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**COMPETITION IN ENERGY MARKETS**

Study by the UNCTAD secretariat

**Executive summary**

A review of the experience in electricity and natural gas market reforms already undertaken in many countries reveals the persistence of significant market power problems. This is attributed to the special features of electricity and natural gas that facilitate market power, weak demand-side response, the complexity of economic regulation, an apparent trend towards the reintegration of previously unbundled elements in the supply chain, and the challenges of applying conventional methods of defining market power and merger analysis to energy markets. The paper highlights some of the challenges that developing countries face in reforming their energy markets. These include the political risks of reforming sectors that are strategic and central to development, the absence of a single winning model for reform and the need to interpret and adapt successful experience to the national context, as well as the complexity and costs of economic regulation.

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## I. BACKGROUND

1. At its seventh session, the Intergovernmental Group of Experts on Competition Law and Policy (IGE) asked the UNCTAD secretariat to prepare a study on competition in energy markets at the national and international levels. Energy markets encompass several sources of fuel and heating, including coal, electricity, gas, oil, nuclear, solar and wind power and others. In the light of the prevailing limitations on the length of sessional documents, the principal focus of this report is competition in electricity and natural gas markets, at the national level. The IGE is invited to consider competition in other energy sub-sectors, including the international dimension, at subsequent sessions.

## II. INTRODUCTION

2. Electricity has special characteristics (see box 1). It is difficult to store yet demand and supply must be matched continuously in order to maintain service quality (natural gas is less of a technical challenge since it can be stored). Imbalances are costly because they lead to blackouts. Moreover, since the electricity grid is interconnected, a failure of one supplier to meet the demands of its users can result in a blackout for all customers. At present, there is no cost-effective technology available to achieve this automatically (IEA (2005)). This makes the reliability of the electricity system a public good that an unregulated market is unlikely to provide adequately.

### Box 1: Special features of electricity

Electricity has an unusual set of physical and economic attributes that significantly complicate the task of successfully replacing hierarchies (vertical and horizontal integration) with decentralized market mechanisms. These attributes include the following:

1. An inability to be stored economically: demand must be cleared with "just-in-time" production from generating capacity continuously at every *location* on the network. Network congestion, combined with non-storability, may limit significantly the geographic expanse of competition by constraining the ability of remote suppliers to compete, further enhancing market power problems. Creating a set of complete markets that operate this quickly at so many locations without creating market power problems is a significant challenge.
2. Very low short-run demand elasticity and supply becomes very inelastic at high demand levels as capacity constraints are approached; as a result, spot electricity prices are inherently very volatile and unusually susceptible to the creation of opportunities for suppliers to exercise market power unilaterally.
3. Loop flow introduces additional complex interactions between generators at different points on the network; offers unusual opportunities for suppliers to take unilateral action to affect market prices adversely; complicates the definition of property rights; and creates coordination and "free-riding" problems.
4. Compatible market mechanisms are required for procuring and effectively operating "ancillary services" that are difficult to design. Moreover, the combination of non-storability, real-time variations in demand, low demand elasticity, random real-time failures of generation and transmission equipment and the need to continuously clear supply and demand at every point on the network to meet the physical constraints on reliable network operations means that some source of real-time "inventory" is needed to keep the system in balance. "Standby" generators that can respond very quickly to changing supply and demand conditions generally provide this "inventory", though demand-side responses can also theoretically provide equivalent services as well.

As a result, traditional constraints on price increases such as demand response, consumer defection, supply substitution and potential entry are naturally weak in electricity markets.

Source: Joskow, (2003).

3. Besant-Jones (2006) classifies the market structures of 150 developing and transition countries into five categories, depending on their degree of vertical integration, with the stage achieved reflected on a graduated reform path (box 2). Categorizing developing countries in this manner is also valid for the situation in developed countries, albeit with a majority of developed countries probably clustered further down the box in this case. The variety of market structures and the degrees of competition that each structure permits reflects the fact that power market reform is a long-term process. According to the IEA, it is a process that has not yet been completed anywhere in the world, and will not be completed in the foreseeable future.

**Box 2: Developing country groups by current power supply structures<sup>1</sup>**

***Vertically integrated monopolist*** (79 countries)

Angola, Antigua and Barbuda, Azerbaijan, Barbados, Belarus, Benin, Bhutan, Botswana, Burundi, Cape Verde, Central African Republic, Chad, Comoros, the Democratic Republic of Congo, Congo, Djibouti, Dominica, Equatorial Guinea, Eritrea, Ethiopia, Fiji, Gabon, Gambia, Grenada, Guinea, Guinea-Bissau, Guyana, Haiti, Islamic Republic of Iran, Iraq, Kiribati, Democratic People's Republic of Korea, Kyrgyzstan, Lebanon, Lesotho, Liberia, Libya, Madagascar, Malawi, Maldives, Mali, Marshall Islands, Mauritania, Micronesia (Fed. Sts.), Mongolia, Mozambique, Myanmar, Namibia, Nicaragua, Niger, Paraguay, Rwanda, Samoa, Sao Tome and Principe, Saudi Arabia, Seychelles, Sierra Leone, Solomon Islands, Somalia, South Africa, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and Grenada, Sudan, Suriname, Swaziland, Syrian Arab Republic, Tajikistan, Timor-Leste, Togo, Tonga, Turkmenistan, Uruguay, Uzbekistan, Vanuatu, Venezuela, Yemen, Zambia, Zimbabwe

***Vertically integrated monopolist + IPPs*** (36 countries/territories)

Bangladesh, Belize, Burkina Faso, Cambodia, Cameroon, China (most provinces), Costa Rica, Côte d'Ivoire, Croatia, Cuba, the Czech Republic, the Dominican Republic, the Arab Republic of Egypt, Ghana, Honduras, India (most states), Indonesia, Jamaica, Lao People's Democratic Republic, Malaysia, Mauritius, Mexico, Morocco, Nepal, Nigeria, Oman, Pakistan, Papua New Guinea, Senegal, Sri Lanka, the United Republic of Tanzania, Thailand, Trinidad and Tobago, Tunisia, Viet Nam, **West Bank and Gaza**

***Single buyer as a national genco, transco or disco, or a combined national genco-transco or transco-disco+ IPPs*** (16 countries)

Albania, Algeria, Armenia, Bosnia and Herzegovina, Estonia, Georgia, India (Andhra Pradesh, Karnataka, New Delhi, Orissa, Rajasthan, Uttar Pradesh), Jordan, Kenya, Latvia, Lithuania, The former Yugoslav Republic of Macedonia, the Philippines, Serbia and Montenegro, Slovakia, Uganda

***Many discos and gencos, including IPPs, transco as single buyer with third party access*** (6 countries)

Bulgaria, Ecuador, Hungary, Moldova, Poland, Russian Federation

***Power market of gencos, discos and large users, transco and ISO*** (13 countries)

Argentina, Bolivia, Brazil, Chile, Colombia, El Salvador, Guatemala, Kazakhstan, Panama, Peru, Romania, Turkey, Ukraine

Source: Besant-Jones, (2006).

4. A comparable picture exists for natural gas market structures. Vertically integrated monopolies dominate the natural gas industry of exporting countries, for example, in Brunei Darussalam, Malaysia, Russian Federation, Nigeria and Algeria. Yet change is coming. For example, since 2003, Indonesia has allowed private natural gas companies to operate in the upstream natural gas market (i.e. exploration and processing) and there is increasingly vigorous wholesale competition in Thailand

<sup>1</sup> IPPs are independent (private) power producers as distinct from public utilities. Discos are distribution companies; gencos are generation companies; and transcos are transmission companies. ISO stands for independent system operator, which is usually responsible for balancing the demand and supply of electricity when the control of this function is separated from the ownership of transmission.

(Skeer (2004)). In Australia, private companies (including public–private joint ventures) carry out production and sell their gas to state transportation networks. The US is generally characterized by many unbundled producers, transportation companies and marketers of natural gas. Outside of North America, there is still very little separation of the transmission and marketing functions.

### **III. INTRODUCING COMPETITION INTO ENERGY MARKETS THROUGH LIBERALIZATION AND REGULATORY REFORM**

#### **(a) Liberalization**

5. Many countries have instituted reforms in their energy markets. OECD reforms were generally motivated by technological and institutional changes and a desire to enhance allocative and productive efficiency. The driving force of reforms in many developing regions was indebtedness and related donor pressure, combined with the desire to extend services to the majority of their population. Many developing country reforms did not prioritize policy goals such as competition and environmental improvements but focused more on reducing the financial burden imposed by public utilities on Governments. In the 1980s, loans for power development accounted for some 25 per cent of total developing country public sector foreign debt service: even in cases when utilities were profitable, Governments were concerned that public debt financing would not meet future power sector investment needs in the face of rising demand (Ghanadan and Williams (2006)). Cost recovery and private sector investment thus emerged as the key precepts of sector reforms.

6. The electricity and natural gas markets are increasingly interconnected because of growing demand for natural gas as the preferred fuel for power generation.<sup>2</sup> Natural gas is seen as having a vital role to play in generating cleaner energy because natural gas power plants are more efficient and pollute less than coal-fired plants. Combined cycle gas turbine (CCGT) power stations feature lower construction costs and shorter construction times in addition to lower production costs.

7. Electricity supply has for many years been regarded as a sector best run as a public natural monopoly. The heavy capital investments associated with traditional generation technologies and supply infrastructure reinforced the notion of a natural monopoly service. In the late 1980s and early 1990s, this perception changed. The drivers of this change were technical developments in generation technologies, growing reliance on markets, financing needs and country-specific requirements. Table 1 provides a snapshot comparison of the context in which electricity reforms were undertaken and their underlying motivations in OECD and non-OECD countries.

8. As with electricity, the natural gas sector has traditionally been dominated by State-owned vertically integrated monopolies with a monopoly buyer or producer

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<sup>2</sup> Natural gas is also an industrial input and a transportation and heating fuel.

depending on whether the country produced and/or imported natural gas. Since pipeline construction requires long lead times and large investments, vertical integration was the preferred model because of the need to develop costly gas transportation networks and secure long-term economic relationships with external suppliers. The natural gas industry is now globalizing as demand expands and new technologies allow creative new ways of customizing products and services. Pipelines and liquefied natural gas (LNG) tankers are rapidly linking markets previously isolated by geography.

9. Reforms in the electricity sector, combined with developments associated with technology and globalization in natural gas markets, have exerted pressure for parallel reforms to be undertaken in neighbouring natural gas markets. The recent sustained increases in the price of natural gas in major natural gas consuming centres (North America, Europe and Asia-Pacific) have acted as an additional trigger, as countries that were previously self-sufficient in natural gas (UK, US) rely more on imports and the influence of high oil prices for those regions where natural gas prices are indexed to oil (Europe, Asia-Pacific). A central element for many countries with respect to the liberalization of natural gas is the development of interconnections to facilitate imports and inter-country trade. To some extent, this is also an issue for electricity, more so in respect of the EU's goal of an internal energy market, but also in other regions where there is cross-border or regional cooperation in electricity supply, for example in Latin America and Southern Africa.

10. The reform model emphasizes competition and arm's length regulation. The expectation is that competition will deliver the benefits of efficiency, enhanced reliability and lower prices, as well as fostering economic growth and development. Developing countries also hope that injections of private capital will facilitate the extension of power systems to the poor, but this expectation has proved misplaced (see paragraph 17). In line with the emphasis mentioned, a standard package of reforms (exemplified by the England and Wales reform) is applied to electricity and natural gas industries.

11. The standard package of reforms includes five interdependent elements: unbundling; privatization; wholesale competition; retail competition; and regulated or negotiated third party access in transmission and distribution in the case of electricity and transportation (pipelines) and storage in the case of the natural gas industry.

12. The first step is unbundling the incumbent vertically integrated monopoly power utility into multiple producers of electricity (generators) or gas and retail suppliers that can trade with each other. The process of unbundling is complemented by the selling-off (privatization) of the different entities produced by unbundling because competition is considered unlikely to develop properly if the entities are under common ownership.

13. Competition in the network segments of the supply chain (i.e. long-distance high voltage transmission and local distribution systems that transport electricity from the generators to users or, in the case of natural gas, pipelines and storage) is not feasible because competition would require duplication of the network. Allowing all producers and retail suppliers to access transportation networks increases the potential for competition by giving retail customers an opportunity to choose their supplier.

This facilitates competition among generators to produce the cheapest electricity and natural gas in order to compete for the custom of retail suppliers, and encourages retail suppliers to compete for the custom of final consumers. If a competitive industry is to flourish, there must be a market in which customers have a choice of suppliers. Consequently, another aspect of unbundling is the separation of natural monopoly transportation segments from other potentially contestable elements and the establishment of regulated third party access to transportation networks.

Table 1: Contrasting fundamentals of OECD deregulation and non-OECD electricity reforms

	OECD deregulation	Non-OECD electricity reforms
Key concepts	Competition, choice, efficiency	Private investment, economic growth
Paradigm change	Natural monopoly model considered no longer relevant for generation, retail services Undo cost of service and rate of return regulation, replace with competitive markets	State utility model producing public debt, sometimes poor performance Dismantle State-led development model, replace with outward-oriented model attractive to investors, commercial operation with full cost recovery
Stated objectives	Lower prices Customer choice Higher efficiency Increase national competitiveness	Unburden national finances (to service debts) Operate sector w/o government financial support Expand investments and upgrade technology Avoid electricity supply constraint on growth
Basic premise	Deregulation will drive industry to operate at long-run marginal cost Firms' efficiency will be rewarded in market	Full commercialization only viable model Private sector best at operating commercially Private sector can mobilize necessary capital
Key features of policy model	Restructure industry to facilitate competition  Change management and investment incentives by exposure to price signals from competitive market	Put utilities on commercial footing, liberalize prices, eliminate subsidies Change management incentives via commercialization and/or private management Change investment incentives by unbundling, ring fencing, legislation, contract terms
Driving forces and design constraints	Large-consumer demands for cheaper power  Merchant generators seeking new markets  Investors seeking higher returns from power sector Utilities aim to avoid regulatory burdens, operate unregulated affiliates	Government worried about fiscal conditions, macroeconomic growth Capital available from investors, multilaterals, in exchange for liberalization Focus on commercial viability and attractiveness to investors, not on consumer concerns
Weaknesses	Stranded assets Market power Manipulation of pools, trading schemes Ensuring adequate long-term investment in transmission, reserves, reliability Low public tolerance for price spikes	Absence of secure legal and property rights for investors Government interference for political interests Lack of competent regulation Power theft, unaccounted losses Corruption, cronyism, and corporate malfeasance Low public tolerance for cost recovery without service improvement

Source: Ghanadan and Williams (2006).

14. Both developed and developing countries have employed the standard package of reforms but with differing degrees of conviction and varying success. Reform outcomes vary according to the depth of liberalization, industry conditions at the start of the reforms and the motivations for reform (see table 1).

### **Box 3: Chilean Power Reform**

Chile shares many of the features of developing countries' electricity systems. The population is relatively small, which means that the ability to exploit economies of scale is moderate. Electricity consumption per head is low by developed country standards but is increasing rapidly (six per cent per annum). The electricity generation system has a large installed hydro capacity base, but as demand increases fossil fuels have become more important. However, Chile is perhaps unusual among developing countries because of the strength of protection for private property and the stability engendered by the long period of economically disciplined military rule.

In 1974, Chile's electricity utilities were in a mess. Inflation, high fuel prices and price controls on final prices had led to large losses and a lack of investment under public ownership. This situation reflected the impact of nationalization and the OPEC oil crisis. The Government wanted to reorganize the sector in order to introduce economic discipline.

Between the beginning of 1982 and early 2004, the installed capacity in both the main hydro-dominated SIC system and the mostly thermal SING system expanded. The SING system suffers from overcapacity, while the SIC system has been subject to rationing in dry years. The expansion of generation capacity was achieved largely under private ownership and while keeping prices low. The route length of transmission lines in the main SIC system expanded by 3.7 per cent annually and similarly for the SING system by 14.9 per cent annually.

A notable success in Chile has been the increase in connections of rural customers to electricity networks. Although most people in Chile live in urban areas and urbanization is high, 62 per cent of rural households (some 269,841 homes) were without electricity supply in 1982. By 2002, only 14 per cent of rural households were without electricity. Most of the progress has been made in the last 10 years following the establishment of a National Programme for Rural Electrification (REP) administered by the National Fund for Regional Development. Under this fund, there is tripartite funding of the capital costs of rural connections whereby users pay 10 per cent, companies 20 per cent and the State 70 per cent, with users expected to pay for running costs.

Between 1992 and 2002, average electricity prices fell by nearly 30 per cent in real terms. The low prices of electricity and high rates of investment in the sector have been accompanied by a strong financial showing by the companies involved. Financial performance was respectable before privatization but has improved markedly since then.

Supply quality has significantly improved in the Chilean electricity sector since 1982. Power outages due to transmission system failures have diminished since privatization. However, there was a serious problem in the summer of 1998-99 when a lack of water to power hydroelectric plants led to repeated power outages. Another major problem that arose recently was caused by the 15 per cent reduction in Argentine natural gas exports to Chile in the aftermath of Argentina's 2002 financial crisis.

The Chilean electricity system illustrates that it is possible to have effective competition and privatization in a relatively small power market with significant hydro generation.

Source: Pollit, (2004).

15. Chile was the first country to comprehensively reform its electricity sector beginning with legislative reforms in 1978. Vertical and horizontal unbundling began in 1981, followed by large-scale privatization in 1986. Chile's reform experiences (see box 3) are important for other developing countries because they demonstrated that reform was possible and that developing countries also stood to gain from reform. They were also instructive in that they underlined some of the differences that exist amongst developing countries. For instance, when comparing the experience of Chile and Ghana (see box 4), the importance of the broader macroeconomic conditions in supporting energy reforms is clear. In Chile, the reform process was reinforced by a long period of economic stability prior to the reform. This was not the case in Ghana, where the process of reform was complicated and somewhat undermined by the fact

that other broader macroeconomic reforms were taking place at the same time. The Ghanaian experience illustrates to a large extent the elements in Table 1.

**Box 4: Electricity Reform in Ghana**

Ghana's electricity reforms took place in a context of episodic fiscal crises associated with government debt, poor financial performance of State enterprises and fluctuations in the world price of cocoa, the country's main export. Structural adjustment in the late 1980s reversed a decade of negative growth but high spending prior to national elections in the 1990s led to a series of fiscal crashes marked by very high inflation (74 per cent in 1995). Ghana's economic policy became closely tied to World Bank and IMF adjustment and stabilization lending.

Prior to reform, Ghana's small electricity sector consisted primarily of two State enterprises, the Volta River Authority (VRA) and the Electricity Corporation of Ghana (ECG). VRA owned all generation and transmission and supplied power to ECG, the main distribution utility. VRA also sold power directly to large industrial consumers and neighboring countries, which paid in hard currency. VRA performed well technically and financially but ECG did not, with high system losses (>20 per cent) and poor service quality. Even after a series of increases, tariffs only recovered one-third of long-run marginal costs in 1993.

Only 24 per cent of the population had access to electricity in 1993. Electricity reform began in 1993, triggered by a supply crunch brought on by rapidly rising demand and drought, which reduced the output of Ghana's hydro-dominated system (>90 per cent of net generation). When the Government approached the World Bank to finance new thermal generation, it was required to increase tariffs, remove barriers to private participation and plan a comprehensive reform. In 1997, the cabinet approved a restructuring plan that would open generation up to competition, open transmission access, unbundle VRA and reorganize distribution as geographically based concessions to end market segmentation. Small customer (<5 MW) tariffs would remain regulated, while large customers would be served directly by generators. A new grid operator would provide merit order dispatch and run a balancing market.

This reform plan was never implemented, in part due to opposition by VRA, which argued that unbundling would weaken it as a competitor in the proposed West Africa Power Pool, and by the country's largest consumer, a subsidiary of Kaiser Aluminum, which sought to maintain its preferential deal with VRA (1.7 c/kWh for 40 per cent of the country's electricity). The plan was also undercut by contradictions between the logic of the power sector and the fiscal logic of reform. Plans to unbundle VRA ran counter to the needs of its joint venture partnership to build new thermal generation; its American partner (CMS Generation) wanted VRA to be a stable company with maximum assets. Restructuring legislation in Parliament was shunted aside in 2000 and has not been revisited. Some other aspects of reform also worked out poorly. A three-year private management contract with a European company failed to reduce ECG's system losses. In the election-induced fiscal crisis of 1997, the Energy Ministry announced a 300 per cent tariff increase, which set off such a national uproar that it was immediately rescinded by the President. This crisis did have a positive result in the creation of an independent regulator, PURC, which has raised tariffs but also rejected proposed increases without adequate demonstration of service improvements, imposing a degree of alignment between fees and service. However, electricity access, which was not part of the financially focused reform agenda, has not improved significantly. When Kaiser Aluminum declared bankruptcy in 2001 and pulled out of Ghana, the country lost its largest consumer and was left with excess capacity and expensive obligations to buy gas-generated thermal power. Sector losses continue to strain the national budget, but after a decade of reform, the basic structure of Ghana's power sector remains the same.

Source: Ghanadan and Williams (2006).

16. Although not the first, the ambitious reform of the electricity supply industry in England and Wales has been emulated by many other developed and later developing countries. It is generally acknowledged that fortuitous conditions in England and Wales at the start of the liberalization process played a major role in smoothing the transition to a market-oriented structure. At the time of the reform, the domestic industry possessed excess generating capacity and a mature and well-connected grid and was enjoying high prices. The appearance of gas as a new and cheaper source of energy, coupled with technological developments that made gas-

fired generators more attractive than the incumbent coal-fired capacity, meant that capacity could be added even as prices fell (Murray (2002)).

17. Similarly auspicious conditions were and still are absent in most of the developing world. Even today, most developing countries typically do not have enduring excess capacity and suffer from frequent outages and poor service quality. Gas does not offer a new and cheaper alternative source of energy, as many developing countries still rely on other cheaper sources of fuel.<sup>3</sup> They do not have sufficiently well-connected grids and many are instead grappling with decaying infrastructure and high investment needs. Rapid urbanization and industrialization create excess demand for energy, while a dispersed population complicates rural electrification. Indeed, population density issues are a major challenge for developing countries, often resulting in piecemeal grid development. Preliminary results from an UNCTAD survey<sup>4</sup> on competition in the energy sector of developing countries show that some countries have developed separate grids for rural and urban areas, probably in response to the challenges of population density and the need to subsidize rural electrification in order to make it economically attractive to private investors.

18. Many developing countries recognized (or were persuaded) that reform was necessary and attempted to follow the England and Wales example. Yet radical liberalization of this type was out of reach for many developing countries, and in many cases the process suffered interruptions and the reform model was adjusted to fit the country's specific circumstances (e.g. Ghana, India, Peru, Ecuador and Brazil).

19. Energy sectors in the various countries that have instituted reforms exhibit a wide range of structures. This variance is explained by the fact that countries may have reformed only part(s) of the supply chain (usually power generation) or have chosen to maintain a degree of vertical integration. They may or may not have private sector participation or employ a mix of State and private sector ownership. For example, Norway liberalized without changing the ownership structure whereas in Argentina, electricity reforms involved the privatization of more than 80% of generation, all of transmission and 60% of distribution (Pollitt, 2004 b). Differences may also have arisen depending on whether or not a country imports energy, on country size and on whether a country had a centralized or federal system of government. In this context, reform in the US, Argentina and Australia was complicated by fragmented electricity and gas supply systems that are under a variety of regulatory and operational jurisdictions. Much of Asia (Bangladesh, China, India, Indonesia, Malaysia, Nepal, Pakistan, Philippines, Republic of Korea, Thailand and Viet Nam) followed the independent power producer model driven by foreign investment. The Asian reform experience was profoundly affected by the failure<sup>5</sup> of a few high-profile cases (the most notorious being India's Dabhol Power Project developed by Enron), the Asian financial crisis and the Californian electricity crisis of

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<sup>3</sup> The example of Poland illustrates this point: Poland meets more than 95 per cent of its electricity needs by burning coal, so it is perhaps unrealistic to expect it to meet the current EU legally binding target of 20 per cent any time in the very near future (Lynam (2007)).

<sup>4</sup> UNCTAD memo, April 2007.

<sup>5</sup> The independent power producers generally obtained overly generous terms that usually transferred all of the risks to Government and were not sustainable. The bidding processes were often not transparent, with foreign Governments intervening on behalf of investors.

2000-2001 (Dubash (2004)). These events precipitated investor flight out of the power sector.

20. According to Besant-Jones (2006), electricity reform is most advanced in countries with relatively larger power systems and higher levels of per capita income (in Latin America and Eastern Europe). He states that reforms based on substantial market restructuring for large middle-income countries would be infeasible for small low-income countries, and questions the case for unbundling with regard to small power systems in countries with undeveloped institutional capacity and weak economic conditions. In his view, a sequenced approach is less risky and more sustainable than a single-stage process for reforming power markets in developing countries. However, in implementing a phased reform with graduated stages, developing country Governments will have to be careful not to lose momentum and allow the reform to peter out or unravel.

21. It is evident from the market structures exhibited by electricity and natural gas industries that there is still much room for the exploitation of market power in various jurisdictions. Indeed, experience indicates that significant market power problems often remain after competition has been introduced into previously regulated industries (Shepherd (1997)). Likewise, several years after embarking on the liberalization of electricity and natural gas markets, the EC admits that competition still does not exist in many Member States and that it is highly questionable that natural gas and electricity prices are the result of a truly competitive process rather than the outcome of decisions by companies with market power (EC (2007)). The exploitation of market power erodes the expected benefits to consumers from the introduction of competition. Of particular concern is ensuring that the market structure that develops during the transition from regulated to competitive markets does not prevent the development of effective competition.

#### **(b) The role of regulation**

22. Effective economic regulation is a crucial institutional variable in the introduction of competition into electricity and gas sectors because it is necessary not only to regulate third party access to the monopoly segments of the supply chain but also to establish wholesale markets and other financial intermediaries both for short-term (spot markets) and for future electricity and gas delivery periods. A lynchpin of such markets is the use of supply and demand to set prices and enable trade between upstream and downstream actors.

23. In this context, some jurisdictions have put in place Independent System Operators (ISO) to carry out this function. An ISO is created when transmission-owning utilities transfer operating control (not ownership) over designated transmission facilities to an independent non-profit organization. The expected benefit of an ISO is to provide dispatch and balancing services and to ensure equal and fair access to the transmission system, precluding discriminatory practices and reducing self-dealing and other market power abuses.

24. The rules and regulations that are relied upon for the operation of energy markets are complex and require constant surveillance. Design flaws have necessitated correction in, for example, the UK, where the New Electricity Trading

Arrangements (NETA)<sup>6</sup> replaced the initial Electricity Pool because the pool was found to facilitate generator market power. In New England (US), the price auction mechanism in the wholesale electricity market was replaced by the locational marginal price mechanism (Joskow (2005)). The New Zealand Government initially favoured industry self-regulation but was compelled after a few years to step in to fill the regulatory vacuum. Clearly, getting competition and economic regulation right has presented and presents a major challenge to even the most developed economies despite their superior institutional and financial endowments. For example, it is estimated that in the UK, some two-thirds of the regulator's budget of £40 million is spent on the regulation of markets (Practical Action (2006)). The total operating costs of regional transmission operators and independent system operators in the US were estimated at over US\$ 1 billion in 2004 (Kwoka, 2005). The funding of regulators represents an additional challenge for developing countries, particularly in the light of resource constraints and competing priorities.

#### IV. COMPETITION ISSUES IN ENERGY MARKETS

25. Electricity's special features (see box 1) make the exercise of market power particularly likely but also very difficult to detect. For instance, it is not easy to distinguish between high prices due to scarcity and high prices due to an exercise of market power. Demand-side responsiveness in electricity markets is weak and thus not effective in tempering price levels and price volatility. Moreover, where retail competition has been introduced, the evidence suggests that customer switching fails to provide a credible deterrent to abuses of market power (Harker and Waddams Price, 2004, Joskow, 2007). When the market is concentrated, spot prices and consequently contract prices will be high unless something is done to restrain the exercise of market power (Newbery, 2002).

26. Concentration in liberalized energy markets is a major concern in both North America and Europe. Increased merger and acquisitions (M&A) activity was apparent even prior to energy market liberalization in Europe and has grown significantly since 1998. In the UK and Sweden in particular, where liberalization was achieved with full unbundling across the gas and electricity industry supply chain, a worrying trend towards vertical reintegration has appeared – although not involving the full supply chain. Reintegration of generation with transmission and distribution has also begun to occur in a few US states (Joskow, 2006a) and New Zealand. The introduction of Europe-wide competition is attributed to intensifying consolidation in energy markets. In an apparent bid to position themselves for increased competition resulting from the larger integrated market, European utility companies have expanded vertically and horizontally across borders (Abate et al., 2001; Hall, 1999). Some European Governments are seen to be supporting such moves by being overly attentive to short-term national concerns. As a result, three energy giants, EDF/GDF of France and RWE and EON of Germany, dominate the European market.

27. There is no consensus on how to treat vertical integration in energy markets but there is perhaps more support in the empirical literature for various efficiency

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<sup>6</sup> Bower (2002) contends that the introduction of NETA was unnecessary and a waste of resources because it did not curtail market power or lower prices.

motivations of vertical integration (Joskow, 2006b). It is a commonly held view that the persistence of vertical integration provides proof of its efficiency (Michaels, (2006). The reappearance of vertical reintegration in the electricity industry has been explained as a strategy to reduce exposure to risk associated with spot markets whereby high prices in the wholesale market might benefit generators but hurt retailers and, conversely, low prices in the wholesale market might benefit retailers. In this context, generating companies can use vertical integration (through mergers or contracts) as a risk management strategy to offset profit losses and coordinate investments. However, whilst recognizing the advantages of vertical integration for energy companies, competition authorities must guard against companies using vertical integration to control markets. The difficulty for competition authorities is that the latter case is often difficult to establish.

28. Demand for natural gas is more responsive to price spikes (Joskow, 2005); however, the prevalence of long-term contracts and take-or-pay obligations is of concern in so far as they can limit access to natural gas supplies and related transportation and storage infrastructure where they are in force, thus reducing the scope for competition. There is no evidence, however, that long-term supply energy contracts are anticompetitive in general (Leveque, 2006). Greater emphasis is often given to their benefits – their ability to limit the exercise of market power and their role as an incentive for attracting investment, reducing price volatility and assuring the income of natural gas exporting countries.

29. Some jurisdictions have preferred to err on the side of caution and take proactive steps against reintegration. For example, in Australia (State of Victoria), reintegration of generators and distributors is prevented through legislation and limits are set on the size of the interest that market participants can hold in other participants. In addition, the Australian Competition Commission favours the development of cross-ownership provisions to complement section 50 of the Trade Practices Act (Willet, 2006). Argentina prohibits natural gas producers and storage companies from owning a controlling interest in a transportation or distribution company, and contracts between affiliated companies are subject to approval by the regulatory body (EFET, 2000). In January 2006, in a decision upheld by the Higher Regional Court of Düsseldorf, the Bundeskartellamt (German competition authority) barred E.ON Ruhrgas from entering into long-term contracts covering more than 80 per cent of its present gas requirements with distributors. Existing contracts are to be terminated by the end of September 2006 (Bundeskartellamt, 2007). Certainly, complex ownership and contractual arrangements can complicate competition authorities' task of identifying anticompetitive practices and exclusionary conduct (see Box 5).

30. Convergence mergers between natural gas and electricity companies are generating concern in respect of their welfare effects because such companies are present and potential competitors in the broader market for energy services. Gilbert and Newbery (2006) model the effects of such a merger and conclude that the merged firm would likely have an incentive to increase natural gas prices above their pre-merger levels but that electricity consumers are not necessarily worse off as a result of a convergence merger. The fact that the European Commission has blocked the EdP/GdP business deal illustrates the possible dangers of convergence mergers (see

Box 6). Empirical evidence does not, however, point to such mergers being anticompetitive per se.

**Box 5: Chevron Corporation and Texaco, Inc.**

On 14 October 2000, Chevron agreed to acquire all of the outstanding common stock of Texaco in exchange for Chevron common stock, resulting in Chevron shareholders holding approximately 61 percent of the new, combined company (and Texaco shareholders owning the rest). On 7 September 2001, the FTC issued a complaint alleging a violation of Section 7 of the Clayton Act and Section 5 of the Federal Trade Commission Act. The complaint specifically claimed that the merger, as proposed, would substantially reduce competition in eleven markets, two of which specifically pertained to natural gas: the pipeline transportation of offshore natural gas to shore from locations in the Central Gulf of Mexico and the fractionation of raw mix into natural gas liquids products at Mont Belvieu, Texas. Pursuant to the consent order that settled the case, Texaco was required to divest, within six months after the merger, (1) its one-third interest in the Discovery natural gas pipeline system in the Central Gulf of Mexico and (2) its interest in the Enterprise fractionating plant at Mont Belvieu.

The pipeline transportation of offshore natural gas to shore from each of the markets is highly concentrated and would have become significantly more concentrated as a result of the proposed merger, giving the combined Chevron and Texaco controlling interests in the only two pipelines, or in two of only three pipelines, in each of the markets. Moreover, the acquisition of Texaco, as proposed, would have given Chevron a financial interest in three of the four fractionators at Mont Belvieu.

According to the Commission, if the transaction had been allowed to proceed as proposed, either unilateral behavior by the combined Chevron/Texaco or coordinated behavior among Chevron/Texaco and its remaining competitors would have led to higher consumer prices. The Commission contended that new entry was unlikely to constrain anticompetitive behavior in the identified markets, that new entrants typically faced significant obstacles to becoming effective competitors, and that it was unlikely that such entry would constrain a price increase resulting from the merger as proposed.

Source: OECD (2007c).

31. Various commentators (for example Barquin et al., 2005; O'Toole, 2004; Leveque, 2006; Newbery 2007; Brennen, 2003; Vandezande et al, 2006 and Wolack, 2004) criticize certain aspects of current merger analysis as employed by competition authorities to review mergers in the energy sector. Much of the criticism is focused on the approach to defining the relevant market and the unsuitability of standard tests of market power. For instance, determining whether conduct constitutes an abuse of dominant position is often complicated because companies with modest market shares have both the ability and the incentive to raise prices when markets are tight and suppliers pivotal, rendering the Herfindahl-Hirshman Index or market share tests less effective (Gilbert and Newbery, 2006). Competition authorities are also criticized for failing to take into account the future impact of mergers in the context of a transition to a competitive market and the increased probability of type II errors<sup>7</sup> when dealing with energy. Many advocate the adoption of stricter and more sophisticated methods of merger analysis that are specifically suited to the special features of energy markets.

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<sup>7</sup> A type II error occurs when a harmful transaction is not detected by the competition authority and is cleared to the detriment of competition and consumer welfare.

**Box 6: Contrasting the EdP/GdP (2004) and the E.ON/MOL (2005) mergers**

EDP, the incumbent electricity operator in Portugal, generates, distributes and supplies electricity in Portugal. Through its Spanish affiliates (Hidrocantabrico and Naturcorp), EDP also has substantial electricity and gas activities in Spain. GDP, the incumbent gas operator in Portugal, is active at all levels of the gas chain in Portugal. GDP has exclusive rights for import, storage, transportation, and natural gas wholesale supply. It controls five of the six Portuguese local gas distribution companies (with EDP controlling the sixth).

After an in-depth investigation, the Commission concluded that the deal would strengthen EDP's dominant position in the electricity wholesale and retail markets in Portugal and GDP's dominant position in Portuguese gas markets. The concentration would thus significantly reduce or pre-empt the effects of liberalization of the electricity and gas markets and increase prices for domestic and industrial customers. Remedies proposed by EDP and ENI were insufficient to satisfy the competition concerns.

The E.ON/MOL transaction was very different from the EDP/GDP merger. Firstly, it did not create a "national champion": MOL is the Hungarian oil and gas incumbent, while E.ON is a German group with a focus in gas and electricity supply in Europe. Secondly, prior to the transaction, E.ON and MOL were not active (nor were they potential entrants) in the same gas and electricity markets in Hungary. MOL was active at the upstream level, in gas production, transmission, storage and wholesale, while E.ON was essentially active at the level of retail supply and distribution of gas and electricity, through its control of regional distribution companies. Therefore, unlike the EDP/GDP merger, the E.ON/MOL merger did not raise any horizontal competition concerns (companies active in the same markets or elimination of potential competitors). The main competition issues were actually of a vertical nature (companies active in downstream/upstream markets). Thirdly, E.ON offered a substantial remedy package, which the Commission considered as appropriate for the elimination of all competition concerns, while remedies in the EDP/GDP merger by no means provided a satisfactory solution to the concerns identified in that case.

Source: EC (2004).

## V. REMAINING CHALLENGES

32. This paper has by no means covered all of the issues surrounding the introduction of competition into energy markets. There remains the challenge of finding the most effective way to develop and manage competitive energy markets that meet competition goals while achieving acceptable social outcomes with regard to climate change, energy supply security and development.

33. For developing countries in particular, energy poverty is still at unacceptably high levels and there is enduring pressure to address the short- and medium-term distributive effects of introducing competition into energy markets. Governments are all too often reminded that while they might shift responsibility for the operation of the energy industry to market forces, they will still be held accountable for the outcomes delivered. The political risks are very high because energy is strategic to a country's development policy. Liberalization may result in increased prices; privatization is not likely to deliver on the goals of rural electrification (see paragraph 17, the example of Chile's rural electrification programme (box 3) is also instructive in this regard); and increasing the efficiency of former State-run utilities can imply the loss of many jobs.

34. The sum of experience with energy market liberalization demonstrates that there is not a single winning market model for introducing effective competition in

energy markets. Aggregate experience also clearly indicates that the details matter a great deal. Successful experiences are not automatically transferable to countries facing different circumstances. They require interpretation and adaptation, even as the principles underlying them must remain unchanged. In reappraising reform policies and their underlying assumptions, (Ghanadan and Williams 2006) assert that reforms must be based on realistic assessments of national needs and capabilities. Besant-Jones (2006) echoes this assertion, stating that the most important lesson from reforming power markets in developing countries is that the extensive range of economic and institutional endowments in each country rules out "cookbook" solutions. Many national electricity industries in developing countries, reformed or not, continue to perform poorly financially and operationally (Ghanadan and Williams, 2006). A notable exception is Botswana, where, as a result of low-level reforms that did not include unbundling, privatization or commercialization, the Botswana Power Corporation is performing well and making a profit (Prasad 2006).

35. Moreover, it is apparent that effective markets must be regulated into existence. In this process, effective regulation is the key and regulators must be vigilant and diligent if they are to ensure that efficiency gains translate into lower consumer prices. Reforming energy markets is a lengthy process that will probably require some calibration along the way. Issues of regulation and competition were not given much attention in the early reform efforts of most developing countries. In many developing countries, State ownership remains dominant, regulation remains largely untested and competition is still restricted (Zhang et al, 2005). Most developing countries are probably already persuaded of the need for regulation. However, the context in which they undertook the reforms was characterized by an overriding emphasis on decreasing the role of the State, which worked against the development of strong regulatory institutions. Regulation of energy markets has also proved very costly.

36. The indebtedness of many developing countries has meant that the process of reform is heavily reliant on foreign investment and is thus inextricably linked to broader macroeconomic reforms. Badly conceptualized or failed energy reforms can have a knock-on effect across all sectors of the economy – from dwindling household disposable incomes to cost increases that hamper business operations and undermine export competitiveness and macro-level increases in inflation, unemployment and external debt. Ironically, unfavourable macroeconomic conditions keep away the foreign direct investment that is crucial to energy reforms in developing countries. Moreover, since developing countries are at a stage of development characterized by energy-intensive extractive and manufacturing industries as compared with more developed economies, energy issues are perhaps more pressing for them. The challenges are daunting indeed, but maintaining the status quo is not an option. Developing countries with particularly unfavourable conditions may want to ask themselves if it might be more beneficial for the time being to follow Botswana's lead rather than risking failed reform and ineffectual regulation. In this context, UNCTAD's role would be to provide a forum for addressing the development dimension of the introduction of competition into energy markets.

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