Comments on the International Comparison of Electricity Markets and Market Power Mitigation

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***Abstract*-- Comparison of market design, implementation and market power mitigation is made difficult because the practical outcomes depend on the fine detail of market design, the governance and regulatory framework, the resource portfolio available to the industry, the nature and pace of demand growth, and the morality and robustness of the society. This panel contribution considers competitive electricity industry design from a decision-making perspective. It defines market power in a broad manner and then assesses the robustness of the Australian competitive electricity industry design to the exercise of market power.**

***Index Terms*-- competitive electricity industry, electricity market design, Australia.**

I. Introduction

An electricity industry consists of sets of generation, network, end-use, protection and control components. It operates by maintaining a continuous flow of energy from primary energy forms to end-use energy forms using electrical energy as an intermediate energy form.

The advantages of the electricity industry energy conversion chain include:

1. The versatility of electrical energy in conversion to and from other energy forms, and
2. The ease of transmission of electrical energy to resolve differences in the geographical distributions of primary energy resources and end-use applications.

The disadvantages of the electricity industry energy conversion chain include:

1. The potential for rapid changes in operating conditions due a lack of cost-effective electrical energy storage coupled with its transmission at the speed of light.
2. The institutional challenges in designing, planning, operating, governing and funding electricity industries of large geographical scope and complexity.

In essence, an electricity industry has to operate continuously as a single, fragile machine made up of a very large number of generation, network, end-use and protection and control components that may be owned and operated by many different industry participants. Moreover, the industry must continue to operate effectively while being continually modified as participants decide to connect or disconnect individual components, invest in new components or retire old ones. This complexity and fragility creates many challenges for market design and for decision-making more generally. They create many opportunities for the exercise of market power, which will be defined here to include any ability to unduly influence and thus distort the outcome of a decision-making process, including but not limited to price-setting, that significantly affects some or all industry participants.

Comparison of market designs and outcomes is made complicated because of the need for detailed rules to govern electricity industry operation. These can hide features that are important in achieving either robust or inferior outcomes with respect to containing the exercise of market power.

For example, technical rules are required for component connection that define and limit the role that each component may play, with detailed requirements and protocols for larger components, and simpler "plug and play" arrangements for small components. Connection rules may in themselves support the exercise of market power by creating inappropriate barriers to entry.

Similarly, differences in culture and commercial law may lead to differing outcomes even with similar industry-specific rules, because decision-makers are influenced by both industry-specific formal rules and the formal and informal rules that constrain behavior in the broader social context.

Thus, rather than focusing on specific outcomes, these comments will focus on assessing the robustness of the overall industry decision-making framework, which may be defined to consist of a set of regimes for managing security, commercial trading, industry regulation and policy formation.

The overall decision-making framework is designed to ensure that the electricity industry "machine" continues to operate effectively while continuing to evolve in the short to long-term future. This can best be achieved by assigning authority and accountability in a coordinated and appropriate manner to those decision-makers who are best placed to understand and manage the risks associated with each decision, while providing clear and appropriate interfaces between decision-makers. However, if accountability is ambiguous or difficult to enforce, opportunities to exercise market power may be inadvertently created.

Table I sets out the various decision-making regimes for a competitive electricity industry. While the broad characteristics of these regimes can be readily defined,

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detailed specifications are much more complex and the interfaces between the regimes must also be carefully specified.

TABLE I. DECISION-MAKING FRAMEWORK FOR A COMPTEITIVE ELECTRICITY INDUSTRY

Regime	Role
Governance regime	The set of formal institutions, legislation and policies that provide the framework in which a competitive electricity industry operates. This includes the formal regulatory arrangements for industry participants as well as the broader social context in which the industry operates. It may involve more than one national jurisdiction.
Commercial regime	The commercial arrangements for the competitive electricity industry. This may include spot and derivative markets for electrical energy as well as ancillary service markets and commercial interfaces for regulated industry participants, such as network service providers.
Technical regime	The set of rules that allow the various components of an electricity industry, when connected together, to function effectively as a single machine, providing a continuous flow of electrical energy of appropriate availability and quality between generation and end-use equipment, tracking decision-maker targets, rejecting disturbances and degrading gracefully if equipment faults occur.
Security regime	The task, assigned to one or more system operators, of maintaining the integrity of a local or the industry-wide core of an electricity industry in the face of threats posed by plausible large disturbances. The security regime typically has authority to restrict and, if necessary, override the commercial regime in defined circumstances. For example, it may direct participants to operate their components at specified levels and, under defined circumstances, disconnect components.

Opportunities to exercise market power, as broadly defined above, may arise in each of these regimes as illustrated by the following examples:

A. Governance regime

Industry participants may be able to achieve excessively preferential treatment with respect to technology type or location compared to their competitors for power station investment. They may also exercise excessive influence over the evolution of industry rules. Governments may unduly influence choice of technology or location for power station investment.

B. Commercial regime

Industry participants may be able to influence prices for electrical energy, energy derivatives or ancillary services, either occasionally or in a sustained, systematic manner.

C. Technical regime

Connection rules may unduly favor one technology type or location over another.

D. Security regime

The security regime may unduly favor one set of industry participants over another when security inventions take place, in either an ad-hoc or systematic manner.

II. ROBUSTNESS OF THE AUSTRALIAN ELECTRICITY INDUSTRY DECISION-MAKING FRAMEWORK

Reference [1] discusses the underlying principles for, and experience to date with, electricity industry restructuring in Australia. Key features of the decision-making framework are set out in the following sub-sections, using the regime roles defined in Table I. In each case, comments are made about robustness against the exercise of market power.

A. Governance regime

1. The Council of Australian (Federal and State) Governments plays a key role in the policy formation process, enhancing uniformity and consistency in the governance regime and restricting the ability of particular politicians to unduly influence industry decision-making. *Comment: this also provides some structural robustness against the ability of interested parties to excessively influence any particular government or government official.*
2. Uniform industry-specific legislation, the National Electricity Law (NEL) defines the decision-making framework for the electricity industry, including commercial, technical, security and regulatory arrangements. The specific details of these arrangements are set out in the National Electricity Rules, which are managed and further developed by the Australian Energy Market Commission (AEMC). *Comment: This provides useful separation of powers, with the AEMC being at arms-length from government. However, it emphasizes the importance of the quality of personnel appointed to and hired by the AEMC because industry participants may attempt to distort industry rules in their favor.*
3. The Australian Energy Regulator (AER) implements a consistent regulatory regime for transmission network service providers and is also scheduled to assume this role for distribution network service providers over the next few years. *Comment: This probably reduces the risk of regulatory capture with respect to state-based regulation. However, it emphasizes the importance of the quality of personnel appointed to and hired by the AER. Concerns are still expressed about bias towards investment in network assets compared to investment in distributed resources. This is partly attributable to legal issues with respect to distribution network service provider accountability for availability and quality of supply.*

B. Commercial regime

1. The National Electricity Rules set out the design of a uniform National Electricity Market (NEM). This includes a real-time set of spot markets for energy and frequency-related ancillary services that implements a security-constrained dispatch and is interfaced to a strong security regime. The National Electricity Market Management Company (NEMMCO) is both the market and system operator and thus has responsibility for implementing both the security regime and the short-term aspects of the commercial regime. *Comment: The simplicity and transparency of the NEM spot energy market design reduces the risks of systematic abuse of market power. However high prices occur (with justification) when supply is constrained with respect to demand. More active participation by end-users would provide further protection against the exercise of market power in the NEM spot market. The frequency-related ancillary service spot markets are less competitive than the spot energy market. However, the cash flow through the ancillary service markets is typically less than 1% of the total cash flow.*
2. The long-term commercial regime is implemented via spot market derivatives and is largely left to the commercial participants to organize in conjunction with financial market providers. *Comment: Derivative trading can give useful protection against the exercise of market power in spot markets because derivative market participants can adopt a wider set of trading strategies and thus increase the effective level of competition. However, in the Australian NEM, the derivative market is far less transparent than the spot market and market monitoring is not as effective.*
3. There are supplementary markets in environmental instruments at both state and federal levels. *Comment: There are (possibly deliberate) weaknesses in market design and in the level of competition that undermine achievement of the stated policy intent.*

C. Technical regime

1. The National Electricity Rules (NER) contain uniform rules for the connection of generators and loads, which call on national and international standards where appropriate. The complexity of the requirements depends on component size. *Comment: An important early principle for the design of the NEM was that it be technology neutral. So far, this seems to have largely been the case although there are still differences of opinion with respect to embedded generation.*

D. Security regime

1. As indicated above, NEMMCO is both the market and system operator. Its security management powers extend with decreasing authority from a very strong role in the short-term to an information-provision role to a two-year horizon updated on a daily basis and to a ten-year horizon updated on an annual basis. The intent is to allow competitive processes to manage the investment aspects of resource adequacy, supported by the energy-only spot market design and the associated derivative markets. *Comment: Strong asymmetry of information makes this a difficult area to assess. There is always the possibility of bias against particular component technologies or component locations. Bias can be introduced at the political level as well as by industry participants.*

III. Future Challenges

Increasing use of temperature-sensitive load such as air-conditioning may increase opportunities to exercise market power due to temporary supply-demand constraints or network flow constraints. Key policy responses include encouraging enhanced end-use energy efficiency, extending the use of interval meters to small commercial and residential end-users, encouraging innovation in retail pricing arrangements, and encouraging active end-user participation in the electricity industry. There are also opportunities for careful, cost-effective investment in network assets to reduce flow constraints.

Climate change response presents another major challenge for managing market power. To date, Australia has relied heavily on low-cost coal-fired power stations to meet base load but now potential investors in new generating capacity may defer their investment decisions due to uncertainty in climate change policy. This may reduce reserve margins and provide greater opportunities for existing generators to exercise market power without inducing new entry.

By contrast, the effect of growing reliance on non-storable primary energy resources such as wind and solar energy is less clear. The additional uncertainty concerning resource availability may disrupt attempts by other generators to systematically exercise market power. On the other hand, unexpected reductions in renewable energy fluxes could induce constrained supply conditions and thus increase opportunities for other generators to exercise market power.

In another example, the Australian Prime Minister appears determined to introduce nuclear power to Australia in what could be argued represents an exercise of market power ostensibly justified by the need to reduce climate change impacts [2].

IV. Conclusions

The international comparison of electricity market designs is made difficult by the complexity of a competitive electricity industry and its associated decision-making framework. At a superficial level, the Australian competitive electricity has to date met the twin tests of delivering lower electricity prices while meeting reliability targets.

However, market power has been broadly defined here to include any ability to unduly influence and thus distort the outcome of a decision-making process that significantly affects other industry participants. It may occur in any of the regimes for governance, commercial arrangements, technical requirements or security management.

Market power has not been identified as a major problem in the Australian electricity industry to date. However, it may still occur, for example in the more subtle aspects of governance such as rule change and influencing investment.

V. Acknowledgment

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VI. References

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VII. Biographies

Hugh Outhred (M'1968) was born in Australia in 1947. He holds BE (Elec) Hons 1, BSc and PhD degrees from the University of Sydney.

He has held academic appointments at the University of New South Wales since 1973 where he is now Presiding Director, Centre for Energy and Environmental Markets.

Since 1979, Hugh has contributed to the theory of electricity industry restructuring and to its design and implementation in Australia. In 1985 and 1986, he was seconded to the Energy Authority of New South Wales as an advisor on electricity restructuring, energy planning and renewable energy. In 1995 and 1996 he led a project for the National Grid Management Council to undertake electricity-trading experiments to trial the proposed National Electricity Market trading rules prior to their formal implementation. He was a member of the NSW Licence Compliance Advisory Board throughout its existence from 1997 to 2000 and a member of the National Electricity Tribunal throughout its existence from 1998 to 2006.