trade a commodity for physical delivery.

⁵ Different services : energy management, metering, cleaning services, maintenance, water delivery, computer services, home security, broadcast, telecom, cable TV...

⁶ Arbitrage is the difference in price between related markets ; either markets for a given commodity traded in different locations, or markets for two different commodities that can in some way substitute each other.

⁷ However if the two markets are not properly paralleled, for example one sets its price on the day, the other day-ahead then there is a risk of, for example, the gas industry causing brown outs in electricity; this may be an acceptable consequence of markets from an economist's perspective, it is not for end users and regulators.

⁸ "*Economies of scale may be defined initially as those that result when the increased size of a single operating unit producing or distributing a single product reduces the unit cost of production or distribution...* Economies of scope are those resulting from the use of processes within single operating unit to produce or distribute more than one product." A. Chandler Jr (1990) *Scale and Scope* , Harvard University Press. pp17

⁹ The term European Community derives from the Treaty of Rome 1957, as amended by the Treaty on European Unity in 1992. The fifteen countries are members to the European Community which in turn forms part of the European Union, which was created by the 1992 Treaty.

¹⁰ About European discussions : Hancher L. (1997), Bouttes JP. (1998), Baudru D. & Rigamonti E; (1998), Percebois J. & Nyouki E. (1998)...

¹¹ Some countries have already exceed this target, such as the Netherlands, where cogeneration accounts for 40% of generation.

¹² A trans-European gas network is being created with E.U. sponsorship to ensure security of supply.

¹³ To ensure industrial competitiveness, end users prices have to come down across the E.U. , where they are average 70% higher than in the US.

¹⁴ Convergence is beginning to occur in many countries throughout the world, although the main locations where it is beginning to have a significant effect are the US and the UK where the development of the competitive markets has promoted an impetus for the convergence of these industries.