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Griffith Asia Institute

Regional Outlook

THE AUSTRALIA-JAPAN DIALOGUE – ENERGY SECURITY: CHALLENGES AND OPPORTUNITIES

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"The Australia-Japan Dialogue – Energy Security: Challenges and Opportunities", Regional Outlook Paper No. 46, 2014.

About the Australia-Japan Dialogue

2013

"The Australia-Japan Dialogue – Energy Security: Challenges and Opportunities" was supported by the Australian Government through the Australia-Japan Foundation of the Department of Foreign Affairs and Trade, the Japan Foundation and the Griffith Social and Behavioural Research College, Griffith University.

The Third Annual Australia-Japan Dialogue

Energy Security: Challenges and Opportunities

Dialogue Background

The 2013 Australia-Japan Dialogue was hosted by the Griffith Asia Institute in Brisbane on November 12-13 with the support of the Australia-Japan Foundation and the Japan Foundation. Its central aim was to promote dialogue between Japanese and Australian energy experts from both public and private sectors and raise awareness of the future opportunities and respective challenges facing both countries in the area of energy security. This dialogue and the papers it has produced sought to identify new ways in which Australia and Japan can work together to address the various and interrelated problems both countries are likely to face in the coming years.

Australia and Japan are mutually dependent on bilateral energy trade, but in very different ways. Japan requires Australia's energy resources, while Australia relies on Japanese demand for those resources for its economic well being. As of 2011, Australia's share in Japan's energy imports –Asia's second largest energy importer – stood at 65 per cent for coal, 30 per cent for uranium and 18 per cent for LNG, respectively. Australia's overall energy exports were valued at $68 billion, of which approximately 35 per cent (or $24 billion) headed to Japan. This amounts to half of Australia's total exports to Japan, making Japan the most important energy export market for Australia by some margin. With various new Japanese-backed LNG projects currently under development in Australia, the mutual interdependence is bound to grow over the coming decades. One of the central policy questions for the future of LNG trade between Australia and Japan and in the region more broadly, is whether LNG is and in itself in the context of energy security, or whether it is a means to an end, namely the development of clean, alternative energy technologies as an eventual replacement for fossil fuels.

In addition to promoting further cooperation in Australia–Japan relations, identifying common and/or related challenges to energy security within the bi-lateral relationship also can make an important contribution to how the concept of energy security and the many challenges it is associated with can be better defined in terms of both academic research and policy development. Indeed, the nature of Australia and Japan's energy relationship, and the domestic and international imperatives that drive it, exhibits many of the characteristics mentioned by advocates of a more expansive and nuanced concept of energy security. The questions now being raised in energy security debates about the significance of energy affordability, sustainability, environmental externalities, and the impact of external shocks on different states are illustrated by many of the challenges *and* opportunities facing both societies. For example, although debate over the need for a shift in energy structure in both countries has been brought on by very different causes, many of the same issues and concerns over public health, environmental impact, energy affordability, and security are common to both Australian and Japanese debates. In Japan, nuclear power is likely to play a diminishing role in Japan's future energy mix due to the serious health and environmental threats that emerged following the 2011 tsunami disaster, but these concerns are being countered by long standing energy security and affordability issues. Meanwhile, in Australia, political pressure is growing for governments to reduce carbon emissions by reducing Australian dependency on coal-fired power generation, again because of health and environmental concerns, but, as in Japan, advocates of change are resisted by those concerned with the economic impacts of dumping coal-based electricity.

Moreover, the 2011 Fukushima disaster highlighted both the precarious and complex nature of "energy security" through the material and political impacts it has imposed on Japanese society, and the capacity of such shocks to influence events well beyond only the domestic sphere. With the closure of nuclear reactors in Japan and elsewhere, the shock already has caused a significant change in the structure of energy demand with fossil fuels resuming a higher share in an already highly competitive international market. Australia is Japan's largest supplier of coal and uranium, and currently its second largest supplier of LNG, but the mix of Australia's energy exports to Japan is now set to dramatically change in the wake of Japan's nuclear power problems, indicating that Australian energy will indeed play an even more crucial role within Japan's post-Fukushima energy security strategy given its growing levels of LNG production. But any such deepening of the existing energy relationship between Australia and Japan will occur in a regional context characterized by increasing energy competition driven by accelerated economic growth and increasing levels of anxiety over how future energy needs can be met. Australia and Japan's energy concerns and the role the bi-lateral relationship can play in managing them, therefore, will be subject to a variety of issues and challenges that stem from not only differing understandings of what energy security represents but also how it is best achieved.

So while obvious complementarities and shared interests have long characterized bi-lateral economic and political relations between the two countries, and the opportunity for Australia and Japan to mutually benefit from a deeper energy relationship seems clear, little attention has been given to the ways in which two very different societies under very different circumstances can actually share very similar energy related problems, albeit for very different reasons.

Executive Summary Key Points:

- Energy security needs to be re-defined in ways that acknowledge security is about more than only access to a reliable energy supply. Exploring key facets of energy security for both Australia and Japan will build on the strength of the current relationship, and also reveal opportunities for further energy co-operation and investment beyond only the current trade arrangements.
- Bi-lateral relationship can be expanded to include R & D in renewables, efficiency, innovation encouragement, uptake, and an economic, social and financial approach to stimulate innovation, development and broader security issues.
- Rising Japanese anxiety about energy security and rising anti-nuclear sentiment are key domestic issues for Japanese governments; what kind of policy can satisfy both concerns? Storage of spent nuclear fuel now a major problem for Japan.

- LNG is currently of major importance in Australia-Japan relationship; key question remains as to LNG's status as a transitional or end fuel.
- Institutional framework of co-operation to promote energy security and fair trade, and to improve transparency of energy trade may be required.
- Carbon prices are a very important tool in climate change related energy policy. Governments need to find more effective ways of dealing with the political issues and better promote the effective implementation of a carbon price; promoting alternative energy development is essential.
- Public participation in energy discussions/debate is vital.
- Growing concerns about geopolitical & legal constraints on energy security in the region; regional dynamics are very fluid, especially regarding economic development, energy demand and competition between states, and territorial claims (SE and NE China Seas in particular).
- Institutional governance challenges in the region also require more attention in the context of developing regional approaches to common problems; can an organization like the IEA be established in Asia?
- APEC could play a bigger role in facilitating multi-lateral and bi-lateral cooperation over energy security negotiations and agreements. But current prospects for regional cooperation are dim given rising China-Japan tensions and the divisions they appear to be creating within ASEAN.
- Indo-Pacific Oil trade is developing, due to Asia's increasing dependency on energy imports, creating a strategic realm from the Gulf to the southern & eastern coasts of Asia. But this trend also is making the region an area for prime strategic competition driven by energy interdependence issues.
- Energy security is a "Wicked" problem characterised by high levels of uncertainty and a broad range of conflicting values and political priorities. Co-operative action on energy challenges is made very difficult by the lack of common understandings in many areas; problem definition (e.g., what does energy security mean/represent?) is elusive due to different framings and priorities among governments and societies.

Michael Heazle and Andrew O'Neil

Griffith Asia Institute

July, 2014

Biographies

Hiroshi Hamasaki

Hiroshi Hamasaki is a research fellow at Economic Research Centre, Fujitsu Research Institute. Based in Tokyo, he has 15 years' experience across the energy sector and climate change, with particular specialisations in renewable energy technologies and policies. He has developed a number of both dynamic computable general equilibrium model (top-down) and technology based mode (bottom-up). Using these models simulation, he has done numerous consulting for Japanese government and companies and overseas private companies and also conducted joint projects with international organisation such as IRENA. Hiroshi currently contributes to IRENA's REMAP project and a variety of modelling works for companies' strategies on R&D on renewable related technologies and renewable market forecasts analysis. He also works for Centre for International Policy Studies (CIPPS) as a visiting fellow and makes policy proposals on energy and environmental policies including the deregulation of energy markets to Japanese government on behalf of CIPPS member companies. He holds a master degree on energy and environmental policy from Imperial College of Science, Technology and Medicine, a master degree on technology management from Wolfson College, University of Cambridge and PhD on energy and environmental policy from Cardiff University.

Associate Professor Michael Heazle

Dr Michael Heazle is an Associate Professor with the Griffith Asia Institute and Department of International Business and Asian Studies where he teaches international relations and politics Prior to his return to Australia in 2003, Dr Heazle taught a variety of subjects in the faculties of Economics and Business Administration at Ritsumeikan University, Kyoto, Japan. He has researched and published in the areas of energy, human, and environmental security; policy making and the treatment of specialist advice; and China-Japan relations. From 1992 to 2000, Dr Heazle was a regular contributor to the *Far Eastern Economic Review*, and wrote for a number of other domestic and international publications including *The Asian Wall Street Journal*, *The Japan Times*, *The Courier Mail*, and *The Australian.* He is the author of *Scientific Uncertainty and the Politics of Whaling* (University of Washington Press, 2006), and co-editor and contributor to three edited volumes (*Beyond the Iraq War: The Promises, Pitfalls, and Perils of External Interventionism, China-Japan Relations in the Twenty First Century: Creating a Future Past?*, and *Foreign Policy Challenges in the 21st Century*). His most recent books are *Uncertainty in Policy Making: Values and Evidence in Complex Decisions* (Earthscan, 2010), and (with Nick Knight) *Understanding Australia's Neighbours: An Introduction to East and Southeast Asia*, (Cambridge University Press, 2011).

Dr Tina Hunter

Dr Hunter from the University of Queensland teaches and researches in the areas of national and international petroleum law, mining law, property law, administrative law and legal philosophy. She has a long association with Norwegian research institutions completing her PhD in comparative petroleum law at the University of Bergen. Dr Hunter teaches in Australia, the UK, Russia and Norway, and consults to Australian and International governments. Her expertise has been sought by the Commonwealth government regarding petroleum exploration. She drafted the resource management and administration regulations in Western Australia, and has analysed petroleum laws in Western Australia and the Northern Territory. She is presently a member of the South Australian Roundtable for the development of unconventional gas projects, and the

Queensland government's working group for the 'Common Resources Act'. When not teaching at UQ, Dr Hunter undertakes research in the UK, Norway, the USA and Canada.

Dr Hunter is inaugural Director of the recently formed Centre for International Minerals and Energy Law, TC Beirne School of Law, University of Queensland.

Mr Ryuta Kitamura

Ryuta Kitamura graduated from the University of Tokyo in 1995 and holds a Bachelors degree of engineering. He joined "Japan Petroleum Exploration Company (JAPEX)" in 1995 and worked as a drilling engineer in China, Indonesia, Azerbaijan as well as in Japan. Ryuta worked on the "Methane Hydrate Development Project" seconded to Japan national Oil Corporation (JNOC). He then moved to Japan Oil, Gas and Metals National Corporation (JOGMEC) in 2007, and then worked in project evaluation division for overseas project at research center in Japan. Ryuta moved to the Sydney office in 2012 as Assistant General Manager in charge of Oil and Gas Upstream.

Dr Ken Koyama

Dr. Ken KOYAMA is Chief Economist and Managing Director at the Institute of Energy Economics, Japan (IEEJ). He also takes a position of Professor at Graduate School of Public Policy at the University of Tokyo since 2010. Dr. Koyama joined IEEJ in 1986 as Economist in the Oil Group. Since then he had various careers in IEEJ including: Senior economist in the World Oil & Energy Group (1992); Head of the World Oil & Energy Group (1997); Senior Research Fellow, Energy Strategy Unit (2005), etc. He was awarded the degree of: (1) B.A. in Economics in 1982 from Waseda University, Tokyo, Japan; (2) M.A. in Economics in 1986 from Waseda University, Tokyo, Japan; and (3) PhD in 2001 from University of Dundee, Dundee, Scotland. His PhD thesis is: Japan's Energy Strategies Towards The Middle East. His specialized field of research is: energy security issues and geopolitics of energy; and analysis for global energy market and policy development with emphasis on the Asia-Pacific region. He has served as a committee member of energy policy related councils and advisory committees of Japanese government in many occasion. He wrote and published many papers and articles on energy issues and had many experiences to speak at international conferences.

Professor Andrew O'Neil

Andrew O'Neil is the Head, School of Government and International Relations and former Director, Griffith Asia Institute, Griffith University. Before entering academia, Andrew worked as an analyst with Australia's Intelligence Community. As part of research teams, Andrew has received funding from the Australian Research Council, Australia's Defence Science and Technology Organisation, the Australia-Japan Foundation, the Australia-China Council, and the Japan Foundation. In 2007, he served as a member of the Australian Foreign Minister's National Consultative Committee on International Security Issues, and between 2009 and 2013, he was editor-in-chief of the Australian Journal of International Affairs. Andrew is an advisory board member of the Lowy Institute's G20 Studies Centre and a Chief Investigator with the Australian Research Council's Centre of Excellence in Policing and Security. He was recently appointed to the editorial boards of the Journal of Intelligence History and Security Challenges.

Mr Robert Pritchard

Robert Pritchard is Executive Director of the Energy Policy Institute of Australia.

The Energy Policy Institute is an independent, apolitical energy policy body whose membership comprises industry associations, energy companies and educational institutions.

Robert is also Managing Director of ResourcesLaw International Associates in Sydney, an energy consultancy. He has 40 years' experience as an adviser on a wide spectrum of energy, infrastructure projects and technology development covering the range of fossil and non-fossil energy forms fuels.

Robert has carried out studies for the APEC Energy Working Group on energy security, cross-border power and cross-border natural gas trade in the Asia-Pacific region.

Robert served for 9 years on the Finance Committee of the World Energy Council.

Dr. Tatsujiro Suzuki
Vice-Chairman,
Japan Atomic Energy Commission
Education
1975.3 B.A. in Nuclear Engineering, School of Engineering, The University of Tokyo; 1978.9 M.A. in Technology & Policy Program, Massachusetts Institute of Technology (MIT); 1988.5 Ph.D. in Engineering, The University of Tokyo
Career Experience
1978.10 The Boston Consulting Group (BCG)
1981.2 International Energy Forum
1986.9 Visiting Researcher, Center for Energy and Environmental Policy Research, MIT
1993.4 Research Associate, Center of International Studies, MIT
1996.10 Senior Research Scientist, Socio-Economic Research Center, Central Research Institute of Electric Power Industry
1997.10 Visiting Associate Professor, The University of Tokyo
2001.4 Professor, Graduate School of Keio University
2003.9 Senior Research Fellow Institute of Energy Economics, Japan
2004.4 Project Professor, Graduate School of Low and Politics, The University of Tokyo
2006.4 Visiting Professor, Graduate School of Public Policy, The University of Tokyo
2006.6 Associate Vice President, Socio-Economic Research Center, Central Research Institute of Electric Power Industry
2010.1 Vice-Chairman, Atomic Energy Commission

Dr Vlado Vivoda
Vlado holds a B.A. (Honours) from the National University of Singapore, and an M.A. (International Relations) from the Australian National University. He completed his Ph.D. on the international political economy of oil at Flinders University in 2008. Since completing his doctorate, Vlado published a book on bargaining in the contemporary international oil industry, along with numerous peer-reviewed articles with journals including *New Political Economy, Business and Politics, Asian Survey, Journal of East Asian Studies, Australian Journal of International Affairs, Resources Policy* and *Energy Policy*. In 2012, he was awarded a competitive Australian Research Council Discovery Early Career Research Award. Vlado has been cited in two submissions to the Australian Senate "inquiry into foreign investment by state-owned entities"; and a submission to the UK Parliament's Energy and Climate Change committee's "inquiry into UK deepwater drilling – implications of the Gulf of

Mexico oil spill”. In November 2012, he was invited as a witness to the Australian House of Representatives, Standing Committee on Economics "inquiry into Australia's oil refinery industry". In December 2012, he was invited by the Asian Development Bank to participate in the workshop on "Ensuring Energy Security in Asia and the Pacific". In 2011, he was invited to participate in the prestigious JENESYS East Asia Future Leader Programme, “Energy Security: Advancements in Cooperation in the East Asian Region”, organized by Japan Foundation. In August 2012, Vlado delivered a course on International Policy and Geopolitics of Energy and Resources at the University College London, School of Energy and Resources, Australia. His publications feature as compulsory course readings at Cambridge University and Peking University. Vlado’s current research focus is on the political economy of mining and energy sectors, and on energy security in the Asia-Pacific region.

Mr Tony Wood
Tony Wood joined Grattan Institute to lead the Energy Program in mid-2011. Since then he and his team have delivered four major reports on energy and climate change and he has developed a strong profile with governments and industry, and is a regular contributor in major media on key energy issues. He also retains a role as Program Director of Clean Energy Projects at the Clinton Foundation, advising governments in the Asia-Pacific region on effective deployment of large-scale, low-emission energy technologies such as solar and CCS.

Prior to these roles, he spent 14 years working at Origin Energy in senior executive roles covering retail and LPG line management and corporate affairs. In 2008, he was seconded to provide an industry perspective to the first Garnaut review.

He has built widespread relationships within the energy sector and is an adviser to government.

Contents

1. Japan's Challenges for Shifting to an Alternative Energy Era: Analysis Using JMRT Model

Hiroshi Hamasaki and Amit Kanudia

Hiroshi Hamasaki

Research Fellow, Economic Research Centre, Fujitsu Research Institute, New Pier Takeshiba South Tower, 1-16-1 Kaigan, Minato, Tokyo 1050022, Japan

Visiting Fellow, Centre for International Public Policy Studies (CIPPS), Mitsui Main Building 2-1-1, Nihombashi Muromachi, Chuo, Tokyo 1030022, Japan

hiroshi.hamasak@jp.fujitsu.com

Amit Kanudia

Partner, KanORS-EMR, SDF Block No.L-7(B), NSEZ, Noida Dadri Road, Phase II Noida 201305, India

Abstract

Among the energy issues facing Japan, energy independence and carbon emissions are particularly important issues in terms of policy-making. Japan imports most of its fossil fuels, and as a result its energy self-sufficiency rate is a mere 4% (18% if nuclear power is included). The Fukushima Daiichi nuclear power plant disaster made the situation much worse by eliminating the nuclear option, which could have played a significant role in solving both issues for the country. Furthermore, the disaster has created a much more urgent and important objective: maintaining a reliable and economically viable energy supply for Japan's citizens and industry, as its nuclear power plants are being shut down one by one.

This research aims to identify key factors which affect renewable energy popularisation, Japan's carbon emissions, energy independence, and system costs. Based on these factors, we will propose a new energy system for an alternative energy era, using a detailed sub-regional electricity technology

model, the Japan Multi-regional Transmission (JMRT) model. In this model, in order to reflect the characteristics of renewable energy, mesh information data of renewable energy potentials are used to calculate the realistic capital costs (including the construction costs of grids and roads to connect to the nearest existing infrastructure) and to reflect the availability factor of renewable energy in the location.

The data was analysed using the systems analysis approach. Systems analysis is the dissection of a system into its component pieces to study how those pieces interact and work together.

Introduction

Among the energy issues facing Japan, energy independence and carbon emissions are two important policy targets. Most fossil fuels are imported and the energy self-sufficiency rate is a mere 4% (18% if nuclear power is included) in Japan. The Fukushima disaster made the situation much worse by eliminating the nuclear option that could have played a significant role in achieving both objectives for the country. Further, it has created a much more urgent and important objective in maintaining a reliable and economically viable energy supply for its people and industry as the nuclear plants are being shut down with immediate effect. The electricity production mix of Japan is shown in Figure 1. The 25% share of nuclear will be almost entirely met by fossil in the short term – mainly LNG. So, the current situation has worsened both in terms of self-sufficiency of energy and CO2 emissions.

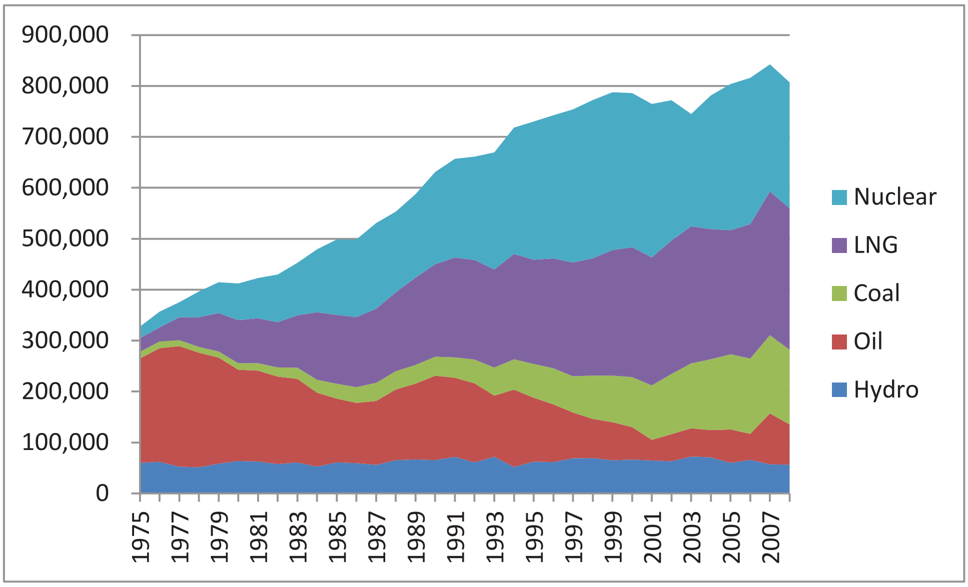

Figure 1: Japanese Electricity Mix TWh (Terawatt Hours)

Source: The Institute of Energy Economics (2011), Handbook of Energy & Economic Statistics in Japan

There is a strong commitment in Japan towards a move from nuclear power to other sources of energy. This is considered desirable both in terms of public opinion and government policy. While public opposition to nuclear energy is not a new phenomenon, the change of government policy is. Driven by high dependency on imported fossil fuels and the negative impact of the two oil crises, the government has been committed to nuclear power as a preferable energy source because it is domestically produced, and therefore more secure (Vivoda, 2012).

The objective of this paper is to characterise the renewable energy potential in Japan and to study its interactions with competitors under some key policy and technology scenarios.

Methodologies

For this research, we have developed a detailed Japan sub-regional electricity technology model, the Japan Multi-regional Transmission (JMRT) model. The JMRT is based on TIMES, which is widely used as bottom-up type energy simulation (Lolou et. al., 2005).

Model Structure

Japan has 10 electricity grids with weak connections between grids as shown in Figure 2. In addition, there are two different electricity frequencies, 50Hz and 60Hz, with frequency converters to convert one frequency to another as shown in Figure 2.

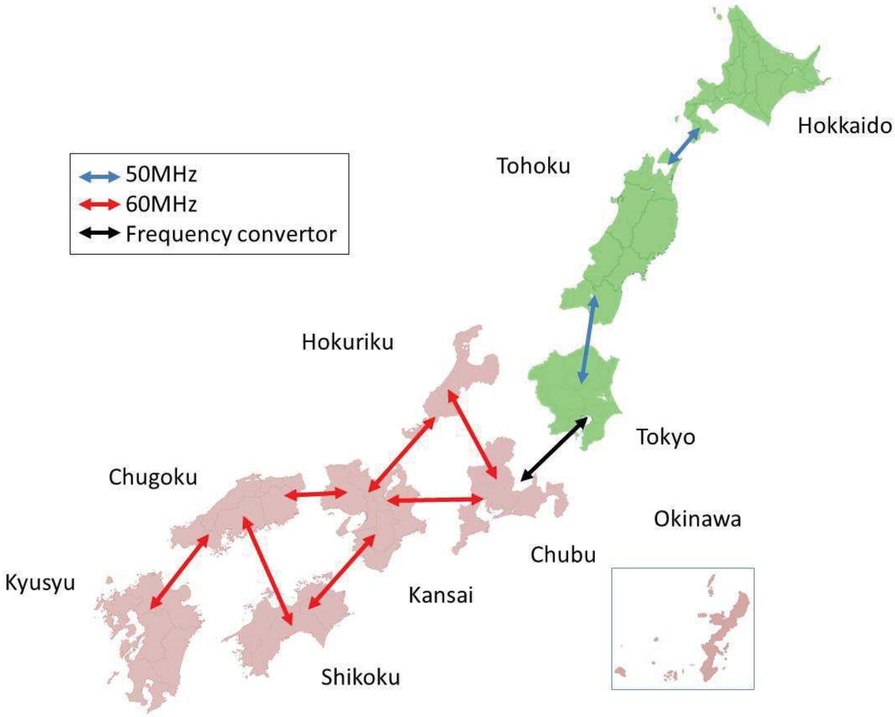

Figure 2: Grid Systems in Japan

Figure 3 represents the energy system used in the model. The model focuses mainly on electricity supply, and existing power stations and pumped storage data are included therein. The model assumes conventional power stations (Ultra-super Critical (USC), Integrated Gasification Combined Combustion (IGCC), Gas Turbine Combined Cycle (GTCC), and nuclear) and renewable (biomass, on-shore and off-shore wind turbine, photovoltaic (PV), geothermal and small hydro) as new technologies.

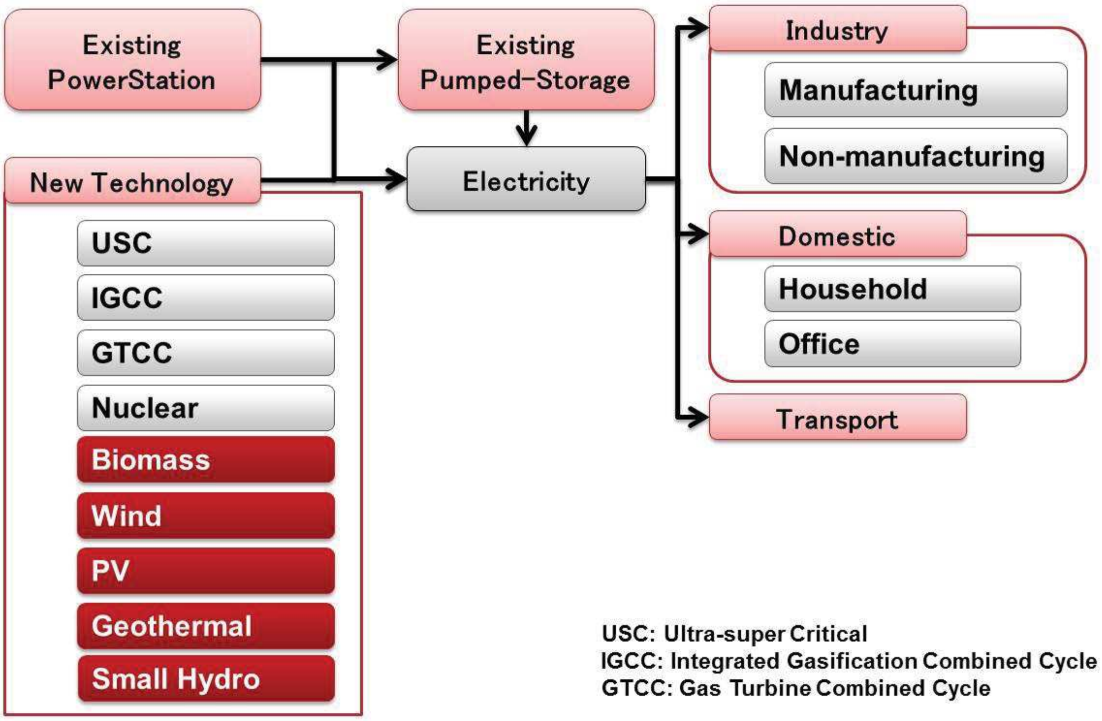

Figure 3: Energy Systems in JMRT

Model Database

Table 1 shows data sources which were used for the model in this study.

Table 1: Data Sources

Categories		Description	Sources
Existing Power Stations		Capacity, Generation	Agency for Natural Resources and Energy, Overview of Electricity Demand and Supply 2009[i] Federation of Electric Power Companies of Japan, Handbook of Electricity Business 2010[ii]
Power Stations Under Construction		Capacity	Agency for Natural Resources and Energy, Prefecture Energy Consumption Statistics, Institute of Energy Economics
LNG Port		Capacity	Tex Report, Gas Annual Report 2010[iii]
Renewable Energy	On-shore Wind Turbine, Off-shore Wind	Potential and Cost	Ministry of the Environment (2011), Survey on Potential of Renewable Energy

	Turbine, PV, Geothermal, Small Hydro		
	Biomass	Potential	New Energy and Industrial Technology Development Organization (NEDO), Biomass Potential and Available Biomass Estimation[iv]
		Cost	International Energy Agency (IEA), World Energy Outlook 2008
Conventional Power Generation	Coal, Gas, Oil, Nuclear and Hydro	Cost	International Energy Agency (IEA), World Energy Outlook 2008
Electricity Consumption		Electricity Consumption by Prefecture	Agency for Natural Resources and Energy, Prefecture Energy Consumption Statistics[v]
Electricity Load Curve			Federation of Electric Power Companies of Japan, Nuclear and Energy Drawings[vi]

In this model, a year is divided into four seasons: Spring (March -June), Summer (July-September), Autumn (October-December) and Winter (January-February), and a day is divided into three sections: Day (8 -14hr, 16-24hr), Peak (14-16hr) and Night (0-8hr). Using these 12 time-slices, the model can reflect realistic electricity demand load curve.

MOE's renewable potential GIS data contain geological, capacity, and cost information. For example, on-shore wind turbine GIS data includes location (latitude and longitude) and wind speed. By using the GIS data, we estimated distance from road, and distance from electricity grid on a 1 km^2 mesh (Figure 4). From this data, we calculated capacity, availability factor, investment, and operational and maintenance (O&M) cost and created a new data set.

IEA/NEA (2010) calculates the expected plant-level costs of base-load electricity generation by power plants that could be commissioned by 2015. The calculations are based on the levelled average lifetime cost approach using the discounted cash flow method.

The Committee of Electricity Generation Cost Verification, the National Policy Unit, and the Cabinet Secretariat, Japan (2011)[vii] estimate the costs of electricity generation from renewable energy using a model plant based analysis. The committee takes a model plant for each generation technology and assumes: description of the plant, generation capacity, availability factor, lifetime and cost including capital cost and operational maintenance cost though interviews, METI (Ministry of Energy, Trade and Industry) Guidelines and data from existing plants.

However these approaches do not reflect renewable energy characteristics fully. Wind characteristics are significantly different across regions (Chang et. al., 2003). To reflect geological information it is necessary to evaluate energy systems in the renewable energy era.

Estimation of renewable potential

The methodologies of cost estimation are derived from the MOE Renewable Energy Potential Survey (2011). We explain how we reflect geological information to JMRT using the examples of onshore and offshore wind turbine.

Onshore Wind

In 1km^2 mesh, a 10 thousand kW wind turbine is assumed to have been built and the initial cost of the wind turbine is 250 thousand JPY/kW. In addition to the initial cost, to build an onshore wind turbine it is necessary to build a road for the delivery of construction material and equipment needed to construct the turbine, and an electricity grid construction to transmit electricity generated by an onshore wind turbine. In this research, we take into account these two construction costs.

Firstly, we measure distances to the nearest electricity grid and a road from each $1km^2$ mesh.

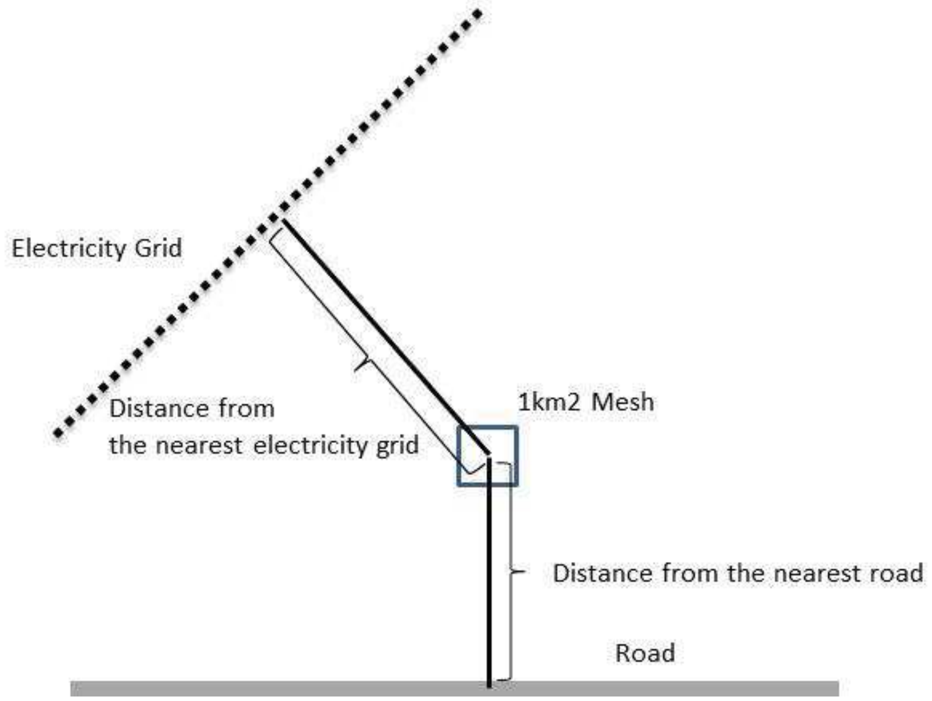

Figure 4: Distances from the Nearest Electricity Grid and Road

Table 2: GIS Data for Road and electricity Grid

GIS Data	Sources
Road	Geospacial Information Authority of Japan
Electricity Grid	SuperMap Japan CO., SuperBaseMap 25,000

Secondly, we estimate the cost of both the road as shown in the figure, and the electricity grid construction using these distance data.

$$\text{Road} = 42.5\ \text{million JPY/km} \times \text{RoadDist}$$

$$\text{Grid} = 27.5\text{milion JPY/km} \times \text{GrdDist}$$

Road: Road construction cost to the nearest road [million JPY].

RoadDist: Distance from the nearest road [km]

Grid: Electricity grid construction cost to the nearest electricity grid [million JPY]

GridDist: Distance from the nearest electricity grid [km]

In addition, we include a preoperational cost of 233.5 thousand JPY in the total initial cost.

To estimate the availability factor, we employed MOE (2011) methodologies as follows.

$$\mathrm{AF} = \mathrm{TheoryAF} \times \mathrm{Use} \times \mathrm{Adj}$$

TheoryAF: Theoretical availability factor

Use: Utilisation Rate (0.95)

Adj: Adjustment (0.90)

Table 3: Wind Speed and Theoretical Availability Factor

Wind Speed (m/s)	Theoretical Availability Factor
5.5	18.5%
6.0	23.0%
6.5	27.5%
7.0	31.9%
7.5	36.3%
8.0	40.4%
8.5	44.3%

Source: Ministry of the Environment (2011)

Offshore Wind Turbine

Water depth dominates the costs of offshore wind and the depth is measured by GIS. The total initial cost of an offshore wind turbine is estimated by equation below.

Sea depth 0-50m: 3.952 (thousand JPY/kW/m)*SeaDepth(m)+390 (thousand JPY/kW)

Sea depth more than 50m: 588 thousand JPY/kW

SeaDepth: Sea Depth [m]

Table 4: GIS Data for Sea Depth

GIS Data	Sources
Sea Depth	Japan Oceanographic Data Center, J-EGG500 (JODC-Expert Grid data for Geography -500m)

As with the onshore wind turbine, we employed MOE (2011) methodologies to estimate the availability factors of offshore wind turbine.

$$\mathrm{AF} = \mathrm{TheoryAF} \times \mathrm{Use} \times \mathrm{Adj}$$

AF: Availability Factor

TheoryAF: Theoretical availability factor

Use: Utilisation Rate (0.95)

Adj: Adjustment (0.90)

Table 5: Wind Speed and Theoretical Availability Factor

Wind Speed (m/s)	Theoretical Availability Factor
6.5	27.5%
7.0	31.9%
7.5	36.3%
8.0	40.4%
8.5	44.3%
9.0	47.8%
9.5	51.1%

Source: Ministry of the Environment (2011)

Database for JMRT Model

To build a renewable potential database for JMRT model, we have made the following modifications. In the case of offshore wind, we add GIS calculated data, distance from the nearest infrastructure and sea depth and new data sets calculated using GIS data and GIS data for each mesh.

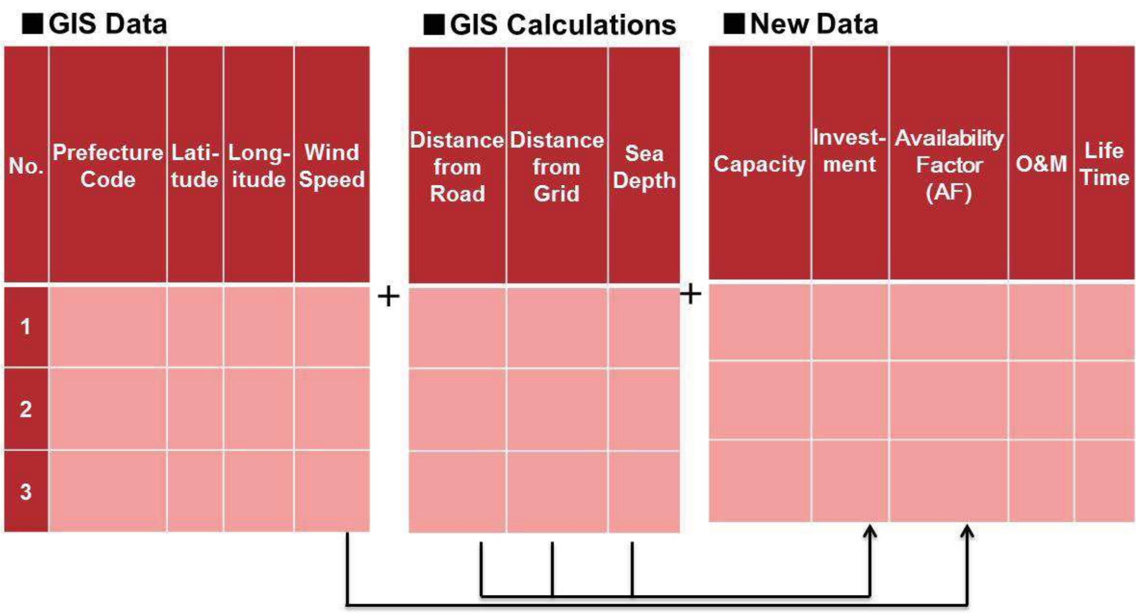

Figure 5: MOE GIS Data and New Data (case of off-shore wind)

For TIMES, we make clusters categorised by investment cost and availability factor and the same clusters are applied to each prefecture. The upper limit of capacity installed in each cluster is applied based on the GIS dataset as shown in Figure 6.

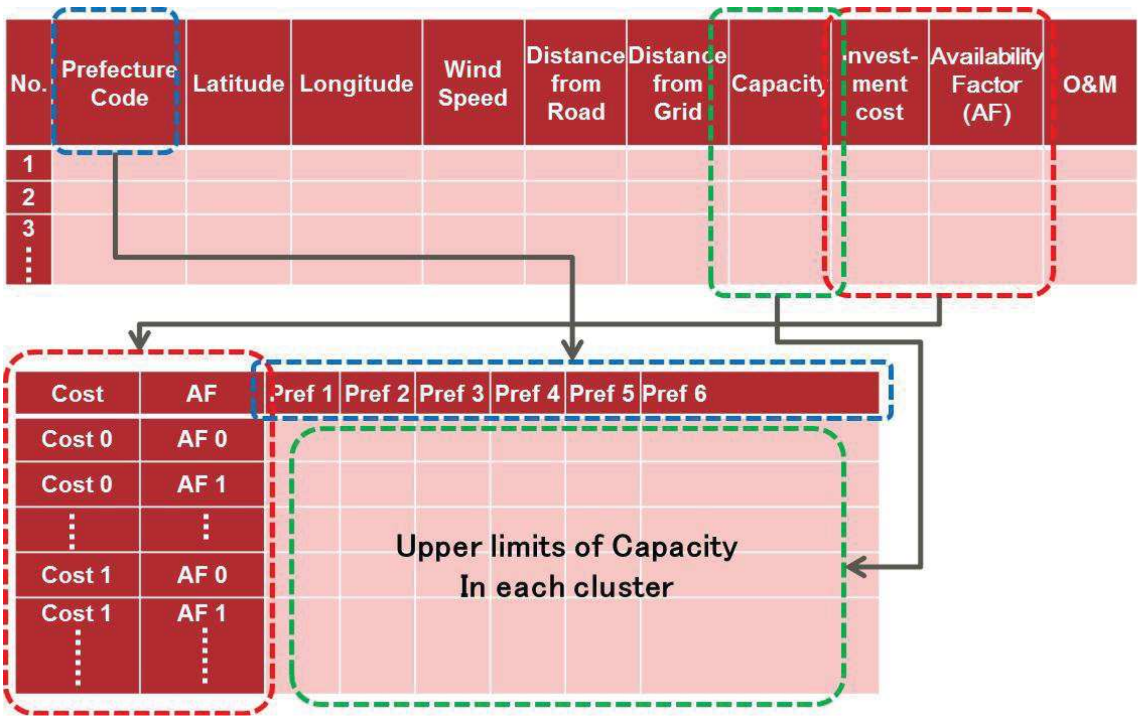

Figure 6: Conversion GIS data to TIMES

Simulation Scenarios

There is huge wind potential in Hokkaido and Kyushu, but huge electricity consumption in Tokyo and in a word, there are geological gap between wind potential and electricity consumption. Japan's electricity system is divided into 10 electricity grids with weak grid connections between grids. Geological un-matching between renewable potential and electricity harms the expansion of renewable energies.

Electricity storage is a key technology for electricity systems with a high share of renewables as it allows electricity to be generated when renewable sources are available and to be consumed on demand. It is expected that the increasing price of fossil fuels and peak-load electricity and the growing share of renewables will result in electricity storage to grow rapidly and become more cost effective (IEA-ETSAP et. al., 2012).

CCS contributes one-sixth of the CO2 emission reductions required in 2050, and 14% of cumulative emissions reductions between 2015 and 2050 compared to a business-as-usual approach, which would correspond to a 6 °C rise in average global temperature (IEA, 2012).

In this paper, we have employed systems analysis. Systems analysis is a powerful tool to identify the interaction between complex factors. For this research, we take three factors, grid-expansion between grids, CCS and electricity storage.

Table 6: Design of Systems Analysis

Grid Expansion	CCS	Storage
	✓	
		✓
✓		
✓	✓	
✓		✓

Note: 10 levels of CO2 prices ($0 to $1,000/t-CO2) are used in each scenario, to trigger low-carbon configurations.

Realistic Cost Curve

The supply curves shown in Figure 7 have been computed using 1km2 mesh GIS data for onshore and offshore wind, and prefectural data for solar PV. More than 1,000 TWh seems be available for well under 15 cents/kWh based on this figure. However, these costs and availabilities ignore very important spatial and temporal issues, which we propose to address using systems analysis.

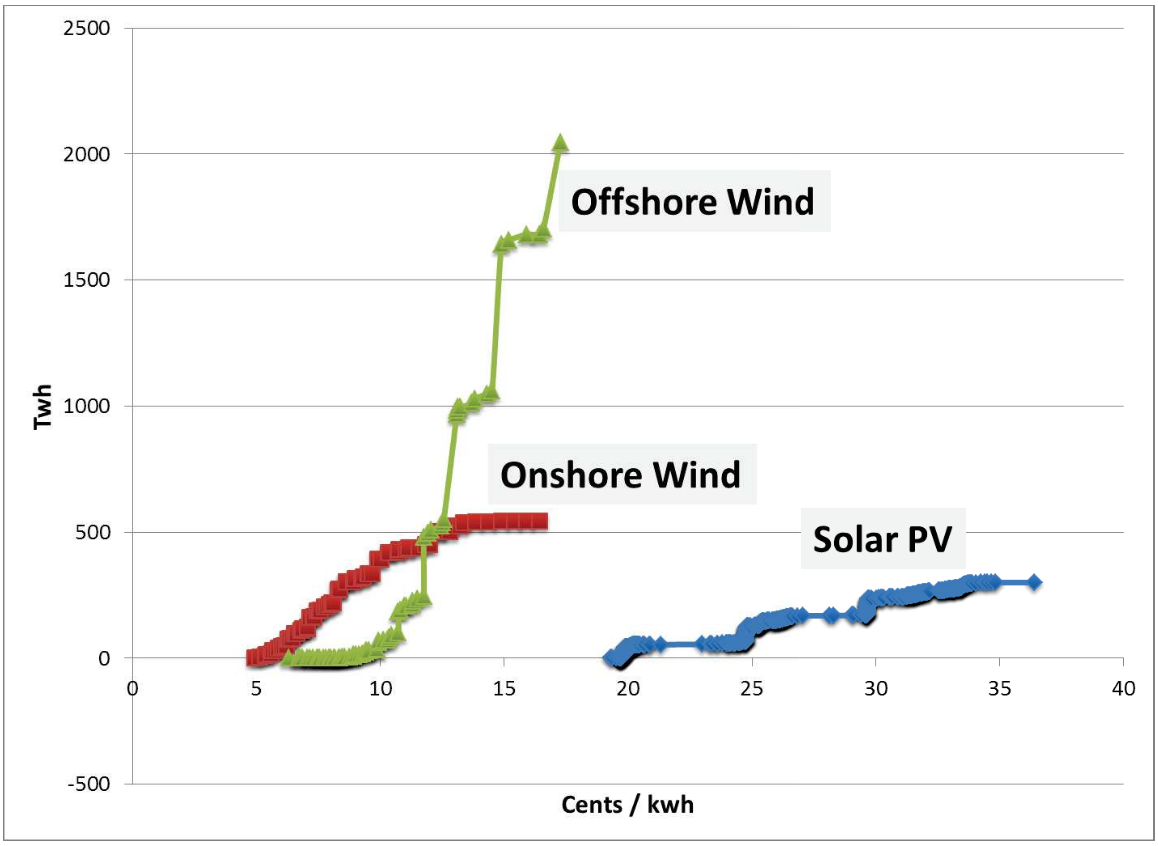

Figure 7: Supply Curves of Renewables

Figure 8 shows comparisons between potential cost curves and more realistic cost curves estimated by the JMRT model. As the figure shows, under the current Japanese electricity system, we cannot make full utilisation of the potential.

There are two main reasons why the actual availabilities would turn out lower and prices would turn out higher.

Geographical RE Supply-Electricity Demand Mismatch

- The Japanese electricity system comprises 10 grids with weak inter-grid connections. The greatest potential for on-shore wind lies in the Hokkaido and Tohoku regions in the north, while the Kanto region has great demand but limited potential, resulting in geographical supply-demand mismatch.
- Given the current state of Japan's power grids, the full potential of on-shore wind in the north cannot be tapped. In order for electricity produced in the north to be consumed in Kanto, interconnecting facilities are necessary, which drives up the cost.

Electricity must be produced exactly when it is consumed

- Electricity (and heat, to a large extent) is different from other energy forms like oil and gas in that several hours or days of supply cannot be stored in tanks and cylinders at the point of consumption.
- Wind power generation depends on wind flows, which are reasonably stable when averaged over months and years, but actual flows over hours and days can be significantly higher or lower than these averages.
- To match the demand (with seasonal and diurnal variations) using an intermittent source we need a combination of standby capacity and storage. Standby capacity could be LNG that can respond quickly and meet the deficit when wind flows are low. Storage would absorb energy when flows are above average and release when they are below. Both these options increase the cost of supplying electricity.

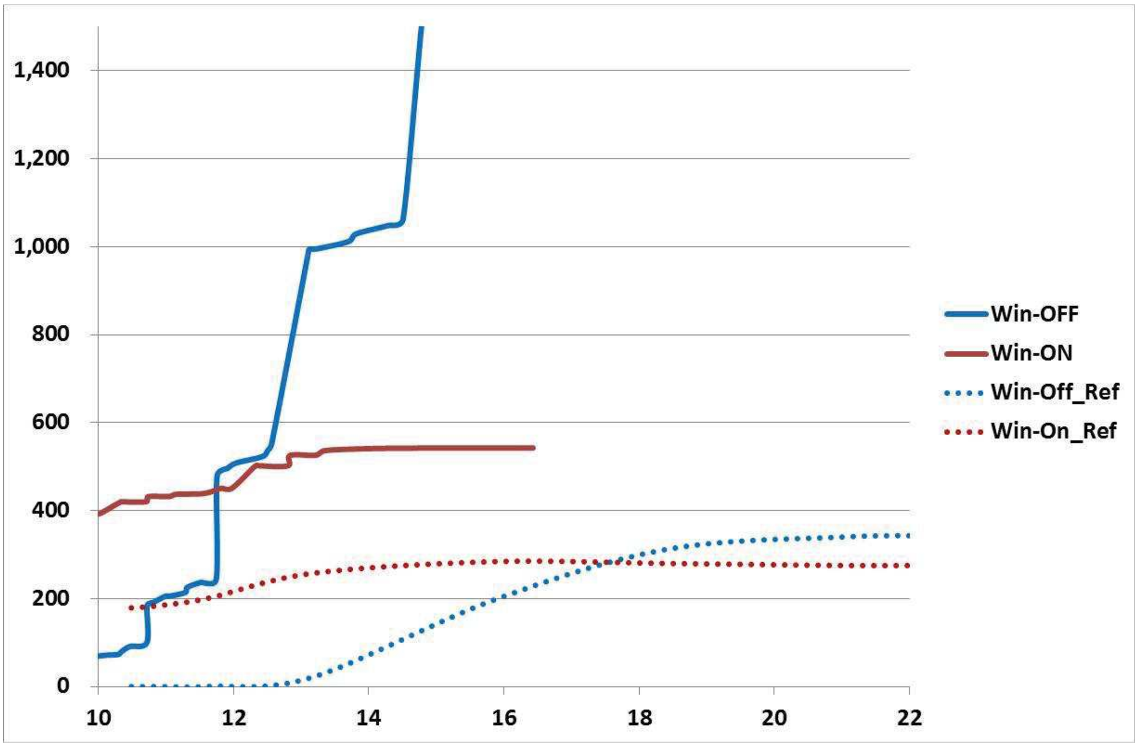

Figure 8: Realistic Cost Curves under the Current Japanese Electricity System (TWh)

Note: Win-OFF: Potential of offshore wind, Win-ON: Potential of onshore wind, Win-Off Ref: reference of offshore wind, Win-On_Ref: reference of onshore wind.

Grid Expansion and Renewables

Figure 9 shows onshore and offshore wind generation in 2050 and all simulation scenarios are categorised into two cases, no-GE and GE. As pointed out above, Japan's current division of its power grid into 10 smaller grids with limited interconnection may have stunted the use of wind power potential, and this simulation supports that hypothesis. Expanding current grid interconnections would increase onshore wind deployment.

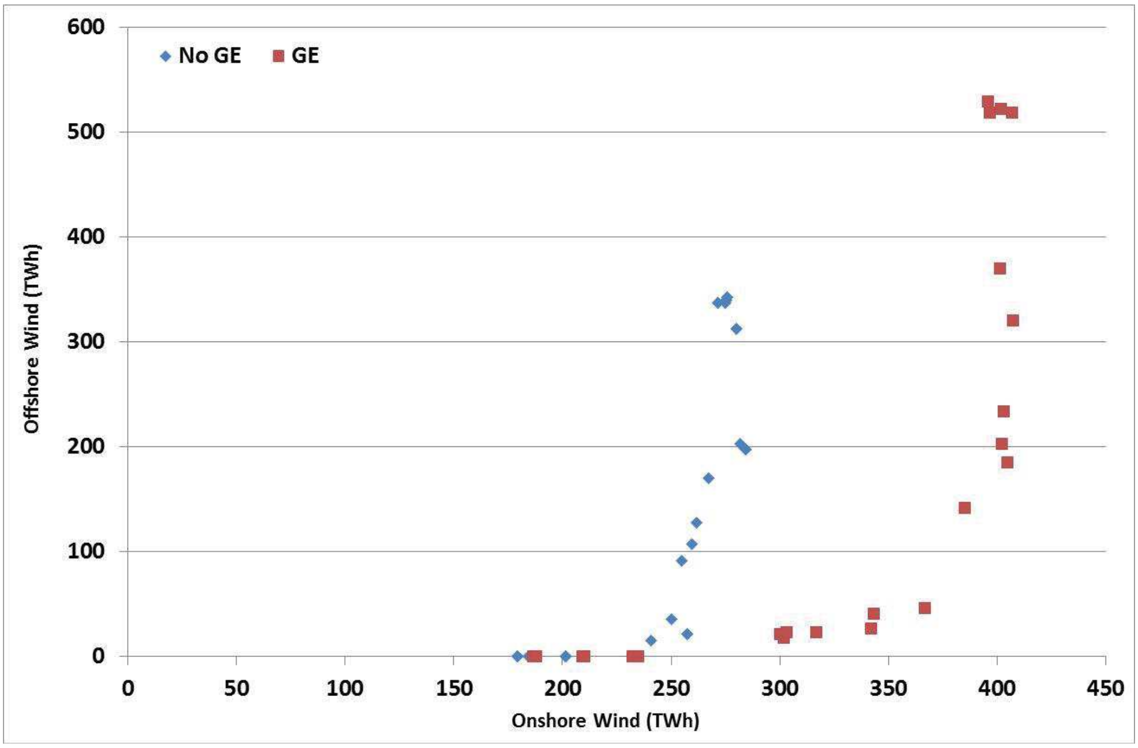

Figure 9: Grid Expansions and Renewable Energy in 2050.

Note: Horizontal axis = Onshore Wind (TWh), Vertical axis = Offshore Wind (TWh).

Figure 10 shows the energy and wind potential in each grid. Huge potentials of wind are in Hokkaido and Kyushu, but there is huge electricity consumption in Tokyo and in a word, there is a geological gap between wind potential and electricity consumption. Japan's electricity system is divided into 10 electricity grids with weak grid connections between grids. As the result, it is impossible to make the most use of the huge onshore wind potential in Hokkaido.

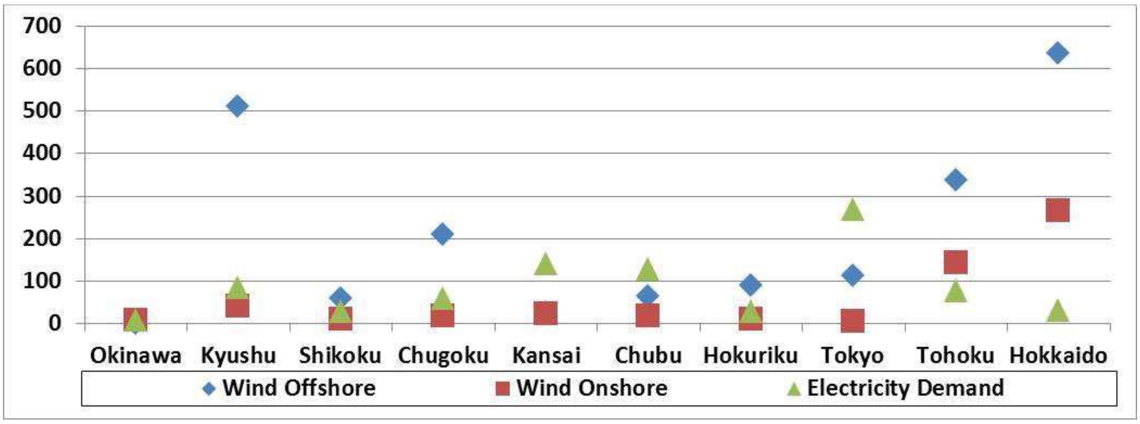

Figure 10: Energy Consumption and Wind Potential in Each Grid (TWh)

Grid expansion makes it possible to access good wind-condition sites for wind turbine and as a result, the actual availability will be more than a reference case as shown in Figure 11.

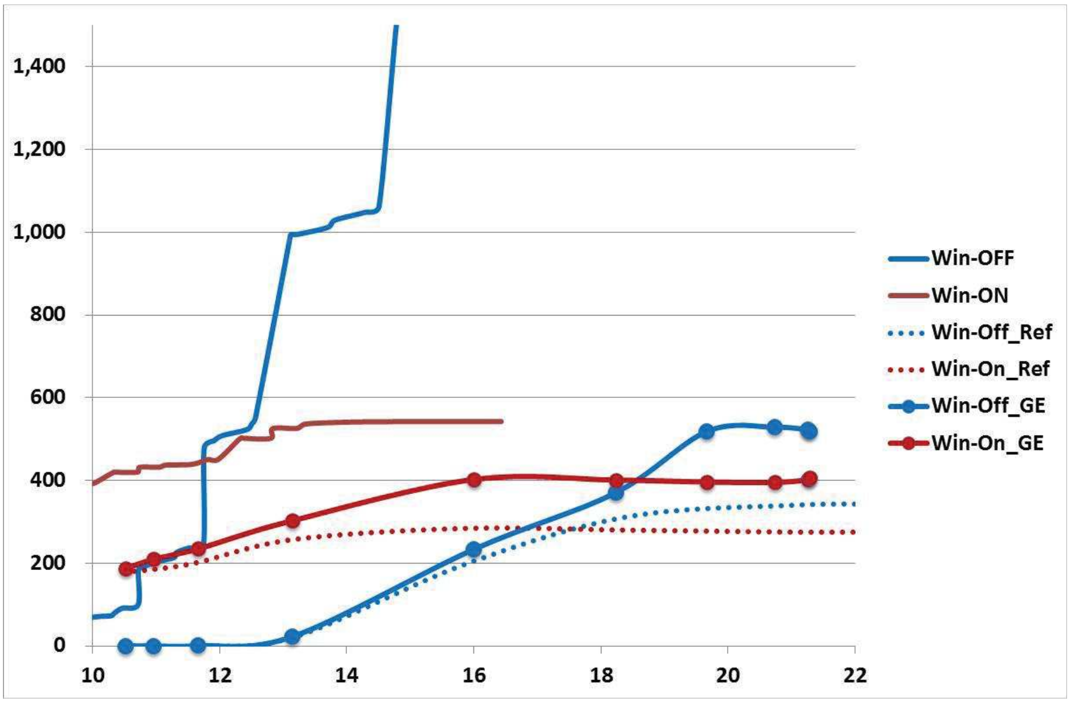

Figure 11: Comparisons of Cost Curves between potential, actual and grid-expansion (TWh).
Note: Win-OFF: Potential of offshore wind, Win-ON: Potential of onshore wind, Win-Off_Ref: Reference of offshore wind, Win-On_Ref: Reference of onshore wind, Win-Off_GE: Grid Expansion Case of offshore wind, Win-On_GE: Grid Expansion Case of onshore wind

With comparison to the reference scenario, grid expansion performs better on both metrics, self-dependency and CO2 emission reductions with less system cost.

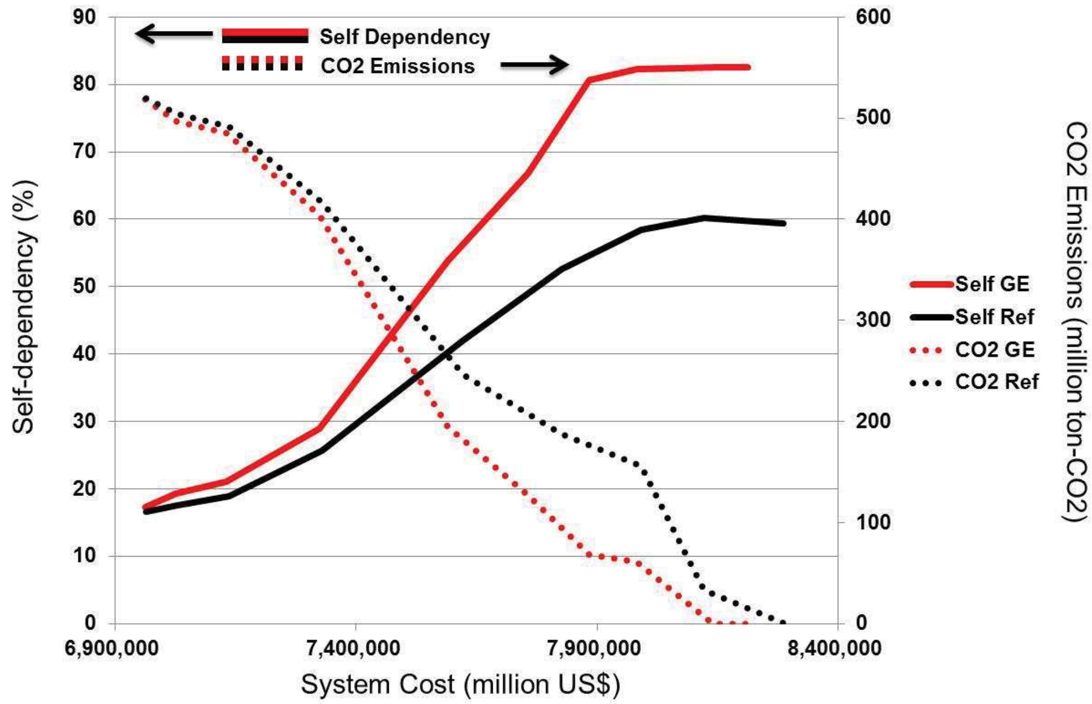

Figure 12: The Benefits of Grid Expansion on Policy Objectives.

Note: Self GE: Energy Self-sufficiency in GE Scenarios, Self Ref: Energy Self-sufficiency in without GE Scenarios, CO2 GE: CO2 Emissions in GE Scenarios, CO2 Ref: CO2 Emissions in without GE Scenarios.

CCS and Renewables

Figure 13 shows onshore and offshore wind generation in 2050 and all simulation scenarios are categorised into two cases, no-CCS and CCS. As the figure show, CCS is competitive against offshore wind from a carbon mitigation point of view.

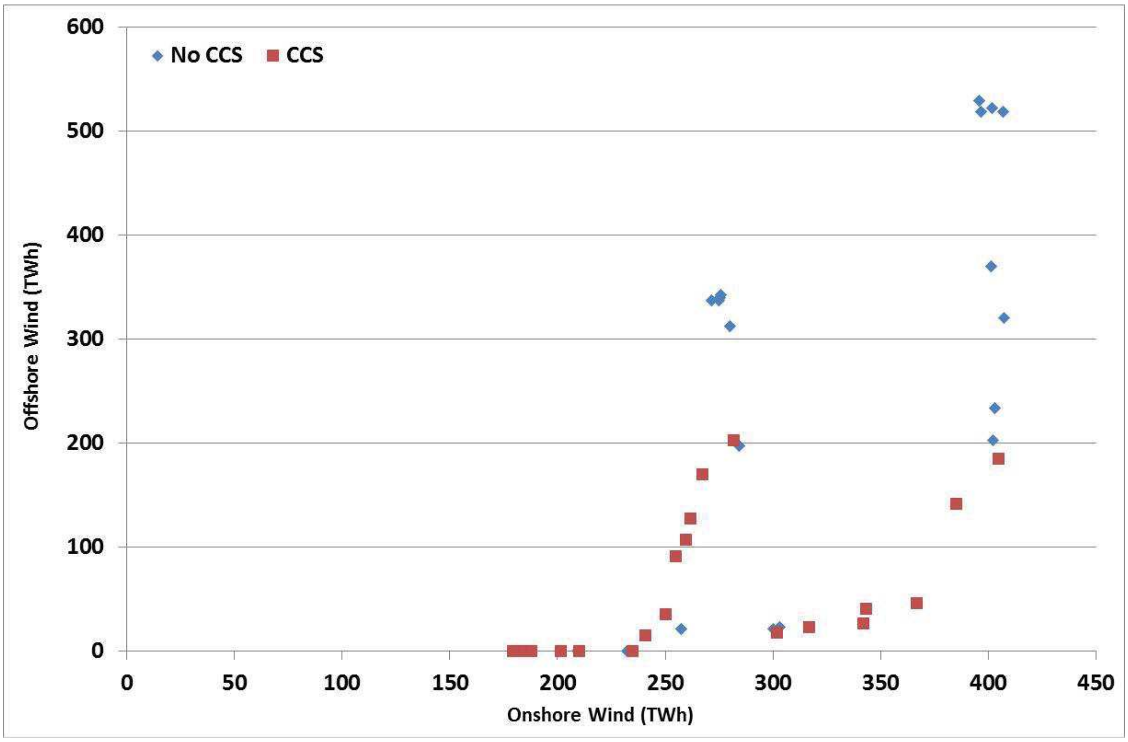

Figure 13: Grid Expansions and Renewable Energy in 2050.

CCS makes thermal power station competitive and as a result, self-dependency will be lower compared to ref, but the carbon tax will be absorbed easily.

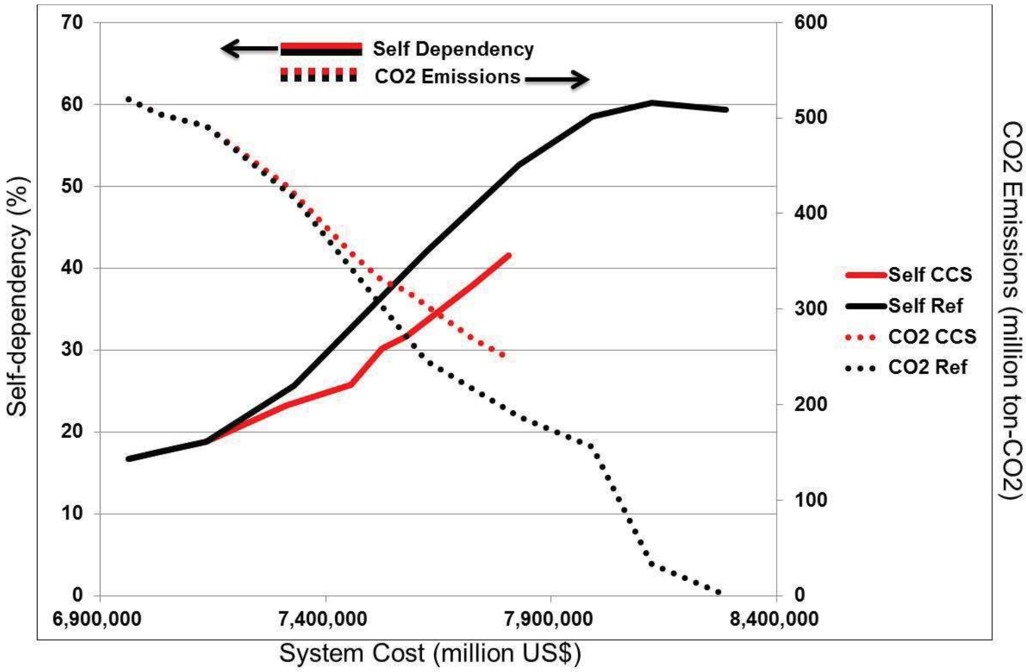

Figure 14: The Impact of CCS on Two Policy Objectives.

Note: Self CCS: Energy Self-sufficiency in CCS Scenarios, Self Ref: Energy Self-sufficiency in without CCS Scenarios, CO2 CCS: CO2 Emissions in CCS Scenarios, CO2 Ref: CO2 Emissions in without CCS Scenarios.

Conclusion

We have used a detailed representation of the current electricity system, along with rich data sets on renewable potential, to explore the interplays between various electricity options for Japan. This work could be useful for policy makers as well as modellers. Modellers, who operate at a higher level of disaggregation than us can use the deployment patterns exposed here as reference. Quantitative estimates of the impacts of various policy options on the primary policy objectives could be useful for policy makers.

As has been explained above, Japan is now facing a challenge which no other country has ever faced: to raise its energy self-sufficiency ratio and reduce GHG simultaneously when most of its fossil fuel supply comes from overseas and it cannot depend upon nuclear power. Though these issues cannot be solved by existing technology, our analysis shows what needs to be done using existing technology information. Japan should integrate all its electricity transmission lines and create a single grid; this would enable it to maximize the use of cheaper renewable energy sources and increase the overall efficiency of renewable energy source usage, and CCS at coal-fired thermal power stations could be better utilized as well. A Feed-in Tariff system, which assures suppliers of renewable energy sources that the energy will be purchased at a fixed price, was introduced in July, 2012 in Japan to encourage utilization of renewable energy sources. However, with separated transmission networks, such a system could in fact raise the price of renewables and thus even be an impediment to the spread of renewable energy.

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2. Nuclear Energy Policy Issues after the 3.11 Fukushima Nuclear Accident and Its Implications for Energy Policy

Tatsujiro Suzuki[viii]
Vice Chairman, Japan Atomic Energy Commission

Introduction

The Tohoku District - off the Pacific Ocean Earthquake and the resulting tsunamis struck the Fukushima Dai-ichi and Fukushima Dai-ni Nuclear Power Stations of Tokyo Electric Power Co. (TEPCO) at 14:46 on 11 March 2011 (all times herein are JST which is nine hours ahead of UTC/GMT), followed by a nuclear accident unprecedented in both scale and timeframe. Since then, 11 March 2011 has become a historic day to remember for all nuclear experts not only in Japan but also the rest of the world.

Almost three years have passed but the accident is not completely over. More than 140,000 residents in Fukushima are still living in temporary housing due to evacuation after the accident and are still uncertain as to when they can return to their original hometowns. Although conditions at the Fukushima power stations have improved, it will take at least more than 30 years to remove melted fuel debris from the site and decommission the plant. Still, we need to draw lessons based on the knowledge and information available so far to assure the safety of existing nuclear facilities and the possible implications for future nuclear energy policy.

This paper summarizes the current status of both on-site and off-site issues on the Fukushima Dai-ichi nuclear power plant, and reviews the possible impact on Japan's energy policy as well as on global nuclear power development. Finally, the paper identifies key policy issues regardless of the future direction of nuclear power in Japan.

Current Status and Future Prospects of the Fukushima Dai-Ichi Nuclear Power Plant and the Environment

On September 7, 2013, Prime Minister Abe made a convincing speech at the International Olympic Committee, saying: 'Let me assure you the situation is under control…It has never done and will never do any damage to Tokyo. There are no related health problems until now, and nor will there be in the future'.[ix]

It was a reassuring speech and the technical basis of his statement is as follows:

- There are 32 radiation monitoring stations and 85 radiation monitoring points along the coast of the Fukushima, Ibaraki, and Chiba prefectures. The Nuclear Regulatory Authority reports that the seawater contains 0.021 becquerel per litre or less of cesium 134 and cesium 137—far below the acceptable standard of 10 becquerel per litre.
- The contaminated water is limited to the area around the port near the Fukushima Daiichi Nuclear Power Station—an area that is no larger than 0.3 square kilometres.
- The annual radiation exposure from food and water is estimated to be lower than 0.01 millisieverts.[x]

However, Tokyo Electric Power Co (Tepco), the owner and operator of the Fukushima nuclear plant and responsible for decommissioning of the plant, has been struggling with the management of a huge amount of contaminated water which is steadily increasing and now it can't be denied that some of it is leaking into the outer sea. The Ministry of Economy, Trade and Industry (METI), which is supervising the decommissioning operation, announced on 3 September 2013, that the Japanese government would involve itself in the events at Fukushima, and the various measures it would pursue to deal with this on-going crisis, such as: establishing an inter-minister level council; establishing an inter-governmental liaison office near Tepco's Fukushima site; establishing an inter-governmental council for coordination near the Fukushima site; providing $470 million in financial support (to install a frozen soil wall, estimated cost $320 million and provide multi-nuclide removal equipment, priced at $150 million); and enhancing monitoring and risk management efforts. The total cost of decontaminating the Fukushima Daiichi site is currently estimated to be around $10 billion.[xi]

Contaminated water is just one of the unprecedented challenges that Tepco and METI has to face. The so-called mid-long term Roadmap for Decommissioning of Fukushima Dai-ichi tells that at least it will take 30 to 40 years to finish entirely decommissioning of the plant. The first stage is to remove spent fuel from the pools in all four units (in 2-3 years), the second stage is to remove the melted core debris from units 1-3 (at least in 10 years) and finally decontaminate the whole plant (in 30-40 years). Even after 2 year and a half years after the accident, the information on melted debris is very limited and no one is sure where it is and in what kind of form that it exists. It is not possible to get close to the reactor buildings of units 1-3 due to high radiation and it will be necessary to develop remote control equipment or sophisticated, radiation resistant robots. In August, 2013, the International Research Institute for Nuclear Decommissioning (IRID) was established to consolidate research and development efforts and to seek worldwide wisdom to tackle this challenging and difficult task. They issued a "request for information" on the web site and collected more than 700 ideas from both Japan and abroad.[xii]

Possible Impact on Energy Security Policy of Japan and on Global Nuclear Power Development

While health and environmental impacts seem to be less than those of the Chernobyl accident, the biggest social and political impact is loss of public trust. This has serious implications for not only Japan but also global nuclear energy development. According to public polling done by Prof. Hirotada Hirose in March 2013, 30.7% of the public wants 'immediate shutdown of all nuclear plants' while 54.1% wants to phase out nuclear power gradually.[xiii]

Meanwhile, the economic impact of shutting down nuclear power plants is also significant. According to a study done by the Institute of Energy Economics, Japan, about 3.6 trillion yen (~$36 billion) of extra payment was made due to the shutdown of nuclear plants during FY 2011 and FY 2012, while energy demand decline contributed to about 1.2 trillion yen (~$12 billion) of saving during the same period. In addition, emission of carbon dioxide (CO_2) in the year 2012 increased about 70 million tons, i.e. about 5.8% increase from the level of 2011. That amount is roughly equal to emission increase in entire Middle East or India alone in 2012.[xiv]

On December 10, 2013, the Committee on Basic Policy for the Advisory Council on the Energy of METI published its opinion regarding the new Energy Basic Plan which is supposed to be adopted by the Cabinet soon. The report stated that the government will decrease its dependence on nuclear energy as much as possible, but also stated that we should use nuclear power as an important base-load energy source and thus should maintain the necessary level of nuclear energy.[xv] Its main rationale for this policy is that nuclear power is one of the most stable energy sources and thus can contribute to Japan's energy security better than other fuel sources. In this sense, 'energy security' is defined here as 'stable energy supply' with relatively competitive fuel costs. The Japan Atomic Energy Commission (JAEC) responded to this opinion, saying that the government should explain better to the public how it reached such decision on nuclear power.[xvi] As of the end of February, the basic plan has not been adopted by the Cabinet.

Policy Issues and Challenges Regardless of Future Directions of Nuclear Power in Japan

Although the future direction of energy policy in Japan is still under discussion, there are certain important issues to be overcome regardless of future of nuclear power in Japan. They are: 1) spent fuel management; 2) plutonium stockpile management; 3) high level waste disposal; 4) securing human resources; and 5) restoring public trust.

Spent Fuel Management

Even before the Fukushima accident, what to do with accumulating spent fuel on site was a major policy issue for nuclear utilities and the government. As of the end of 2011, about 17,000 tons of spent fuel was in storage out of which about 14,000 tons was at nuclear power plant sites and 2,900 tons was at the Rokkasho reprocessing plant. The total pool storage capacity at nuclear power plant sites is about 20,630 tons and thus roughly 70% of which is full. For some reactor sites, the pool will be full within a few years if reactors start operation now. Rokkasho reprocessing plant, whose capacity is 800 ton/year, has only one storage pool with 3,000 tons. The plant is currently shutdown after a period of hot testing and repairing of vitrification equipment, and it is not clear when the plant starts its commercial operation due to new regulatory standards which will be ready by the end of the year. Since the storage pool is almost full, unless it starts commercial operation, it may not be able to accept spent fuel further.

The other option is an away-from-reactor centralized storage facility at Mutsu city, which is also under construction. Its capacity is 5,000 tons but not fully operational and will accept only spent fuel from Tokyo Electric Power and Japan Atomic Power. Safe and secure dry cask storage on site is technically possible as proven at Fukushima Dai-ichi site and Tokai Dai-ni nuclear power plant site. But, all local communities at power plant sites are not in favour of accepting further spent fuel storage on site. In short, finding additional storage capacity (possibly dry cask storage) is a top priority issue for nuclear utilities and the government, in order to increase flexibility of spent fuel management as uncertainty of reprocessing still remains.

Plutonium Stockpile Management

Basic policy for spent fuel management in Japan has been (and still is) 'reprocessing and recycling plutonium' for energy use. Since plutonium can be also used to manufacture nuclear explosives, the Japan Atomic Energy Commission (JAEC) has introduced a 'no plutonium surplus' policy since 1991, and strengthened its policy in 2003 by introducing new guidelines to improve transparency when Rokkasho commercial reprocessing plant was expected to start operation soon. According to the guideline, utilities are expected to submit a 'plutonium usage plan' annually before they reprocess and recover plutonium. In short, it is assurance that Japan will not possess plutonium without its usage plan. However, in reality, the plutonium usage program (recycling as a MOX (mixed-oxide) fuel into existing reactors and fast breeder reactors in the future) has been delayed significantly. As a result, at the end of 2012, Japan possessed about 44 tons (9.3 tons in Japan, and 34.9 tons in France and the UK where Japan had a commercial reprocessing contract). This is the largest stockpile of a non-nuclear weapon state and this stockpile could increase further if the currently planned Rokkasho reprocessing plant operation and recycling program into 15-18 reactors does not move smoothly.

Meanwhile, due to heightened concern over nuclear proliferation and nuclear security, international attention on Japan's plutonium stockpile is also increasing. For example, the US-Japan nuclear working group of the Mansfield Foundation published its recommendations on nuclear energy policy for Japan this year, which says:

> The disposition of Japan's sizeable plutonium stockpile is an outstanding issue that must be addressed regardless of whether or not Japan decides to move forward with nuclear power. *Absent a credible strategy for reducing Japan's plutonium stockpile, non-proliferation and security concerns will grow over time, undermining Japan's international leadership on nuclear non-proliferation*.[xvii]

In order to reduce such concern and to minimize proliferation and nuclear security risks, Japan may need to come up with new plutonium management plan. I personally propose three new principles for new plutonium management plan in Japan as follows.

1. Demand comes first: Reprocessing should take place only when plutonium demand (use) is specified.
2. Stockpile reduction: Matching demand/supply is not good enough. Existing stockpiles should be reduced before further reprocessing.
3. Flexible plan: Current Pu use plan (MOX recycling in 16~18 units) is no longer certain. Other options (Pu ownership transfer, disposition as waste etc.) need to be pursued with minimizing cost, transportation and time required to dispose.[xviii]

High Level Radioactive Waste Disposal

Like many other countries, Japan has not found a final repository site for high-level radioactive waste (HLW). Since 2000, when the Law on Specified Radioactive Waste (i.e. vitrified HLW) was passed and the Nuclear Waste Management Organization (NUMO) as a principle implementation institution for final disposal was established, all the efforts to find even a single candidate for a possible literature investigation did not succeed. Japan's approach was to wait for local communities to volunteer to be a candidate but only one town (Toyo-town) volunteered but later cancelled the request due to strong public opposition. In 2010, JAEC issued a request to Science Council of Japan for their advice on how to improve public communication on HLW for a possible breakthrough. On September 11, 2012, Science Council of Japan (SCJ) published its answers to the request by the JAEC. The report recommended the 'fundamental reform' of Japan's HLW waste disposal policy. In particular, one recommendation that attracted media attention was '(long term) temporary storage' instead of going directly to 'geological disposal' for which they believe scientific knowledge is still uncertain to commit to geological disposal in Japan.

JAEC responded with its own policy statement on December 18, 2012.[xix] JAEC agrees with SCJ that the current HLW disposal program needs to be reviewed with fresh eyes, but maintains the basic conclusion of its advisory committee report published in 1998 which recommended 'geological disposal' is the most appropriate policy option under the current circumstances. Still, JAEC also agreed with SCJ that constant review of the program is necessary and the 'retrievability' and 'reversibility' of the program should be clearly integrated into the disposal program. Further, it also recommended the government ‘establish an independent and functionally effective third party organization to provide suitable advice to the government and related parties in time.’

Currently, METI has set up two working groups on HLW disposal to review the HLW disposal program: one is to look at the whole process and programs including public participation; and the other is to review scientific knowledge on HLW disposal in Japan especially after the 3/11 Tohoku Great Earthquake.

Securing Human Resources and Research & Development

Since the future prospects of nuclear power have become uncertain, it is likely that attracting young and capable talent to nuclear energy fields may become difficult. Further, the demand for new tasks such as decommissioning of Fukushima reactors is emerging. Therefore it is important to secure human resources to meet such new and challenging tasks in the coming decades. In addition, research and development programs need to be re-examined also to meet new challenges and provide future human resources. In order to meet such challenges, JAEC published policy statements on human resources on November 27th, 2012[xx] and on research and development on December 25, 2012.[xxi]

For human resource management, JAEC recommended, among other things, drawing up a ‘human resource demand/supply map’ i.e., recommending that ‘the related government agencies and demand side, including the nuclear industry, clarify when, in what areas and how much manpower is required based on operational plans’. This cannot be done by government agencies but should be done by related industry organizations as they probably have better knowledge and data. Other important recommendations include: 1) education based on lessons learned from the Fukushima accident; 2) providing new education opportunities for mid-career experts; 3) enhancing human resource development for nuclear safety, security and safeguards; 4) providing incentives for nuclear businesses; and 5) securing human resources for maintaining the operation of domestic nuclear power plants; and 6) human resource development for the international deployment of nuclear energy and technology etc.

Restoring Public Trust

Last, but not least, important policy issue is to restore public trust. As noted above, loss of public trust has been the biggest impact of the Fukushima accident on nuclear energy policy in Japan. JAEC issued a policy statement on this issue on December 25, 2012,[xxii] in it, JAEC listed four basic principles for restoring public confidence as follows:

Accountability

First, it is important to reveal the mission of individuals/organizations tackling such challenges to public interests to understand the why and how of what they do. In other words, such individuals/organizations need to be aware that they need to inform the public of their actions to explain the appropriateness of their decisions. When taking actions on behalf of the public, issues of awareness, planning and promoting, seeking solutions to challenges, the results achieved and how to handle risk management need to be considered.

Correct Information Disclosure

Secondly, it is important to remember that these explanations should be provided based on sufficient and correct information to the public on a timely basis. For example, in discussing a facility's actions for nuclear power safety, we should carefully explain the nature of the threat facing a facility, its target, and how it intends to reach the target. In doing so, explaining using comparisons with other facilities is acceptable but must be done carefully. This is because essentially, evaluations should be made in terms of all factors, including costs, environmental impacts (EI), and stability and comparison based on one point alone may be improper, even if accurate.

However, we should also note that speed is sometimes more important than accuracy. In that case, we should immediately inform details of what has happened and why, and what would happen in the future while clarifying some uncertainties in such information.

Transparency/Fairness and Public Involvement in the Decision Process

Thirdly, it is important to design a fair decision-making process, as the basis for various administrative decisions, and while making the process open, to provide opportunities for public participation in the process. In this case, the parties concerned should deeply appreciate that securing transparency means the public can view the decision-making process related to their interests, access information related to their interests, and make remarks on the same. Based on this acknowledgment, the greater the public interest in a decision, the more carefully we should notify the public at the earliest possible stage before making it. We should strive to give the public opportunities to express their views.

JAEC feels remorse for the lack of compassion at this point in the process of preparing documents carried out by the Subcommittee on Nuclear Power/Nuclear Fuel Cycle Technology and continues to reform its operations based on verification results.

Further, administrative bodies should establish a verifiable decision-making process, namely, from the creation of administrative documents, hearing from experts, interested parties and the public, to final making decisions.

Easy to Understand Explanations

Fourth, public explanations should be clear and plain, with accuracy a prerequisite. It is often noted that if the public cannot understand the information released, it cannot be considered transparent, even if we believe transparency is attained in doing so. It is not easy to ensure material is both accurate and comprehensible, but court decisions have long since been written in normal Japanese. Administrative bodies must not forget to check the processes of creating documents and preparing explanations from this perspective, continuously educating and training themselves in this area.

Conclusion

Nuclear energy policy after 3/11 needs to be changed reflecting lessons learned from the Fukushima accident. Different priorities and tasks are required in the post-Fukushima accident environment, which are: decommissioning of Fukushima site and restoring life of people in Fukushima, enhancing safety and security, spent fuel management, plutonium stockpile management, waste disposal, human resource development and most of all restoring public trust. These are necessary changes regardless of the future directions of nuclear energy in Japan.

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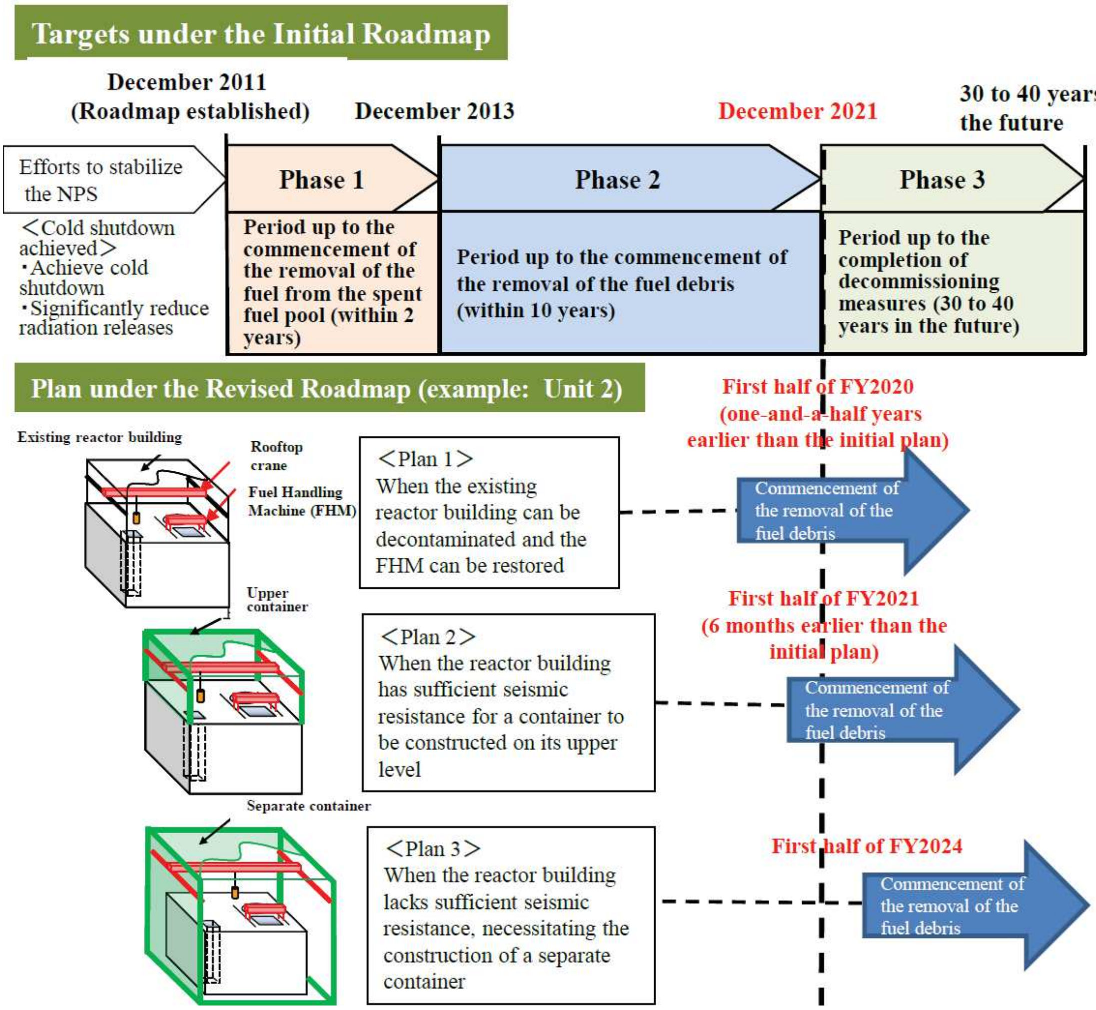
Figure 1: Mid to long-term roadmap for decommissioning the Fukushima Dai-ichi plant.



Source: Agency for Natural Resources and Energy, Announcement of the Revised Version of the Mid-and-Long-Term Roadmap towards the Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station Units 1-4, June 2013, <http://www.meti.go.jp/english/press/2013/0627_01.html>.

Table 1: Japan’s plutonium stockpile (as of December 31, 2011 and 2012)

	2012 (kg)	2011 (kg)
Stock in Japan (Pu total)		
Reprocessing Plants	4,363	4,364
MOX Fuel Plant	3,364	3,363
Stored at Reactors	1,568	1,568
Sub-total (Pu fissile)	9,295(6,315)	9,295 (6,316)
Stocks in Europe (Pu total)		
UK	17,052	17,028
France	17,895	17,931
Sub-total :Pu total(Pu fissile)	34,946 (23,277)	34,959(23,308)
Total (Pu fissile)	44,241(29,592)	44,254(29,624)

Source: Japan Atomic Energy Commission (2013, 2012)

<http://www.aec.go.jp/jicst/NC/sitemap/pdf/130911e.pdf>.

3. Japan-Australia Collaboration Opportunity in Oil & Gas Upstream Business

Ryuta Kitamura, JOGMEC.

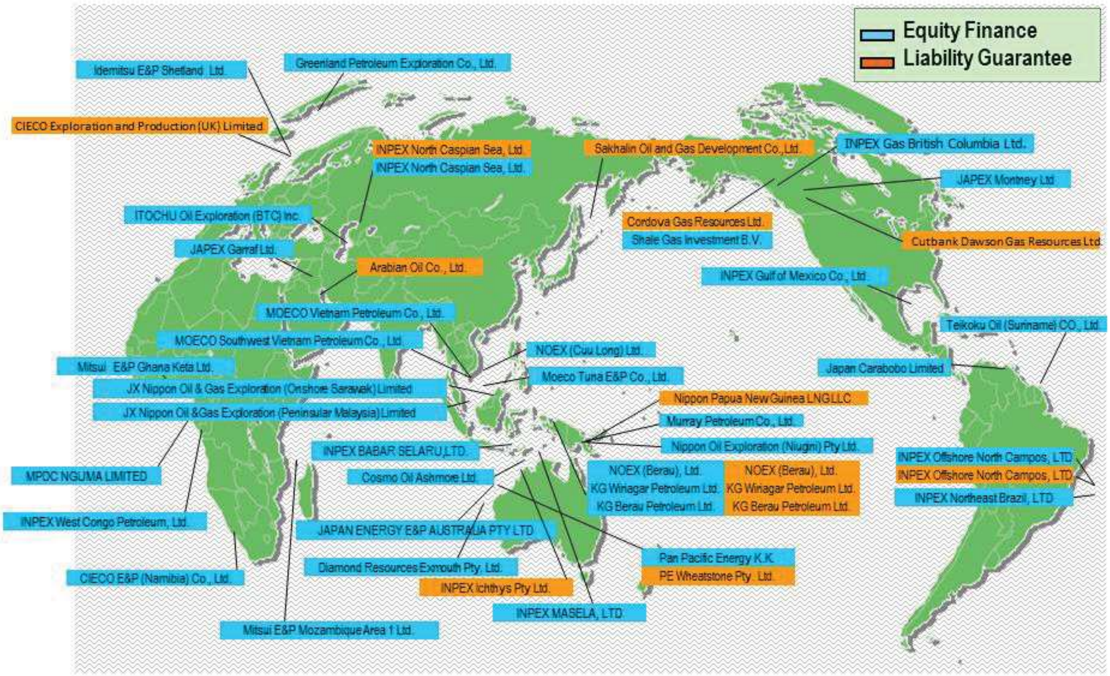
Introduction

JOGMEC is a Japanese governmental agency, which was established in 2004 after a restructuring of Japan's National Oil Corporation (JNOC). Our mission is to ensure a stable supply of oil, natural gas, mineral resources, coal, and geothermal energy for Japanese industries and citizens. To fulfil our mission, we have some viable tools.

One of our main tools is to provide financial support through equity capital & liability guarantees for Japanese companies. JOGMEC provides equity capital for oil and natural gas E&P projects including gas liquefaction projects performed by Japanese companies. JOGMEC makes such investments to mitigate the project risks Japanese companies face when participating in concessions or initiating production. JOGMEC provides liability guarantees for overseas oil and gas E&P projects conducted by Japanese companies, helping them to finance oil and natural gas E&P projects.

We are currently supporting two big LNG project in 2013 here in Australia. The one is Ichthys LNG project which is under development offshore in Western Australia and onshore in Northern Territory, and the other is Wheatstone LNG project offshore and onshore in Western Australia. We also support some exploration projects offshore Australia.

JOGMEC E&P Projects (March, 2013)

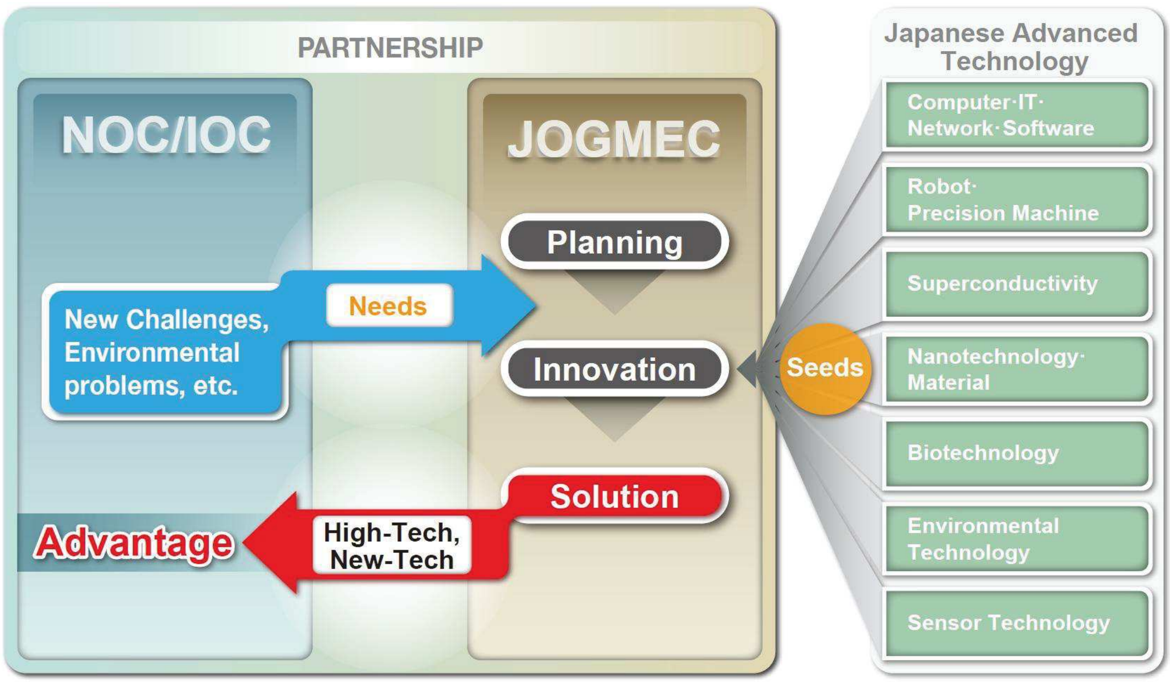


The other tool is providing technical support for enhancing energy security, which include 'Research & Development' and our new initiative, 'Solution Providing with Innovative Technologies'.

Oil & gas producing companies are facing rising challenges such as environmental issues and E & P activities in more severe conditions. On the other hand Japan has developed advanced technologies in many sectors, including IT, electronics, materials, and machinery, etc. From FY2013, JOGMEC launched the 'Solution Providing with Innovative Technologies'. Through this new initiative, JOGMEC aims at strengthening relationship with oil and gas producing countries as well as with their national oil and gas companies (NOCs) and international oil companies (IOCs) by utilizing cutting-edge, innovative Japanese technologies to assist them in overcoming their upstream development challenges. In this new initiative, JOGMEC will facilitate the application of such Japanese technologies to tackle the challenges faced by producing companies. We hope this initiative will further strengthen relationships between Japan and oil & gas producing countries like Australia. For example, water treatment technology or CO_2 removal/recovery technology might be adapted for Australia.

In FY2013, 'JOGMEC Techno Forum 2013' was held in Tokyo to introduce this new initiative to a wide range of innovative Japanese companies to create a platform of dialogue to start the matching of upstream technological challenges with potential technological solutions possessed by Japanese innovation. At the Forum, in order to deepen the understanding of the upstream oil and gas industry of participants from other industrial sectors, JOGMEC invited many speakers from the upstream oil and gas industry to speak on the flow of upstream oil and gas projects as well as key technological challenges in the industry. At the Forum, JOGMEC invited specialists in the field of resource development, including unconventional resources such as shale gas, to speak on the change in the global energy landscape, the potential of Japanese technologies, and the future role of JOGMEC.

Figure 1: Jogmec Diagram



The other tool the 'Research & Development' activity has long history, and we have been collaborating with many national oil companies as well as governmental bodies, which include Abu Dhabi National Oil Company (ADNOC), PetroVietnam (PVN), Petrobras and more. JOGMEC specializes in technology related to oil and natural gas exploration and development, and deploys its expertise to find solutions to technical problems in oil and gas fields in which Japanese companies are involved. JOGMEC also collaborates on projects globally, having technical partnerships with oil and gas producing countries. We develop the basic and advanced technologies necessary for these solutions, and provide the technologies and the latest technical information to private industry. In FY2007 we have established long term R & D Strategy toward 2030, then selected 6 prioritized technological fields as below:

1. Maximizing Oil Recovery

Conventional EOR/IOR Technology, Productivity Improvement Technology, Reservoir Evaluation and Modelling Technology.

2. Oil and Gas Reservoir Detection and Characterization

Exploration and Reserves Evaluation Technology, Reservoir Characterization Technology, Dynamic Modelling Technology.

3. Well Drilling and Field Development

Drilling Technology Improvement and Cost Reduction, Production Facility Optimization Technology Improvement and Automation, Frontier Area Development Technology.

4. Unconventional Hydrocarbon Exploitation

Methane Hydrate Development Technology, Oil Sands/Oil Shale/Heavy Oil Recovery and Upgrading Technology, Non-conventional Gas Exploitation and Production Technology.

5. Effective Utilization of Oil and Gas

GTL Technology Demonstration Project, Upgraded Liquid Fuel Production Technology, Exploitation Cost Reduction Study through Floating System.

6. Environment-conscious Oil and Gas Exploitation

CO2 Injection Technology, Methane Bio-conversion Technology, Emission Reduction Technology.

Based on the strategy above we are currently focusing on four main categories, which are 'Maximizing Oil Recovery', 'Unconventional Hydrocarbon Exploitation', 'Offshore Oil and Gas Development' and 'Environment-conscious Oil and Gas Exploitation'. There are two potential R & D projects, which might be adopted to the Australian industry, 'Gas-to-Liquid technology' and 'unconventional hydrocarbon exploitation'.

In response to the diversification of gas utilization, JOGMEC has been developing its own Gas-To-Liquid technology called JAPAN-GTL, through collaboration with a consortium of Japanese companies, which are: INPEX Corporation, JX Nippon Oil & Energy Corporation, Japan Petroleum

Exploration Co., Cosmo Oil Co., Nippon Steel & Sumitomo Engineering Co. and Chiyoda Corporation. GTL is a technology that converts natural gas into liquid petroleum products, and is considered to be a highly effective method for securing alternative fuel source and diversification of energy supplies. The JAPAN-GTL Process is a ground-breaking technology that would for the first time ever allow for natural gas containing CO2 to be directly used. Since it can convert natural gas, shale gas and so on as a raw material, it should be viewed as a potential new resource for the world, to replace petroleum products and produce products such as clean naphtha, kerosene and diesel, which include no sulphur or aroma.

We have successfully completed a demonstration plant test which could produce 500bbl/day of GTL liquid from 2009 to 2011 in Japan. Furthermore, in parallel with a demonstration plant test, we have conducted supplementary research and development, and studies relating to the commercialization of the JAPAN-GTL Process. As a result of the work described above we successfully commercialized the JAPAN-GTL Process in March 2012.

We are in discussion with some companies about the possibility for this technology's commercialization. We expect to adopt this technology for developing remote and small/middle scale gas field which will make them more profitable.

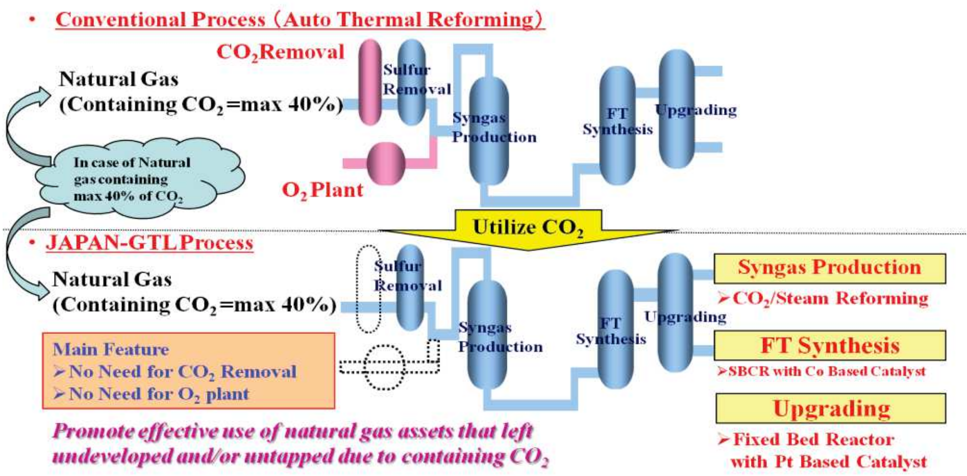


Figure 2: Process

Lastly, we are working on R&D for unconventional hydrocarbon exploitation, which includes a natural methane hydrate development project in Japanese water as well as shale and tight gas/oil development.

We would like to provide technical support for more efficient shale and tight gas/oil development in the near future. To enhance our understanding of unconventional resources, we have signed a joint research agreement with Mitsubishi Corporation and Encana Corporation for unconventional gas development in Canada. We will conduct integrated core analysis, geomechanical and seismic studies using data from Montney formation in British Columbia, Canada.

In conclusion, JOGMEC can provide supporting tools for oil and gas upstream business, including 'solution providing with innovative technologies', 'Gas-to-Liquid technology' and 'unconventional hydrocarbon exploitation technology', which we think is valuable for building collaborative partnerships and strengthening relationship between Japan and Australia.

4. Japan's Energy Policy at a Crossroads

Ken Koyama, The Institute of Energy Economics, Japan

Abstract

Today, almost three years after the March 11th disaster and the Fukushima accident, Japan still has to face many unsolved problems, and is struggling to overcome uncertainty and challenges for its energy future. Under the current difficult situation, Japan needs to achieve "3Es (Energy security, Environmental protection and Economic efficiency)" plus "S" (Safety) and "M" (Macro economy protection) simultaneously, taking account of the new reality after the Fukushima accident.

Promotion of nuclear power has played an important role in Japan, in terms of such effects as: diversifying energy sources, reducing fossil fuel imports, reducing CO2 emissions, etc. But the Fukushima accident made the energy policy landscape of Japan completely different. Japan now stands at a crossroads in term of decision making on national energy policy.

The major problems that Japan now needs to address include:

(1) Issues related to restarting nuclear power plants that have been mostly offline due to safety concerns;
(2) Decision making for Japan's long-term 'energy best-mix' policy (Revision of Japan's 'Basic Energy Plan';
(3) Promotion of energy market reform;
(4) Enhancement of security of fossil fuel supply, both in terms of volume and price, under the emerging global energy landscape including US 'Shale revolution', geopolitical problems in the Middle East;
(5) Further promotion of energy efficiency improvement and renewable energy introduction in Japan.

To protect Japan's national interests in terms of energy related challenges, the Japanese government will be required to design and implement a comprehensive strategy, by best utilizing and combing

Japan's advanced technology, accumulated energy policy know-how and private sector entrepreneurship.

With recognition of this in mind, this paper tries to identify the Post-Fukushima energy related challenges that Japan has to face, and to discuss future directions for Japan's energy policy, with the aim of drawing some implications for Japan's energy future on Japan-Australia bilateral relations.

The Impacts of March 11th on Japan's Energy Landscape

March 11th Earthquake/Tsunami and Fukushima Nuclear Accident

On March 11th, 2011, the Great East Japan earthquake and resultant tsunami hit Japan, causing catastrophic human, economic and social damages. The March 11th natural disaster generated almost 19,000 victims – dead or missing. Japan's economic/industrial infrastructures located in the earthquake/tsunami affected area were seriously damaged, and Japan's GDP was reduced. The number of essential energy supply infrastructure were also severely damaged. But there is no doubt that the most serious problem was the Fukushima nuclear accident. The meltdowns, hydrogen explosions and the external release of large quantities of radioactive materials at the Fukushima Daiichi Nuclear Power Station resulted in one of the most serious nuclear disasters in history. After the accident, the Japanese government declared the achievement of a 'cold shutdown situation' and the completion of 'Step 2' in the plan to resolve the nuclear accident on December 2011. Judging by reality, however, true resolution of the accident will require decades in view of the difficulties of leakages of contaminated water, decontamination of a wide range of lands/areas, decommissioning of the plants, and the return of large numbers of evacuees.

Nuclear Shutdown and Energy Saving/Fossil Power Generation

After the Fukushima accident, concern over nuclear safety became a nationwide and very serious social topic in Japan. Under these circumstances, nuclear power generation from existing plants continued to decline in Japan after the accident. This was mainly due to the difficulty in securing social/local acceptance to re-start a nuclear plant when the plant shutdown for regular maintenance. On May 2012, the last remaining nuclear plant stopped its operation for maintenance, and Japan experienced 'zero nuclear' situation for the first time in its history after the first introduction of nuclear power in 1966. In FY 2010 (before the Fukushima accident), nuclear power accounted for 31% of total power generation in Japan. But the share declined to 2% in FY

2012 because of the nationwide nuclear shutdown. The substantial reduction in nuclear power generation resulted in serious challenges for securing power supply stability in Japan. But thanks to strong efforts to enhance power saving[xxiii] and utilization of fossil fuel power generation, Japanese power market succeeded in avoiding any unplanned black-outs after the Fukushima accident. But the power generation portfolio in Japan saw significant change. While the share of nuclear power in total power generation declined from 31% in FY 2010 to 2% in FY 2012, those of LNG and oil increased from 31% to 47%, and from 5% to 15% respectively[xxiv]. In other words, the reduced contribution of nuclear power was offset by LNG and oil fired power generation, and LNG fired power generation became a mainstream source of power generation in Japan. To meet the growing demand for fossil power generation in particular for LNG, Japan's imports of fossil fuels increased substantially. For example, Japan's LNG import increased from 71 million tonnes in FY 2010 to 87 million tonnes in FY 2012, up by 16 million tonnes or by 23%.[xxv] Out of 16 million tonnes of incremental imports, import from Qatar accounted for largest portion (7.5 million tonnes), which indicates that Japan's dependence on Middle East (Qatar) LNG increased. As of FY 2012, Australia is the largest LNG supplier to Japan (volume: 17 million tonnes, share 19%), followed by Qatar (15 million tonnes, 17%) and Malaysia (14 million tonnes, 16%).

Energy, Environmental and Economic Impacts on Japan

The above-mentioned large scale increase in fossil fuel use to offset the reduction in nuclear power helped Japan to avoid an energy shortage or black-out, but it also had serious implications for Japan's energy security, environment protection and its macro economy.

First, increases in LNG and oil use in power generation resulted in a lowering of energy self-sufficiency in Japan, as nuclear power is regarded as a 'quasi domestic energy source' in Japan. IEEJ estimated that Japan's energy self-sufficiency in total primary energy (when nuclear energy is counted as 'domestic' energy) will decline from 18% in FY 2010 to 7% in FY 2013. While Japan is expected to become more energy import dependent as a whole, it is also important to note that Japan's dependence on Middle East LNG has increased substantially as a major part of the incremental LNG supply came from Qatar. Thus Japan has become more exposed and vulnerable to the instability in the international energy market.

Second, CO_2 emissions are now increasing in Japan because of higher fossil fuel use to replace nuclear power. IEEJ also estimated that Japan's energy related CO_2 emissions will increase from 1.12 billion tons (6% higher than that in FY 1990) in FY 2010 to 1.22 billion tons (15% higher) in FY 2013.

The increased CO_2 emission has created new challenges for Japan to comply with the Kyoto target as well as for strategic considerations on post-Kyoto climate change policy. Therefore, a comprehensive energy and environment policy review has become a critically important task for the Japanese government.

Third, the huge increase in fossil fuel imports directly resulted in larger import payments, which has caused negative economic impacts on Japan. The increase in fuel import payments contributed to Japan historical trade deficit. Japan recorded a trade surplus of 5.4 trillion yen in FY 2010 but it is now estimated that Japan's trade deficit will reach as high as 10 trillion yen in FY 2013, while fuel import payment is expected to increase from 18.1 trillion yen to 27.1 trillion yen for the same period.[xxvi] The increase in fuel import payments is also expected to increase Japan's average electricity cost by 4.4 yen/kWh in FY 2013 as compared to FY 2010. The estimated cost increase will have serious economic implications because the amount is equivalent to almost a 20% increase in power consumption bills for the average household in Japan, as well as being equivalent to an over 40% increase for large scale industry users, which may affect their international competitiveness.

Energy Policy Debates After the Fukushima Accident

The Need For a Comprehensive Review of Japan's 'Basic Energy Plan'

Japan, as a major energy consuming country with heavy energy import dependence has always needed to pursue a simultaneous strategy of the 3 'E' objectives namely: <u>E</u>nergy security, <u>E</u>nvironment protection and <u>E</u>conomic efficiency. For this purpose, the Japanese government is required to engage in long-term strategic energy planning for the country, the most important of which is known as the 'Basic Energy Plan' of Japan.

The most recent Basic Energy Plan was approved by a Cabinet Decision in June 2010,[xxvii] which includes a target of increasing the energy self-sufficiency ratio (including equity-based energy imports) from the present level of 38% to 70% by 2030, while reducing CO_2 emissions by 30% compared to their 1990 level. To achieve these targets, expansion of nuclear power was regarded as the most crucial element, because nuclear power is recognized as 'quasi-indigenous' and a CO_2-free energy source. Actually, the Plan sets a target to increase the share of nuclear power in total power generation up to 50% in 2030 by increasing nuclear capacity from about 49 GW in FY 2007 to 68 GW by 2030.

However, the Fukushima accident resulted in drastic changes to the energy landscape in Japan. Public concerns over the safety of nuclear power became so widespread and serious immediately after the accident that the feasibility of large scale nuclear expansion in the plan was questioned. Thus Japan needed to comprehensively review its energy policy, represented by the Basic Energy Plan, based on the new realities after the March 11th event.

Innovative Energy & Environment Strategy

After the Fukushima accident, the Japanese government led by the Democratic Party of Japan (DPJ) embarked on a comprehensive review of the Basic Energy Plan. Special government advisory committees were established to discuss the revision of the plan, and they finally concluded three scenarios for Japan's energy future after extensive discussion. The three scenarios include: 'Zero nuclear scenario'; '15% scenario'; and '20-25% scenario', based on the difference in the share of nuclear power in total power generation in 2030.[xxviii] National debate was invited to discuss 'pros and cons' and feasibility of the three scenarios during the summer 2012.

Then the Energy and Environment Council, a central body in charge of energy policy review at the time of DPJ government, finally decided to adopt the 'Innovative Energy and Environment Strategy', on September 14, 2012, in which it was clearly stated that Japan should pursue the establishment of a nuclear-independent society as soon as possible.[xxix] The strategy also stated that all possible policy resources should be utilized to achieve a 'Zero nuclear' status sometime in the 2030s, while the Strategy seemed to have no concrete timetable and work plan to achieve its goal. However, the Strategy itself was not approved by a Cabinet Decision. Instead, the Cabinet Decision on 19th September 2012 only stated that the establishment of a new energy policy should be based on responsible discussion with respective local governments and international society as well as with the understanding of Japanese citizens, with a continuous check and review process.[xxx]

The regime change from DPJ to LDP government

Furthermore, the Lower House election in Japan on December 2012 resulted in an overwhelming victory for Liberal Democratic Party (LDP), which made LDP and its president, Shinzo Abe, form a new Japanese government. With this regime change, Japanese society started another round of energy policy review under the new LDP government. LDP also won an overwhelming victory again in the Upper House elections on July 2013. Under the new political circumstances, Mr. Abe and LDP are expected to enjoy stable and enhanced political power in domestic politics as compared to the past several years in the Japanese political scene. This new political environment may make Mr. Abe focus on tackling the various challenging tasks that Japan has to face now. Energy policy challenges in the Post-Fukushima reality is of course one of them.

After the elections, the general perception was that LDP government was likely to take a stance that favoured restarting nuclear power plants as a critical mean to address 3 'E' and macro-economic issues for Japan. The LDP government was also viewed as being likely to take a more supportive stance towards the best utilization of nuclear power in Japan's energy portfolio, while also requiring a stringent enhancement of nuclear safety and also trying to restore credibility to nuclear policy.

Priority Energy Policy Challenges for Japan

Nuclear Restart

As discussed earlier in the first section of this paper, there are emerging problems in terms of energy security, CO_2 emissions and macro economy situation in Japan, caused by the enormous increase in fossil fuel use to offset reductions in nuclear power use. In this regard, it is generally recognized that the LDP government will take a positive stance of considering restarting nuclear power plants as a critical mean to address the three 'E' and macro-economic problem for Japan.[xxxi] As the LDP government gives top priority to the economic recovery of Japan, they cannot ignore the problems of wealth outflow and rising energy costs that have emerged from the expansion of fossil fuels use. How to address the nuclear plant restart problem on the basic premise of thoroughly enhanced safety may be one of the most important challenges for the LDP government for the immediate future.

In reality, however, there are some important elements for consideration with regard to re-starting nuclear power plants. The most fundamental point is that it is the independent Nuclear Regulatory Authority (NRA),[xxxii] not the government, that is responsible for conducting a comprehensive review on the safety of each nuclear power plant, based on the newly established safety standards and to make decision if re-start will be permitted or not for each nuclear power plant on a case-by-case basis from a technical and safety standard viewpoint.

NRA, created last September for the first time in Japan's history as an independent nuclear safety regulator, is now working towards undertaking technical reviews for re-start of plants, based on the new safety standards which include wide range of stringent safety measures for large-scale earthquake and tsunami, severe accidents management, counter terrorism, etc.[xxxiii] While power companies in Japan have already submitted applications for a re-start of 17 nuclear power plants in 10 sites (as of February 28th, 2014), NRA in response formed up 3 teams to conduct a technical review. As it is reported that one review team may handle review of two plants simultaneously in a review process and that the review process will take at least 6 month or longer, it is quite likely that the number of re-started plants within the year 2014 will be limited. In reality, as of today (February 28th, 2014), no nuclear power plant in Japan can get an approval from NRA. There is an expectation that the first approval from NRA may be issued sometime late spring or early summer, given the current pace of on-going safety reviews, but it is still very uncertain when the first approval will actually be issued. But once NRA gives safety clearance to a specific plant, then the government is expected to play an important role to promote dialogue with local communities where the specific nuclear plant is located (and their surrounding communities) to accept the restart of plants.

Energy Policy for the 'Best Energy Mix' for Japan

In addition to the issue of the re-start of nuclear power plants, the LDP government after the recent elections is required to address the basic problem of the positioning of nuclear power in Japan's long term energy portfolio. For Japan's economic and energy survival, the government may now need to examine this problem based on the new concept of simultaneous achievement of the three 'E' plus 'S' (Safety) and 'M' (Macroeconomic protection), in the Post-Fukushima energy economic reality in Japan. In this regard, the LDP government seems to recognize that there is no 'silver bullet' energy option, in other word, each energy option has benefits and disadvantages so that 'best energy mix' concept is essential. The discussion started in order to examine the long term energy portfolio of the newly restructured Strategic Policy Committee of the Advisory Committee for the Ministry of Economy, Trade and Industry (METI).[xxxiv] But considering the complexity of the discussion topics as well as the sensitive nature of nuclear safety and the time required for rebuilding public trust for nuclear policy, it is difficult to expect an early or quick solution for the long-term energy portfolio in Japan.

After extensive discussion, the Strategic Policy Committee released a draft recommendation for the Basic Energy Plan late last year, positioning nuclear power generation as a key energy source while giving top priority to safety based on deep reflection on the Fukushima accident.[xxxv] Since then, however, the LDP government has postponed its Cabinet Decision on the new Basic Energy Plan due to the need to deal with nuclear policy as a politically highly sensitive issue. Media reports state that the government and ruling parties have various opinions about the position of nuclear energy and are required to coordinate these opinions.

Another factor which reportedly affected the timing of the cabinet decision was the outcome of the high-profile Tokyo gubernatorial election on 9th February 2014 in which some candidates called for an 'immediate nuclear zero policy' and attracted public attention back onto the issue.[xxxvi] In reality, the former Health, Labour and Welfare Minister Yoichi Masuzoe, supported by LDP and Komei Party, achieved a landslide victory at the election. As he takes a moderate stance towards nuclear energy and has criticized an 'immediate nuclear zero policy' as unrealistic and irresponsible during his election campaigns, the election result has implications for energy policy discussions. In other words, if any candidate calling for an 'immediate nuclear zero policy' had won or fought a close race with the winner in the election, it could have exerted a great impact. In this sense, the election results can be expected to have a substantial impact on Japan's future energy policy.

As far as the energy policy is linked to national fundamentals, prudent and sufficient discussions and considerations on the policy are important as a matter of course. Based on sufficient considerations, however, the government is required to decide and implement the policy as sufficiently early as possible. In this sense, it is significant that the government finally published a draft version of the Basic Energy Plan (based on the recommendation of the Committee) on February 25th, 2014.[xxxvii] And it is now expected that government is likely take a move toward making a cabinet decision on the new Basic Energy Plan based on the latest draft soon.

Under the circumstances, the LDP government is expected to still continue to take a cautious approach towards the energy portfolio issue while making strong efforts to rebuild public trust in nuclear safety policy. The government is also expected to focus on such policy areas as:

a) Designing new policy to further enhance Japan's energy efficiency;
b) Promoting such renewable energy as solar and wind power by best utilizing a Feed-in-Tariff system (introduced on July 2012), while paying due attentions to lessons learned from experiences in Germany and Spain where rapid penetration of renewable energy resulted in higher energy costs for consumer as well as increased needs to enhance power supply stability;
c) Enhancing policy for security of fossil fuel supply, as Japan will continue to be heavily dependent on fossil fuel imports in the foreseeable future. Best utilization of oil, gas and coal is required based on the recognition of their respective advantages and disadvantages.

With regard to security of fossil fuel supply, the government needs to deal with gas/LNG security of supply in particular, given the expected important role of natural gas in Japan. Thus securing new and diversified supply sources of LNG, for example from the US, is regarded as critically important for Japan' energy policy to address the so-called 'Asian premium in LNG price' issue. The 'Asian Premium' is a market phenomenon in which LNG price in Asia is much higher than those in Atlantic market, in particular in US markets where the shale gas revolution has made the gas supply-demand balance ease substantially[xxxviii].

The 'Asian premium' now attracts a great deal of attention in Japanese policy, industry and media circles. This is because higher LNG prices (in comparison to other markets) are regarded as a major cause of economic disadvantage in Japan such as: the national wealth outflow; trade deficits, and higher energy bills for consumers. The problem also has raised national concerns about how to improve Japan's (or Japanese LNG buyers') bargaining power in LNG procurement to overcome these economic disadvantages. In those circumstances, it is of critical importance for Japan to enhance such efforts to promote expansion of LNG/gas supply in the market; to diversify LNG/gas supply source; to enhance relations with LNG/gas supplier country/entity; to promote cooperation among LNG/gas consuming countries.[xxxix]

As discussed above, there are so many difficult and complex challenges for these aspects of the energy policy review. Thus no optimism is guaranteed to have an easy solution for these complicated challenges.

As discussed earlier, it is now expected that the government may be able to make a cabinet decision on the new Basic Energy Plan soon. However, the cabinet decision will still leave key energy policy challenges for the future. The most serious challenge includes a makeup of consensus on the concrete 'numerical target' for the energy portfolio in 2030. The recommendation of the government subcommittee released late last year offered a summary of qualitative views, falling short of specifying a quantitative target for each energy source in 2030. Given the nature of investment in the energy area which requires a long lead-time for producing investment results, it is important to have quantitative policy targets in implementing energy policy. It is important to have quantitative reference standards for making objective and reasonable policy decisions. As all nuclear power plants in Japan are left offline with no specific schedule given for their restart, quantitative details of the energy mix may have uncertainties and be difficult to work out. But discussion on the energy mix needs to be started soon.

Power Market Reform

After March 11, 2011, there were also discussions on reforming the institutional framework of the electric power industry as a part of the review of the national energy policy. A special committee in charge of this issue published an interim report[xl] on July 2012 that called for overall market reform such as: full retail market opening/liberalization; the further promotion of competition in the power generation and wholesale power markets; and the enhancement of transmission neutrality and the introduction of unbundling. A final report of the committee was published (under the new LDP government) on February 2013.[xli] This report identified a three stage market reform as follows:

1st stage: Creation of a 'national independent transmission organization' by around 2015;

2nd stage: Full retail market opening by around 2016;

3rd stage: Legal unbundling of the transmission and distribution sectors by about 2018-2020.

From now on, it is expected that discussion and preparation will continue to determine the details of this planned three-stage market reform. In this regard, it is important to recognize the reality that current power supply capacity in Japan may be potentially insufficient because of the continued nuclear power plant shutdown, and, therefore, the '3E's+S+M' concept should be the guiding principle when discussing the details of the three stage reform program. The critical question to be answered is: how to identify what institutional reforms in detail would contribute most to the security of power supply, which is the key issue for the Japanese economy and civilian life.

Conclusion

Importance of Comprehensive 'Best Mix' Concept

Japan now stands at a crossroad in the face of very serious energy challenges after the Fukushima accident. Under these circumstances, to protect Japan's national interests in terms of energy related challenges, the Japanese government will be required to design and implement a comprehensive strategy, by best utilizing and combing Japan's advanced technology, accumulated energy policy know-how and private sector entrepreneurship.

In order to pursue a fundamental and comprehensive review of Japan's national energy policy, the government must objectively consider both internal and external conditions on energy security, global/regional environment problems, and political and economic factors surrounding Japan.

When revising our strategic energy plan for the future, our national debate/discussion should be based on objective and scientific analyses, data and information. In addition, we need strategic thinking to maximize Japan's national interest. For this purpose, we will be required to take full account of Japan's unique and serious situation, but at the same time, we also need to consider a global perspective and to plan and implement strategies with global perspectives. The true 'best energy mix' policy is not a simple question of finding the best combination of energy source options. The concept should include: the 'best mix' of market mechanisms and government functions (policy measures); the 'best mix' of opinions and actions of the government, the private sector, experts and the public; and the 'best mix' of domestic market/system oriented energy policy and international energy strategies.

Implications for the Japan-Australia relationship

Finally, as a typical example of this aspect of the international energy strategy of Japan, it is worth discussing here the need to strengthen interdependence of Japan-Australia relations. Japan, as a major energy consuming/importing country, requires 'security of energy supply' while Australia as a major energy resource producer/exporter requires 'security of energy demand'. The two countries depend on each other for mutual sustainable development. It is also very significant to remember the facts that:

a) Australia is the top LNG and coal supplier to Japan. Japan also depends on uranium supply from Australia.
b) Australia is embarking on massive expansion of LNG production/export capacity, in which Japanese companies are involved to play important role as investors/buyers.
c) Japan is a major export destination country for Australian LNG, coal, uranium, etc.
d) While Australian energy exports to Asian emerging countries in particular to China are expected to increase in the future, Japan will remain as stable and reliable market outlet in Australia's energy export portfolio.
e) Japan and Australia can share many common values as developed OECD countries with strategic alliance with the US.
f) Further enhancement of the two country relationship can therefore be a cornerstone of achieving the '3E+S+M' objective of the both countries.

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5. Australia and Japan: Fundamental energy security challenges

Tony Wood, Grattan Institute.

Abstract

This paper will explore the energy security challenges facing Australia and Japan in the context of energy reliability, affordability and sustainability. The political context for energy security, together with global and regional forces provides a context for these challenges. The current global gas revolution is used as a specific example of the common but different challenges facing the two countries. Japan has limited domestic energy resources and an on-going challenge in the context of the Fukushima incident. It is also a major Australian energy customer. Australia has effectively no physical constraints on energy supply, but is facing its specific set of issues emerging from rising prices and uncertainty regarding climate change policy.

Australia & Japan: Fundamental Energy Security Challenges

Energy security can be defined narrowly to cover physical supply. However, in considering the challenges that countries like Japan and Australia are facing in the second decade of the twenty-first century, a more expansive definition may be more useful. In this paper, energy security is considered to cover physical supply options or reliability, whilst also including the critical issues of affordability and sustainability. This framework provides a useful structure to consider the similar and differentiated challenges faced by both countries, but with the focus being on Australia.

In exploring these dimensions, it is useful to recognise that, when political and policy issues are being considered and when difficult choices have to be made, reliability will always outrank affordability and affordability will outrank sustainability.

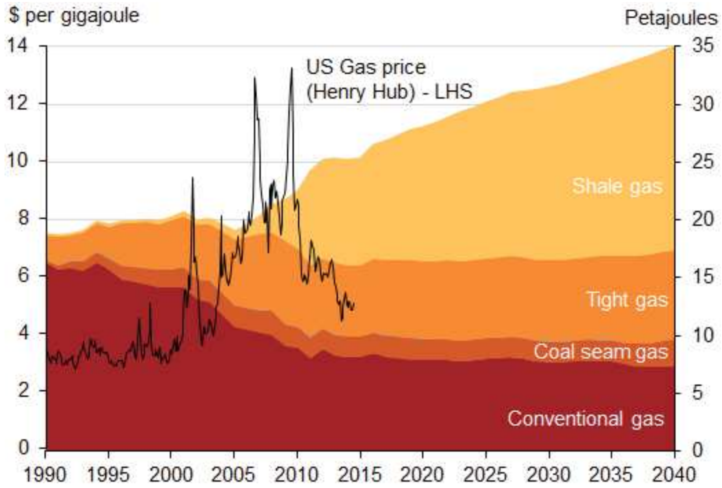
The Challenge of Energy Reliability

Most countries in the world face supply challenges with one or other form of primary energy sources. These challenges may arise from the physical resource base of the country or can also be created through some policy choices. For example, the UK is looking to replace its nuclear power fleet and develop off-shore wind power whilst relying on other countries for its gas supply. Germany is now grappling with the consequences of moving away from nuclear as a political decision and with the consequences of the extensive subsidies that have been provided for renewable energy. .The United States has been acutely sensitive to dependence on other countries, including those in the Middle East, for its energy supplies, and is now in the midst of a major energy revolution based on shale oil and gas. Japan has been largely dependent on imports for its primary energy and had developed a significant fleet of nuclear power plants. Since February 2011, however, that fleet has been shut down, exposing the Japanese economy and consumers to a new challenge. Australia is in a very unusual position globally in regard to energy resources and therefore physical reliability. With very large resources of coal, gas, sun, wind and uranium, there are effectively few if any absolute challenges. The only physical constraints are the low level of oil reserves and the absence of high mountains for hydropower. Australians have also chosen to forego nuclear power as an option.

There is a range of approaches that countries take to address energy supply challenges. These include establishing a diverse portfolio of supply arrangements (e.g. Australia's answer to its obligations for a strategic oil reserve), securing new, unconventional sources (shale gas, methane hydrates or solar) and taking direct interest as equity stakes in overseas supply (a strategy followed by China, Japan and Korea in several countries, including Australia and Canada). The adoption of a diverse range of technologies can also complement geographic diversity.

Physical supply challenges can be met by government policies or through market forces. The latter is best illustrated by the current gas revolution that began in, and continues to be led by, the United States. Figure 1 shows how the gas price in the US had risen to very high levels only a few years ago, to the extent that multiple Liquefied Natural Gas (LNG) import terminals were being planned. However, the high prices acted as a powerful stimulus for new supply that was delivered via the combination of three significant technological developments, three- dimensional seismic, horizontal drilling and fracture stimulation.

Figure 1: Markets can be powerful drivers of technology

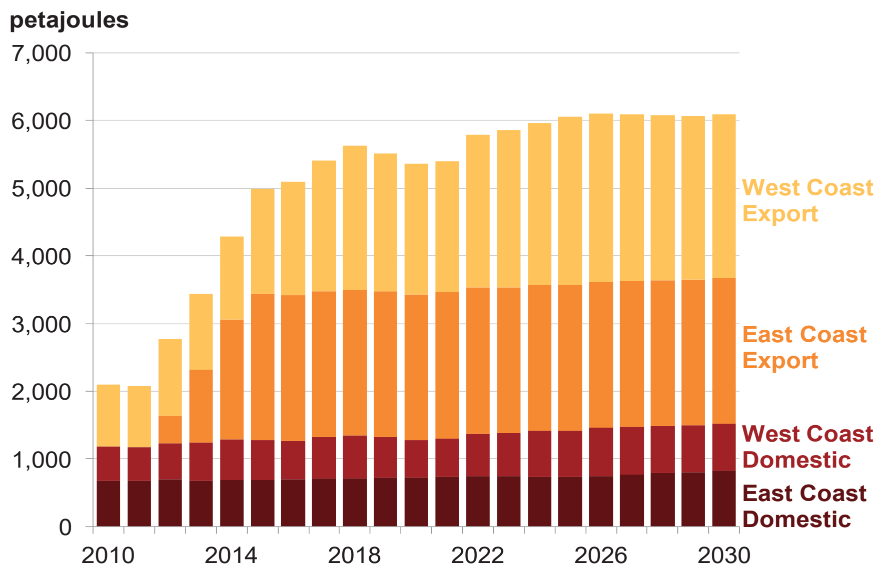


Source: EIA, US Geological Survey

As a result, production of shale gas increased very rapidly and prices plummeted. Whilst the very low prices (around $2 per gigajoule) were not sustained, the price for gas in the US remains generally below $4 per gigajoule.

There is the potential for replication in our region, and Australia's coal seam gas development provides an example. As shown in Figure 2, Asian demand has driven a spectacular investment cycle in Australia that will see production quadrupling, creating more than $50 billion in annual export earnings and will catapult Australia to the top of the league table of LNG exporters.

Figure 2: The Australian response delivers a big, mutual opportunity



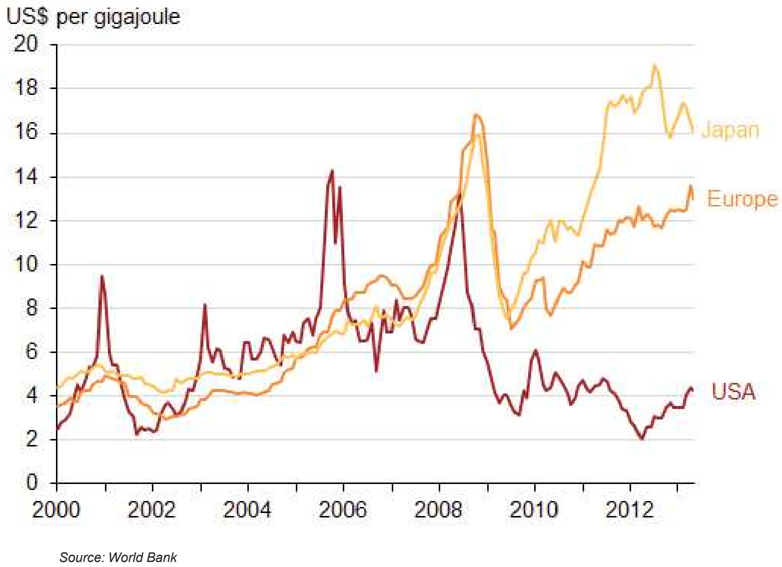
Of course, this growth does not come without growing pains and the consequences for prices for domestic Australian consumers and for Asian buyers are powerful illustrations of such consequences.

The Challenge of Energy Affordability

Affordable energy is critical for social and economic prosperity. Historically, energy sectors have often been dominated by governments. This involvement has included subsidies, ownership of vertically integrated electricity and gas utilities and state-owned oil companies and via economic regulation. For many countries in our region, explicit energy subsidies consume significant proportions of national budgets and distort decision making by consumers while being very difficult to unwind politically.

The global gas revolution again provides an illustrative example of a key challenge in terms of the way that markets respond to supply and demand via price. Figure 3 shows a remarkable price separation driven by physical processes and constraints.

Figure 3: Global gas prices have separated



This is not sustainable

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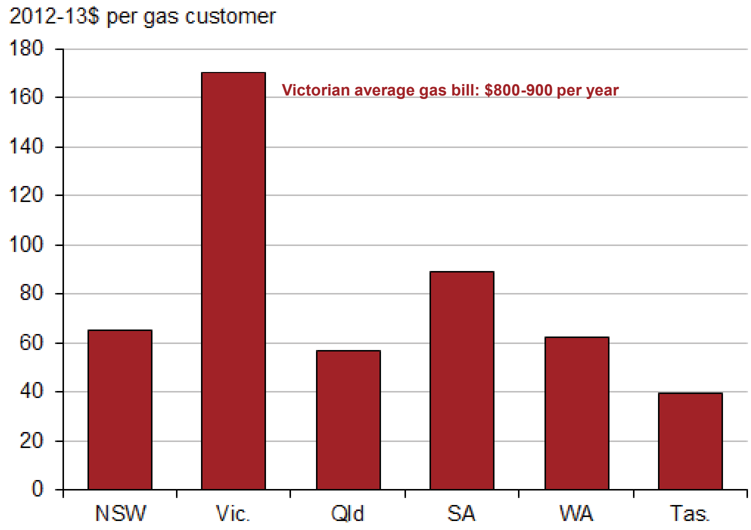
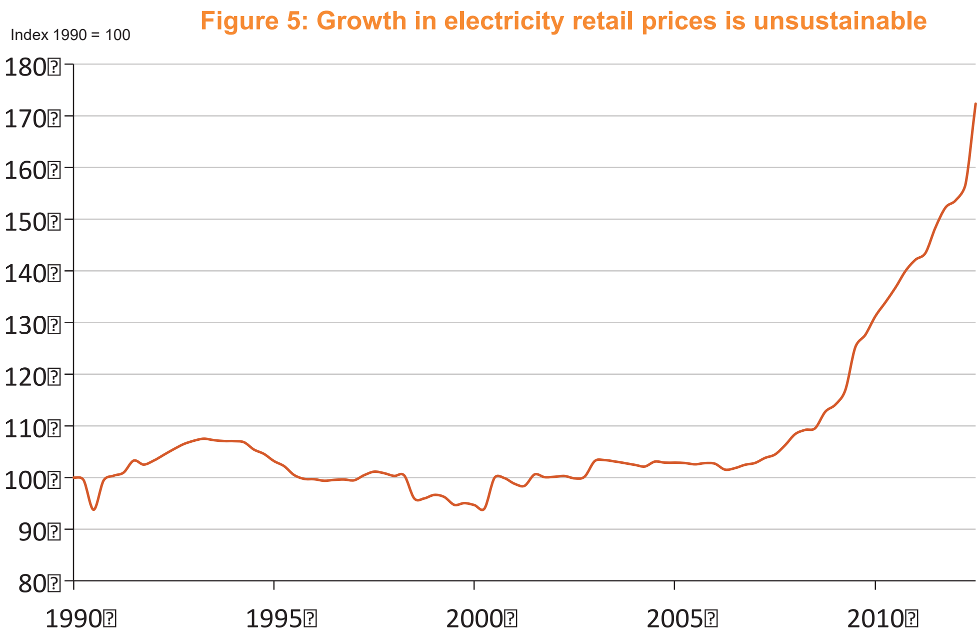
This position is not sustainable, and pressures in both directions will likely drive prices back towards the historical alignment. This does not happen easily or quickly. In the meantime, consumers in Japan are bearing the brunt of the high gas prices which only look like getting worse as the winter approaches. Equally, the implications of exposure to global markets are driving a high level of angst in Australia. For households, particularly those who use gas for heating, there will be considerable pain. For a small number of key businesses, the price impacts are material and could be fatal. Manufacturing groups are loudly calling on governments to intervene. Figure 4 shows the likely impact on households, highlighting the difference in consumption levels, driven primarily by home heating. This will be a political challenge..

Figure 4: Australian households will see gas price increases



This is bad enough. However, it comes after several years of very significant increases in electricity prices, adding to the political pressure. Figure 5 shows how electricity prices have risen very rapidly, mainly due to network charges, but with a modest contribution from climate change and renewable energy policies.

Figure 5: Rise in Energy Prices Since 1990



Source: ABS (2012)

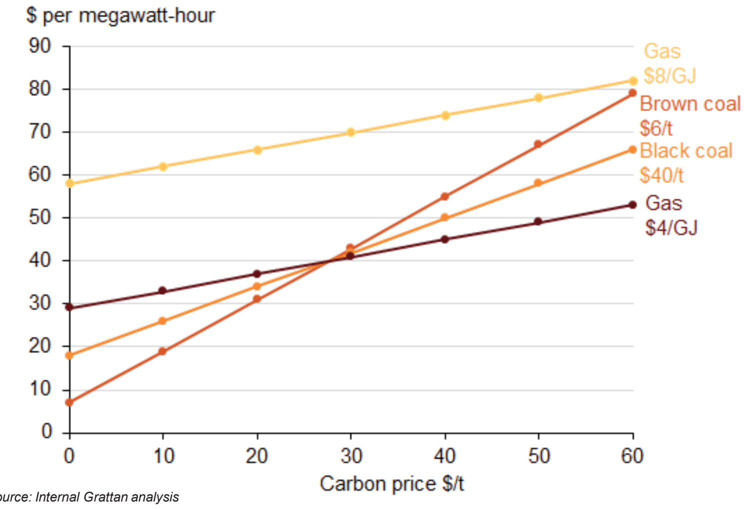
The Challenge of Energy Sustainability

Most forms of primary energy do have specific environmental challenges. For example, nuclear energy and radiation, wind farms and visual amenity and coal seam/shale gas and fracking. Invariably, these are managed through local policies and regulation that deploys best practice and technological knowledge to address and manage risks, or, in some cases, exclude a particular energy source from consideration. For example, France has banned fracking technologies whilst nuclear power is illegal in Australia.

The biggest challenge for energy sustainability is however climate change. In most, if not all, countries, stationary energy is a major, or the major, source of greenhouse gas emissions, and few countries have a demonstrably effective and efficient policy response. Climate change advocacy and policy are not the primary topics of this paper. However, it is clear that there are several, related challenges: the lack of an international framework; the absence of comprehensive climate and energy policies; the pursuit of multiple and often inconsistent policy objectives and most importantly the policy risk for investors in all forms of energy, either low or high emissions.

In some parts of the world, the global gas revolution has driven both a revised energy supply scenario as well as falling greenhouse gas emissions, the most notable example being the USA. In Australia, a similar "dash for gas" was expected to result from pricing carbon. However, the combination of falling demand, high coal and gas prices and a renewable energy target has meant that the market outcome has been quite different. Emissions from the sector have indeed fallen, however primarily through a move away from black coal. Figure 6 illustrates the sensitivity of the fuel switching point to both carbon end commodity prices.

Figure 6: Commodity prices interact with a carbon price



Source: Internal Grattan analysis

Together with the RET: the dash for gas is not happening

Concluding Position

Australia has its own unique energy security challenges. On the reliability front, there are no underlying physical challenges to overall energy supply, although regional issues can be significant. Although Australia has very limited transport fuels, it has diverse import sources and can turn to some combination of LNG, LPG, LPG or electric vehicles real physical or economic constraints become significant. Australia already has a high usage of LPG in commercial and taxi vehicles, CNG for buses and trials of LNG are planned.

Electricity and gas prices have been increasing and this is creating a political challenge for the national and state governments. There are no obvious solutions, although a lot of focus rests on the regulatory framework that covers both electricity and gas networks. Demand has responded to price pressure and the consequences of falling demand will create their own challenges.

Australia is not on a sustainable, long-term energy path. Climate change policy remains very uncertain and low-emission technologies are much undeveloped. Unusually in the world, a combination of circumstances means that energy-related greenhouse gas emissions are falling without a shift to gas.

The above challenges mean that the recently elected government must rapidly come to grips with some urgent policy challenges, whilst others with a longer-term impact will require much detailed and extensive consideration.

6. The Importance of Being Uncertain: Strategic Competition and Energy Security in Asia

Michael Heazle, Griffith Asia Institute.

Abstract

The region's changing strategic character has produced several security dilemmas between China and several regional states. The China-Japan relationship is of particular concern, because, as I argue in this paper, it has moved beyond the 'dilemma' stage to a situation where aggression is no longer suspected, but rather expected. One important implication of these tensions in the realm of energy security is that multi-lateral energy cooperation initiatives in the Asia are unlikely to succeed in the current environment where increasingly intense competition for energy reserves is acting as a catalyst for growing strategic rivalry and raising the probability of conflict.

Introduction

The question of how energy security related interests and challenges within the Australia-Japan relationship are linked to the broader regional environment raises a number of complex issues. These include the region's on-going economic development and increasing energy demands, maritime security interests and the need for uninterrupted sea lane access, political and economic imperatives concerning the type of energy mix required by individual states in the region, multi-lateral initiatives aimed at greater diversity in energy sources and less dependence on fossil fuels, and, more recently, environmental impacts and sustainability (Sovacool, 2009).

Another, and perhaps more fundamental, issue influencing policy perceptions of energy security focused on in this paper is the increasingly fluid strategic landscape that has emerged in North and Southeast Asia during the last decade. Central among these is the altered distribution of economic and military power within the region brought about by China's on-going economic and military development and the Chinese Communist Party's commitment to ensuring the longevity of both its own rule and China's status as a great power – two distinct, but interdependent ambitions that are now causing concern among China's neighbours, in particular Japan. China and Japan, the region's two largest economies, energy consumers, and military powers are locked into a slowly escalating dispute over competing territorial claims to oil and gas reserves in the East China Sea. Their deteriorating relationship over potentially huge, but yet to be confirmed, gas and oil reserves[xlii] serves as an especially clear illustration not only of *how* energy competition is becoming a key driver of strategic tension between states (Dannreuther, 2003; Thompson, 2006; Calder, 2007; US Energy Information Administration, 2012), but also *why* regional, market-based cooperation on energy security – incorporating measures used, for example, by the International Energy Agency model – is in contrast to earlier optimism[xliii] becoming increasingly unlikely.

According to Niquet writing in 2007 (2007: 2; see also Bush, 2010), both the growing strategic significance of energy, and the under-developed state of multi-lateral measures to protect against energy vulnerability in the region have been clear for some time:

> Energy challenges represent one of the most important security paradigms in the Asia-Pacific region where you have a mixture of growing energy dependency, fuelled by high economic growth, the emergence of new major players like China and India, and a quasi-complete absence of regional regulatory mechanisms to tackle the challenges in a multi-lateral way. These challenges mostly concern Japan and China, where crucial energy issues are aggravated by power rivalry, historical and ideological issues, and a lack of both economic and political harmony between them.

Indeed, China's emergence as a competitor to US power in the region has created an already widely acknowledged and debated security dilemma between China and the US and some of its alliance partners in the region (Christensen, 1999; Ross 2005; Thompson 2006; Bush, 2010; Glaser, 2011; Manning 2013; Yunzhu, 2012; Jimin, 2013). However, escalating tensions between China and Japan over the Senkaku/Diaoyu Islands are the clearest indication of the potential for strategic rivalries to not only thwart regional cooperation, but potentially escalate into military conflict. As I argue in this paper, increasing competition among states for primary energy sources in Asia is acting as a catalyst to push existing uncertainty over China's strategic ambitions beyond the 'dilemma' stage to a 'post-security dilemma' situation where aggression in pursuit of primary energy reserves is no longer merely suspected, but is rather increasingly expected. Moreover, the increasing attention China, Japan, the US, Australia, and some ASEAN states (e.g., The Philippines and Vietnam) now give to the possibility of military conflict erupting over energy-related territorial disputes in the East and South China Seas suggests that the prospects for multi-lateral energy cooperation in the Asia-Pacific are becoming extremely limited and will remain so – at least until strategic competition over energy resources between regional powers eases.

The Security Dilemma

The security dilemma is a concept intended to explain how and why states with no aggressive intent can still end up fighting a war against each other. The logic of the security dilemma and its potentially tragic outcome is driven by uncertainty over the intentions of other states, and how this uncertainty causes states attempting only to increase their own security to inadvertently decrease the security of others (Jervis, 1978: 169-170). First introduced by John Herz (1950) more than sixty years ago, the notion of security dilemmas developing under uncertainty has become an important explanatory concept for both offensive and defensive realists, albeit for very different reasons, which has led to on-going disagreement over definition, and questions about when security dilemmas occur, and how, if at all, they can be managed. On the latter question, the debate has attracted commentary from liberal, constructivist, and regime theory scholars supporting defensive realist claims that security dilemmas can be ameliorated through international institutions, diplomacy, and signalling.[xliv] Thus, disagreement largely has focused firstly on a variety of very different notions about how security dilemmas are defined and the dynamics that drive them (Herz, 1950; Jervis, 1978; Tang, 2009; Mitzen and Schweller, 2011; Glaser, 2011); and secondly, on the question of whether they can be overcome, which links to the familiar issue of cooperation under anarchy.

Underlying these disagreements, however, is an unquestioned assumption shared by all participants that security dilemmas, variously defined, are often the fundamental dynamic causing conflict between states. Security dilemmas, therefore, are regrettable and to be avoided where possible (which according to offensive realists is never, hence what Mearsheimer (2001) calls 'the tragedy of great power politics'). In this paper, I use the example of China's increasing tense relations with Japan and some ASEAN states to question this broadly held assumption by arguing that the security dilemma dynamic, what I refer to as Mode 2 inter-state relations characterised by uncertainty, is preferable to the only short-term alternative, now being played out in North Asia, which is increasing tension leading to conflict. I assert that there are in effect only two alternative modes of relations between states to a security dilemma: 1) a security community type mode (Mode 1 characterised by strong belief no threat exists) in which states not only are unconcerned by other states increasing their military capability, but on occasions encourage it (e.g., US and Japan); and 2) a conflict-spiral type mode (Mode 3 characterised by certainty a threat exists) in which a state or states, rightly or wrongly, become certain enough that another state or states are a credible enough existential threat to warrant preparing for war.[xlv]

Defensive realists, in contrast, assert that a security dilemma can be weak or strong, and argue that conflict spirals (Mode 3) develop only under strong security dilemmas, defined as situations where 'attacking is easy' and states believe the intentions of others to be aggressive. Glaser, for example, argues that when a state's 'adversary is driven only by a quest for security …then it should find increases in the adversary's military forces less troubling and not feel the need to respond in kind' (Glaser, 2011: 82). There are, however, two problems with this understanding of a security dilemma. The first is that it assumes the ability of policy makers to *know* not only when defence has the advantage over offence, which often can be unclear (Jervis, 1978: 186-193), but also the actual intentions of a foreign government, which are arguably even more difficult to accurately gauge, especially over time. The second problem, leading from the first is one of logic. The essential characteristic of being in a dilemma is uncertainty. If, as Glaser contends, strong or weak security dilemmas result when one believes the adversary's intentions to be either offensive or defensive, then when either of those beliefs become entrenched the dilemma can no longer exist, since one is no longer uncertain about the others' intentions. Thus, I describe so-called 'strong' security dilemmas as 'post-security dilemmas' because they are, by definition, cases where policy makers have, for whatever reason, moved beyond uncertainty (the condition required for a dilemma to exist) to relative certainty (in which case a dilemma can no longer exist) in their beliefs about the intentions of another state. As Schweller (2010: 302) puts it, 'as a security dilemma unfolds and becomes more intense, it is not driven by uncertainty but by misplaced certainty that the other is a true aggressor.'[xlvi]

I also argue, as do offensive realists like Mearsheimer, that security dilemma-type relations between states are unavoidable, but unlike offensive realists I position security dilemmas as a condition from which stronger and more stable relations rather than only conflict are possible in the long-term.[xlvii] My main point, however, is that the uncertainties that make a dilemma over the nature of relations and intentions between two or more states possible can have a mitigating effect on the prospects for war so long as the uncertainties remain high. It is only when, as Mitzen and Schweller (2011) argue, that states become *certain* about another state's intentions to act aggressively that conflict becomes more likely. Uncertainty, in short, can restrain conflict between states, while perceptions of 'certainty' can, and often do, lead to conflict.

> While there is nothing illogical about the structural realist argument [i.e., uncertainty leading to conflict under a security dilemma], it seems just as logical that states would refrain from building arms, let alone using them, when they are uncertain about each others' intentions. Why would uncertainty make states more likely to initiate war rather than less likely to do so? … The logic that states should be prone to high risk actions when they are uncertain that an aggressor is out to get them – when existential danger is merely possible but not highly probable – is far from obvious. (Mitzen and Schweller, 201: 9)

Security dilemmas should, therefore, be understood as the default position in inter-state relations since states remain uncertain, in the short-term at least, of the intentions, and often also the capabilities, of others in the absence of evidence deemed compelling enough to make the alternative judgment that no threat exists. The accumulation of evidence indicating benign intentions over the longer term, which is instrumental in building trust, however, is more helpfully thought of as time consuming rather than rare, particularly since the moment at which the transition from potential competitor/aggressor to security partner/friend is seldom clear. The US, for example, still held operational plans for a war against the UK as late as the 1930s.

Thus, there is an important temporal dimension to one or the other transitions emerging that is inherent to the nature of the modes themselves. Mode 1 for example is the product of mutual trust that has developed over decades of cooperation and sustained recognition of shared values and goals as expressed through the domestic political system type, foreign policy behaviour and objectives, and shared interests. Examples of Mode 1 relations include US relations with the UK, Japan, and Australia, among others. Stability over time is the key factor in Mode 1 relations developing, which means transitions from the default security dilemma position to a security community type relationship can occur only incrementally over time.

In contrast, the transition from a security dilemma to aggression and potentially war suffers from no temporal impediments, and can occur quickly if states act in ways likely to convince others – as opposed to only kindling suspicion as per a security dilemma – that they harbour malign intentions.

Such transitions can occur as a result of misperception and miscalculation, as reflected by Saddam Hussein's ultimately security seeking motivations for failing to fully cooperate with UNMOVIC while relying on the Security Council's ability to restrain US military action; or as the result of expansionist policies – regardless of their motivation – being acted upon, as demonstrated by the energy and resource access concerns that led Japan to its fatal decision to attack Pearl Harbour and invade Southeast Asia in 1941-42.

Security dilemmas, unlike Modes 1 and 3, are characterised by uncertainty, which, rather than only making conflict more likely as per the orthodox view, also can act as a brake on aggression and hostilities taking place due to a lack of confidence in policy makers' minds about either (or both) the necessity of going to war and the chances of being better off as a result of doing so. Avoiding provocative behaviour, maintaining a sufficient level of deterrence, and 'signalling' non-aggressive intent through transparency and diplomatic negotiation and engagement, thus are the key ways for governments to avoid sliding out of the relative peace and stability of a security dilemma into confrontation, and possibly open conflict.

The immediate priority for China and Japan should be to prevent their bi-lateral relations from sliding further into the conflict-spiral mentality that characterises the Mode 3 Security Dilemma stage. The current prospects for this occurring, however, are not good as both states continue to confront each other in the East China Sea over the rights to energy reserves large enough to significant bolster either country's, in particular Japan's, level of energy security while also increasing their respective military capabilities. As a consequence, attempts at regional cooperation on energy security are unlikely to succeed in the continued absence of improved political relations and decreasing levels of energy driven strategic competition between Asia's two largest regional powers.

The China Dilemma

At the core of disputes over the security dilemma's explanatory focus and relevance is disagreement over not only the inherent nature and pre-disposition of states as determined by the nature of the international system in which they exist (security satisficers versus security maximisers), but also the prospects for mitigating the security dilemma's effects. Thus, do most states, most of the time, strive only to accumulate enough power to be secure, while also believing (and expecting) their pursuit of security will not make other states insecure? Or is the demand for security insatiable and unrelenting among states that are always fearful of others' intentions and what tomorrow may bring, making the pursuit of security a zero-sum game in which increased security for some will always mean less security for others? Put differently, are there genuine status quo states that are happy to balance against rivals once they feel secure, or are all states fundamentally revisionist due to the insatiable appetites for power forced upon them by an anarchical, and perpetually dangerous, international system?

These distinctions are very difficult, if not impossible, to reliably draw in real time, since there is no way of ever knowing for sure why a government develops or buys a new kind of weapon system, or the kind of use it will be put to in the future. This is of particular concern in the current case with China. Foreign policy decision making in the Chinese government appears fragmented between the CCP, the People's Liberation Army (PLA), and several ministries, making it unclear which policy priorities and strategies for their realisation are dominant at any one time. But even if the actions and intentions of a state today could be understood with confidence, there is no way of knowing whether their motivations will remain benign and purely defensive tomorrow. As, for example, China increases its military capabilities, other states, like Japan and the US, experience a dilemma over how to respond because there is no way of knowing China's true intentions. Is China a *status quo* power modernising and expanding its military purely for defensive purposes? Or is China a revisionist power planning to challenge and change the balance of power in its own favour through coercive means? Such difficult to answer questions define the nature of the dilemma faced by decision makers, but while all sides remain uncertain it is likely, as I argued earlier, that governments will err on the side of caution and try to avoid actions that alarm other states.

Opinions on the impact China will have on regional security in Asia are numerous and diverse. Two perspectives, however, have come to dominate contemporary discussion. The first is that Beijing will remain preoccupied with preserving internal domestic stability and be content with playing a constructive role in improving regional cooperation in Asia; Beijing's primary concern and focus will be to defend its sovereign territorial integrity. From this perspective, China will not seek to dominate regional affairs and – in line with its historical approach to international relations – it will not have aggressive designs on other states (see, for example, Keith 2009).

The second dominant perspective is that China's rise will pose acute challenges for regional countries in Asia. China will seek to dominate the Asian region and shape it in its own image. Countries will have little choice but to either accommodate or confront China in its quest for regional hegemony. In this scenario, China will behave just as all other great powers have behaved throughout history – it will aspire to exercise control over its own 'sphere of influence' (see Mearsheimer, 2001). Viewed exclusively through the prism of balance of power thinking, the most likely outcome of China's rise is conflict between China and Japan, involving also the US and most likely Australia, at some point as strategic competition intensifies under the logic of the security dilemma (White 2010: 36–47, Cook et. al 2010: 12, 25–37).[xlviii]

Indeed, over the last two decades, China's steady economic growth and development has been accompanied by a growing body of literature warning of the security consequences of a wealthier and more powerful China. Numerous realist scholars and observers have warned of the emerging 'China threat'. Informing this view are assumptions about the imperatives the anarchical international system imposes on the behaviour of emerging great powers like China. Chief among these is the view that China is intent on pursuing hegemony in Northeast Asia and in Asia more generally (Mearsheimer 2001; Roy 1996; Thayer 2005), that emerging powers are never 'status quo' powers, and that they inevitably cause shifts in regional balances of power that must be countered by other powers in the region. In a 2005 exchange with former US National Security Advisor Zbigniew Brzezinski in *Foreign Policy*, Mearsheimer (2005: 48) asked:

> Why should I expect China to act differently than the United States? U.S. policymakers, after all, react harshly when other great powers send military forces into the Western Hemisphere [. . .] Are the Chinese more principled, more ethical, less nationalistic, or less concerned about their survival than Westerners? They are none of these things, which is why China is likely to imitate the United States and attempt to become a regional hegemon. China's leadership and peoples remember what happened in the last century, when Japan was powerful and China was weak. In the anarchic world of international politics, it is better to be Godzilla than Bambi.

The balance of power dynamics shaping the behaviour of emerging and existing powers alike are regarded by advocates of the China threat thesis as objective forces and constraints produced by the international system that states ignore at their peril. All rational states, therefore, strive to maximise their individual power through military capability and alliances in order to remain secure. Great powers, including the US, strive to achieve and maintain hegemony in their own regions, while attempting to deny it to other great powers in their own back yards. The potential for conflict grows as regional powers compete, and the limited incentives for cooperation are, then, hardwired into state behaviour by the characteristics of the international system. Statements about peaceful intentions and defensive military spending by governments count for little in such structural accounts of the international system and how it works.

Given the argument that rising powers are more likely than not to challenge the existing order, and the well understood consequences of acting in ways that produce suspicion and concern among other states, it seems reasonable to assume – as defensive realists do – that states wishing to avoid confrontation would be careful to manage their actions in ways that signalled non-aggressive intent. Since 2009, however, and arguably even earlier, the signals from the Chinese government have been less than reassuring, and on balance have indicated expansionist rather than defensive intentions. These indications include China's aggressive pursuit of its territorial claims in the East and South China Seas using its expanding maritime forces; the inclusion of offensive weapons systems and platforms in its military modernisation; and increasingly belligerent rhetoric from different sources within the Chinese government threatening punitive action in response to any infringement on Chinese interests or sovereignty.

Adding to these concerns is the broadly held view that the CCP's domestic legitimacy has become reliant on both the Party's ability to deliver continued economic growth, and maintain the support it derives from nationalist sentiment created out of the promise of a strong and prosperous China. Reliable access to energy resources, therefore, is critical not only for China's continued development but also, in effect, the CCP's survival, which arguably is the main priority of its leaders. Given these circumstances, and in particular the heavy consequences of underestimating the potential threat to regional order and security posed by an offensive rather than defensive China, it is logical for governments in the region to err on the side of caution and assume that China is a rising, and, in the absence of evidence to the contrary, most likely also a non-*status quo*, revisionist power.

Furthermore, given China's experience with almost a century of foreign occupation prior to the CCP's 1949 victory over Chiang Kai Shek's nationalist forces, which underpin the Party's inflexible approach to territorial issues and the absolute nature of Chinese sovereignty, there is also a strong possibility that China's security concerns may be beyond reassurance; thereby making the current drift into a conflict spiral irreversible.[xlix]

Energy Security and the Effects of 'Post-Dilemma' Strategic Competition

The increasingly competitive nature of China and Japan's energy security ambitions is illustrated by a dispute between the two nations over the demarcation of exclusive economic zones incorporating the Senkaku/Diaoyu Islands on the eastern edge of the East China Sea. On-going disagreement over possession of this grouping of small islands and rocky outcrops – which only started in 1970 when China became interested in the islands after a 1969 UN survey revealed the possibility of large oil and gas deposits in the surrounding waters (US Energy Information Administration, 2012) – has significantly contributed to the souring of China–Japan relations, and reflects the extent to which strategic rivalry driven in large part by competition over energy sources has become a major obstacle to improved political relations.

The waters around the Senkaku/Diaoyu Islands are the centre of both a dispute over EEZ demarcation and, subsequently, the rights to the oil and gas reserves contained within. Following the discovery of a Chinese submarine in Japanese waters near the islands in November 2004, the Japanese government indicated the importance of the disputed reserves by tripling its 2005 budget for energy exploration in the East China Sea from 3.8 billion yen to 12.9 billion yen (Oxford Analytica 2005). China already had begun development of gas reserves in an area close to Japan's claimed EEZ boundary, and Tokyo responded by demanding evidence the Chinese operation is not tapping Japanese reserves by commencing its own development with test drilling beginning, rather auspiciously, on 1 April 2005. Adding further to the tensions, various nationalist groups from both sides, with China also gaining support from Taiwanese and Hong Kong activists, have attempted to make claims on the islands dating back to the late 1980s.

The Japanese government has sought to further establish its claim by building a lighthouse on one of the islands that will be maintained by the Japanese Coast Guard. Responding to strong Chinese criticisms of the move, former Foreign Minister Nobutaka Machimura stated in February 2005 that 'There is no territorial dispute . . . over the Senkaku Islands . . . This is not even a matter of legality' (Japan Today, 2005b). This view has remained the official Japanese government position on the islands and Japan's EEZ. Tokyo Governor Shintaro Ishihara, well known for his strong nationalist views, also announced in early February 2005 plans to build an electrical power plant on another island close to the disputed EEZ boundary, which is administered by the Tokyo metropolitan government despite being 1,740 kms from the Japanese capital. In a clear provocation to the CCP, Ishihara aimed to counter Chinese marine research in the area by commencing 'visible economic activities' in the waters surrounding the tiny Okinotori Island. After presenting the plan at Koizumi's office, Ishihara enraged the Chinese further by saying 'I won't tolerate any words of aggression from China' (Japan Today, 2005a).

After a brief period of improving relations and negotiations aimed at resolving the dispute through a joint exploration plan during 2008 and 2009, hopes for a more stable political relationship were dashed by yet another major diplomatic row over the islands. In September 2010 a Chinese fishing boat captain rammed a Japanese Coast Guard vessel patrolling the disputed waters after initially attempting to flee the area. Japanese authorities responded by arresting and holding the Chinese captain and vessel, and threatened to lay charges against the fishing captain under Japanese law. Under intense pressure from the Chinese government, which included the subsequent arrest of four Japanese nationals in China on alleged spying charges, and threats of Chinese retaliation from then Premier Wen Jiaobao (FT.Com, 2010), Japan finally relented for fear of relations between the two regional powers spiralling out of control, sending the fishing boat captain back to China in late September.

More recently, China-Japan relations have further deteriorated over the Senkaku/Diaoyi Islands dispute in the wake of more frequent confrontations between Japanese and Chinese ships in the area surrounding the islands, and incursions by Chinese drones and aircraft into Japan's claimed airspace around the islands. In January 2013, perhaps the most dangerous military encounter between China and Japan to date occurred when a Chinese ship locked its fire control radar on a Japanese destroyer; earlier, another Chinese naval vessel had locked onto a Japanese helicopter in a separate incident (Yoshida and Aoki, 2013). By October, Prime Minister Abe was effectively accusing China of revisionist intentions, and announcing Japan's intention to 'stand up to China', following Beijing's warning that it will treat any Japanese attacks on Chinese drones flying over the islands as an 'act of war' (BBC News, 26 October 2013).

Even more troubling are the signs that China's more aggressive approach to its territorial claims are creating divisions among the ASEAN states that have begun to affect regional forums, such as the ASEAN summit and APEC. At the 2012 ASEAN meeting hosted by Cambodia, Chinese officials unsuccessfully attempted to push through an agreement that its territorial disputes with ASEAN states in the South China Sea would only be discussed on a bi-lateral basis outside of ASEAN forums. The Philippines was especially outraged by the announcement, which it condemned as false, saying no such deal had been brokered. Arguments over how the territorial disputes should be managed already had caused the earlier breakdown of the Foreign Ministers meeting in July, and prevented the issuing of a joint communiqué from the meeting for the first time in 45 years (South China Morning Post, 22 November 2012). Indeed, the rancour surrounding the controversy is very unusual for ASEAN meetings, which normally go to great lengths to avoid disagreement and promote consensus.

China's attempts to keep the territorial disputes from becoming a regional issue continued at the 2013 APEC meeting in Bali when a Chinese Foreign Ministry official condemned a joint statement from Australian Foreign Minister Julie Bishop, Japan Foreign Minister Fumio Kishida, and US Secretary of State John Kerry opposing 'coercive or unilateral actions' aimed at altering the *status quo* in the East China Seas. The official urged the US, Australia, and Japan to avoid 'inflaming regional tensions' and warned them not to use their alliance arrangements to intervene in territorial disputes (South China Morning Post, 7 October 2013).

The emergence of such divisions is only likely to exacerbate the difficulties regional initiatives on energy security have already experienced. Discussions on energy security measures have been stalled for more than a decade due in large part to conflicting priorities and increasing competition for energy among the ASEAN states (Nugroho, 2011;Ravenhill, 2013). ASEAN's Southeast Asian gas pipeline network, for example, is reportedly only half completed and running out of both funding and political support as uncertainty over its future benefits and profitability grows (Sovocool, 2009; Energy Tribune 2012; Desker, 2013).

China's rise, and in particular its aggressive pursuit of far reaching territorial claims in the East and South China seas, clearly is having a major impact on not only the regional balance of power, but also concerns among many states as to the desirability and future nature of an altered, China dominated regional order. These concerns also are reflected in what Manicom (2013: 10) describes as 'competitive regionalism', which is in part the product of China and Japan's growing strategic rivalry. The US and Japan have unambiguously demonstrated their preference for the current post-war order to remain as the region's strategic framework, while opting for the development of a Pan-Pacific approach regional institutions and initiatives within that framework. China instead advocates a narrower, and more development focused approach that ultimately would limit rather than engage Western involvement.

Moreover, as indicated earlier, concerns about the future role and influence of China in Asia and US and Japanese responses to these concerns are creating divisions within ASEAN based on decisions either to bandwagon with China or balance against it that increasingly resemble the sharper divisions forming within the broader strategic landscape. Under the conflict spiral type post-security dilemma environment emerging between China and Japan, ASEAN states are coming under pressure to either 'bandwagon' with China, or balance against it, with some states such as the Philippines and Vietnam already deciding to externally balance against China by supporting the US in its counter-balancing policies in the region and also Japan's strong line against China's territorial claims. Other states so far have remained more ambivalent (e.g. Thailand, Malaysia, and Indonesia), while Burma appears to have opted to bandwagon in support of China.

In environments characterised by increasing strategic competition, governments are more likely to focus on how the *relative* gains produced by regional cooperation on energy security and other issues will be distributed, rather than on the overall, or *absolute*, gains such cooperation may otherwise offer to all states (Mearsheimer, 1994-95; Jervis, 1978 & 1999). And as energy driven strategic competition between Asia's major powers further intensifies, the prospects for multilateral cooperation are likely to worsen rather than improve as Sino-Japanese rivalry continues, a trend that seems certain to continue given the region's increasing demand for energy and dwindling primary resources (Senderov, 2012).

Conclusion

Within a security dilemma, it is *certainty*, misplaced or not, rather than uncertainty over threat perceptions that causes the dilemma to dissolve and conflict to ensue. Therefore, states wanting to avoid strategic rivalry and competition need to consider not only the often inevitable emergence of security dilemmas in their foreign relations, but also the ease with which foreign policy statements and actions can cause the restraining influence of uncertainty over intentions to be replaced by certainty of aggressive intent, as now appears to be the case in China-Japan relations.

The islands issue, with its prize of possibly huge oil and gas deposits, has become a matter of both strategic priority and national pride for both countries as demonstrated by the regular clashes that now occur. There is, therefore, little chance of either side backing down. Further escalation of the dispute now seems the most likely short-term outcome, and the prospects for multilateral cooperation on energy security measures will become more limited as deteriorating Sino-Japanese relations and the strategic and political competition they engender figure more prominently in the strategic calculations of other states. Moreover, attempts at engaging Chinese and Japanese cooperation on energy through regional multi-lateral forums under the conditions of a Mode 3 conflict spiral, as I have outlined here, may have the perverse effect of emphasising areas of conflict and worsening tensions in ways already indicated by the developing divisions within ASEAN over China's South China Seas claims and the kinds of strategic alliance choices these claims are forcing.

The prospects for multilateral cooperation on energy security progressing in the short to medium term, therefore, are poor. Australian and Japanese interests are likely to be better served by developing a mutually beneficial long-term energy strategy within the current, and relatively long-standing, Mode 1-type bilateral relationship. Using current initiatives such as Australian LNG exports to Japan as a platform for further energy cooperation, this strategy should, I propose, prioritise the joint development of both sustainable and more efficient energy technologies in order to a) decrease Japan's very high level of external energy dependency while providing the Australian economy with a hedge against the inevitable future decline of export demand for coal; b) provide both economies with a valuable platform for future energy technology exports; and c) improve the energy security situation of both developing and developed states in the region while also, therefore, decreasing energy competition and the incentive it produces for states to contest territorial boundaries as a means of securing additional fossil fuel resources.

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7. Rising demands for Australian Gas Exports in the Asian Century: Implications for Japan's energy security

Tina Hunter, University of Queensland

Abstract

Australia is presently the sixth largest gas exporter, with all of its gas exported as liquefied natural gas (LNG). Australia's exponential increase in gas production as a result of the development of both conventional and unconventional gas sources is likely to place Australia as the second largest gas exporter by 2025. Such a demand for Australian gas exports, predicted to increase fourfold by 2050, will inevitably challenge Japan's energy security as it competes for gas resources in an era of rising demand for Australian gas, both in the Asian region and domestically.

As Japan seeks to secure long-term access to gas resources, particularly Australian resources, there will be a need to consider options for ensuring energy security. Traditionally, energy security has been secured by entering into long-term agreements with LNG producers. However, increasingly, Japanese petroleum companies are likely to enter into joint ventures in Australia to develop gas resources, thus securing production of gas, rather than just supply of produced gas.

This paper will examine the rising demands and competition for Australian gas in an age where Japan is one of several Asian nations looking to Australia to secure their long-term energy needs. It will firstly examine the existing international and domestic demands on Australian gas production, and the likely future demands. It will then consider these demands within the framework of Japan's energy security, examining whether competing demands for Australian gas resources are likely to have an impact on Japan's energy security. Finally, it will examine how Japan can gain greater access to Australia's gas resources in order to secure access to energy at a time of rising Asian demand.

Background and Context of LNG in the Asia Pacific Region

Government policies have an imperative role in the development of LNG in Asia Pacific region. As far as LNG development is concerned, they can be grouped in two broad categories, those concerned with domestic infrastructure, energy and environment matters, and those concerned with the national interest.

In the first category, government policy, for example to liberalise domestic gas and power industries, has an important effect on LNG business. Similarly, the government position on environmental protection is an important factor on the demand side as Japan illustrates. The Japanese government's commitment to greenhouse gas reduction under the Kyoto Protocol to the UN framework convention on climate change will be difficult to achieve without greater use of natural gas over other fossil fuels, therefore, Japan switched to natural gas use in order to fulfil this assurance. Other Asian countries are also following the same policy as Japan to reduce greenhouse gas emissions. Hence, because of government policies for environment protection, more Asian countries are switching from coal and oil consumption to gas consumption.

Today, gas trade in the Asia Pacific region is mainly in the form of LNG, and in fact Asia dominates the world's LNG market. In contrast, international trade of natural gas via pipelines is quite limited in the Asia Pacific region. Among Asian countries Singapore imports pipeline gas from Malaysia, Thailand from Myanmar (Burma), and Hong Kong from China. Currently, the major importers of LNG in the Asia Pacific region are: Japan, Korea and Taiwan. With plenty of LNG supply available, new buyers will be important for expanding the gas market in Asia. In addition to pipelines, two countries India and China may soon start importing LNG. Only 10–15% of the LNG consumed in Asia is currently imported from Alaska and the Middle East, including Abu Dhabi, Qatar, and Oman, but the share of imports arriving from the Middle East is increasing.

India is the third largest consumer of natural gas in the Asian region, relying until now on domestic production; but gas still accounts for less than 10% of primary energy consumption there, and the economy is increasingly starved for natural gas and power. For a number of reasons, ranging from environmental concerns to competitiveness in power generation, natural gas remains a desirable fuel in India.

There are currently announced plans for somewhere between 10 and 20 LNG terminals in India. India as an LNG importer will differ significantly from existing Asian buyers in the east (Japan, Korea and Taiwan). India is a larger country with a faster growing population and has a much lower per capita income. It produces some domestic oil and gas and has some existing pipeline infrastructure. India's large agricultural sector means that the fertilizer industry (and petrochemicals in general) will facilitate increasing use of natural gas in the domestic economy.[l] While China could conceivably also benefit from a strong fertilizer industry, its pipeline infrastructure is less developed and what does exist may not be as helpful as is India's major pipeline running inland from the coast with several spurs. Still, like much of Asia, neither China nor India has significant gas infrastructures for supplying residential or commercial users, or even a wider variety of industrial users. As per EIA report, natural gas accounts for only 10% of the primary energy consumption in Asia, as compared to 24% in the world while LNG demand currently accounts for about two-thirds of global gas consumption.[li]

Further, three new Southeast Asian countries will start imports of LNG in the next 3 years once their gasification terminals are completed. Singapore, Vietnam and Thailand are part of a growing group of new LNG buyers in Asia as imports of the clean fuel allows nations to diversify energy resources away from oil and coal.

State-owned Petro Vietnam Gas Corp plans to select by the end of this year an aggregator to buy LNG in the spot market for 3 years before committing to long-term supplies. The 1 million tonne-per-year (tpy) terminal is scheduled to be ready in 2015, its capacity will be increased , from 3 million tpy in 2020 to 6 million tpy by 2025, respectively, to meet rapidly growing LNG demand.[lii] Singapore's LNG terminal is expected to send out its first gas by mid-2013.

The above facts reflect how Asia dominates world LNG trade and how LNG imports in Asia have increased nearly fivefold in the last few years while gas trade by pipelines is very limited. Further, Asia's LNG imports are projected to grow 8% this year, after declining 3% in 2009 due to financial crisis.[liii] The global LNG business has so far been driven by Asia, underpinned by consumption in Japan, South Korea and Taiwan. In addition to these leading countries India, China, Singapore, Vietnam and Thailand are the emerging consumer of LNG in Asia pacific region. It is expected that LNG use will increase 45% in China and 12% in India by 2011.

Hence, the outlook for LNG demand in Asia pacific region is very robust, projected to nearly double by 2015, around 150 million tonnes or 163 million tonnes under a high growth scenario. The majority of Asia Pacific LNG consumption is still expected from three established LNG markets: Japan, Korea and Taiwan. While the rate of growth in LNG imports in Japan is expected to slow, it will remain the largest and one of the most important markets in the region. LNG imports in Korea and Taiwan are projected to almost double, supported by robust economic growth and an increasing emphasis on gas fired power generation.[liv]

Strong growth is also projected in the emerging LNG markets of India and China as stated above, as both countries seek LNG imports to complement existing domestic gas supplies and to fuel expected rapid growth in economic output and electricity generation, and to increase the use of clean energy sources.

However, unconventional gas (particularly shale gas) also exists in the Asia-Pacific region, including in India and China, although there is great ambiguity as to the magnitude of reserves and whether they are suited for extraction. If these resources are developed on a large scale, Russian gas exports could be squeezed from both the West and the East. Increasing Alaskan, South American and Middle Eastern LNG exports to the Far East due to the North American (and possible European) glut could reinforce the eastern part of such a squeeze.[lv]

The Rising Global Demands and Competition for Australian Gas in a Global Context

Production of natural gas from countries such as the Russian Federation, Qatar, China and the US will primarily continue to feed the world's demand for gas, although due to recent investment, Australia will to play an increasingly important role within the ever-changing global gas markets. It is set to become the world's second biggest exporter of LNG by 2015.[lvi] Natural gas is currently the third largest global energy source and its consumption is projected by some to rise by as much as 3.4% per year to 2030.[lvii]

As the world moves towards a lower carbon economy, gas is becoming a fuel of choice, particularly for power generation, in many regions. Gas is an attractive choice for emerging economies aiming to meet rapid growth in demand in fast-growing cities as urbanisation increases. The increase in gas consumption in emerging economies will result from rapid economic growth and associated urbanisation and industrialisation, direct gas consumption and the growth thirst to satisfy power generation demands.[lviii]

The International Energy Agency (IEA) (2012) forecasts that gas consumption is set to reach 3.9 tcm (137.7 tcf) by 2017, this reflects its greater use in power generation. Gas-fired electrical generation is typically characterized by lower capital expenditures, shorter construction times, greater flexibility in meeting peak demand, lower carbon emissions and higher thermal efficiencies relative to other substitute fossil fuels.[lix] Gas-fired generation can also serve to complement renewable energy sources, and help to overcome intermittency problems associated with renewable energy sources such as solar and wind.[lx] While substantial growth in gas demand is projected to come from electrical generation, it will depend on the price of gas relative to substitute fuels, as well as domestic policy settings regarding nuclear energy and carbon pricing, and other carbon limiting regulations or measures. Factors such as commitments to energy security, climate change and local pollution issues will have substantial bearing on the setting and adaptation of policy.

Recent energy-related policy developments in China, particularly those outlined in its 12th Five Year Plan (2011–2015) highlight that China's policymakers are actively encouraging diversification of the electrical generation mix away from coal, towards gas, renewable energy sources and nuclear power.[lxi] According to the IEA, the Chinese government aims to increase its share of gas in domestic energy consumption to 8.3% of the total by 2015. China's domestic production is set to increase 60% between 2010 and 2016, however this will only account for around half of the incremental increases in demand, so the deficit will have to be met by gas imports.[lxii] In a similar manner, the Indian Government plans to increase the share of gas in its energy mix of its economy. Such policy changes, if realised, should have a significant, positive impact on demand for Australia's gas resources.

Table one highlights Australia's gas industry in a global context. Globally, natural gas has a proved reserve life index of 64 years, whereas Australia's proved reserve life index is 84 years. The IEA (2012) estimates that there are nearly 404 tcm (14,285 tcf) of remaining recoverable resources (including all resource categories) of conventional gas worldwide, which is equivalent to almost 130 years of production at 2011 rates. Table 2 shows that Russia, Iran and Qatar together hold around half of the world's proven gas reserves. Australia accounts for around 1.8% of global proved gas reserves and in a ranking of major gas resource-holding nations is positioned at No. 11 (Table 2). The largest gas producers are the Russian Federation and the United States. Australia produced around 1.58 tcf in 2011, accounting for around 1.4 per cent of world gas production.

The share of unconventional gas in total global gas production is projected to rise from 13% in 2009 to 22% in 2035. However, these projections are subject to a great deal of uncertainty, particularly in regions where unconventional gas production is yet to occur or is in its infancy. Environmental concerns and policy constraints also have the potential to limit unconventional gas output particularly in Europe. The future of unconventional gas production and the extent to which it is developed over the coming decades is heavily dependent on government and industry response to environmental challenges, public acceptance, regulatory and fiscal regimes, and widespread access to expertise, technology and water.

Australia's primary energy production increased by 23% between 2000 and 2010. The main sources of energy produced in Australia are coal, uranium and gas. Australia produces uranium, but it isn't consumed domestically, with all of its output exported. Some coal and gas are consumed domestically in Australia. Natural gas consumption in Australia increased from about 10.76 bcm/380 bcf/400 PJ in 1980 (<15% of total energy consumptions) to some 37.57 bcm/1327 bcf/1400 PJ in 2010 (some 24% of total energy consumption).[lxiii]

Approximately 39% per cent of world gas consumption is for power generation, with the industry and residential sectors accounting for a further 18% per cent and 16% per cent respectively.[lxiv] Gas consumption in the electrical sector is set to account for the largest growth and is projected to increase at an average rate of 1.8% until 2035. Increased gas consumption in buildings, industry and transport areas is also projected to occur, but this is expected to be less important than the growth of gas in the power sector. Australia, being an island continent, distant and cut off by wide stretches of ocean from regional neighbours, participates in the international gas trade through the LNG market.

Energy consumption in Asia historically has been dominated by hard coal consumption. Australia is one of the world's largest coal exporters, having benefitted from Asian growth. Due to air quality concerns, particularly in China, Australia is well positioned to increase its gas exports by supplying LNG to help fuel Asian economic growth, which will also assist in clearing the skies above rapidly expanding cities and assist in the overall reduction of CO_2 output. Indeed coal has become a constraint on Australia's own efforts and stated goals of curbing CO_2 emissions. LNG is playing a key role in deleveraging Asian energy from a strong reliance on coal.

Australia is presently ranked fourth among the world's LNG exporters. However, based on projects currently under construction, Australia is destined to become the second largest LNG exporter worldwide by 2015. Australia could rival Qatar for the position of the World's largest LNG exporter by 2018, but that depends if all of its planned projects being constructed and on the evolution of the LNG market in Asia, upon which Australia is more dependent than Qatar. Geographically Australia is well placed to continue to supply the large markets of Japan and the Republic of Korea, as well as the growing Chinese and Indian markets. Australia's LNG facilities are about one week's shipping away from North-East Asia. The benefit of the shorter distance, relative to the exporters located in the Middle East or in the Atlantic Basin, is reduced delivery times and transportation costs.

International gas pipeline trade is around twice the size of LNG trade. However LNG is more economic than pipelines over long distances, particularly across oceans and avoided the geopolitical risks of crossing transit countries. The LNG industry has evolved by bringing production to market from remote or “stranded” gas fields, and its supply chains are well suited to servicing large costal population centres such as those in China, Japan and Korea. As significant additional LNG receiving terminals are scheduled to be built in Asia, Australia should be well-positioned to participate in such supply chains and compete in their future development.

Existing International, Domestic and Future Demands of Australian Gas Production

Australia is on track to become the world's largest liquefied natural gas (LNG) exporter by the end of our forecast period in 2022, surpassing Qatar as a series of major projects come online. However, the spiralling costs of LNG projects will most likely slow the momentum in further expansion of Australia's LNG export capacity. Gas production growth could be further threatened by increasing rules on the extraction of coal-bed methane. Australia will also have to contend with a growing reliance on oil imports as domestic crude oil production declines while refining outlook appears increasingly bleak in face of regional competition.[lxv] Concerns have been raised about the capacity for Australia's natural gas supplies to keep pace with growing demand, particularly in eastern Australia, In particular, it has been suggested that unless significant infrastructure investment is undertaken now. The demand/supply balance in eastern Australia will deteriorate quickly as natural gas resources are depleted in the face of strongly growing demand.

A government push towards liquefied natural gas (LNG) exports and the increased use of gas in the country's energy mix will see more opportunities available for gas exploration as the federal government continue to open new offshore areas for investment through the yearly Offshore Petroleum Exploration Acreage Release. The proximity of Australia to the growing Asian gas market had also seen companies eager to tap into its gas potential. This was especially so for Western Australia, which is located closer to targeted markets in Asia - particularly Japan, South Korea and China. However, an impasse between labour unions and businesses on labour costs could stifle interest in western and north-western Australia's untapped potential, if it raises the costs of developing increasingly deep water and stranded gas fields.

Coal-bed methane (CBM, also known as coal seam gas in Australia) was also set to push gas reserves growth. The share of CBM in Australia's total gas reserves rose dramatically by an average annual rate of 56% between 2000 and 2010. As of January 2012, CBM reserves were estimated by Geoscience Australia (GA) to be 924bcm, or about 24.2% of its total gas reserves. 92% of these are in Queensland and the remaining in New South Wales (NSW). Surat Basin holds 69% of Australia's total CBM reserves, followed by Bowen Basin (23%). Other basins with CBM reserves are Gunnedah (4%), Gloucester (2%), Sydney (1%) and Clarence-Moreton (1%).[lxvi] Its CBM potential had attracted the likes of Chinese NOC PetroChina, which made a US$43mn offer to buy Molopo Energy's CBM exploration permits in the Bowen Basin, Queensland, spanning 1,370 square kilometres (sq km) over five project areas. Despite its CBM reserves, the amount of gas that can be extracted from a CBM field remains a challenge even for relatively experienced players such as independent Santos. The company's Chief Executive David Knox told reporters that 'we won't really find out the true production rates until we start putting on compression and really start to (pump out the water)'. Hence, it is difficult to forecast how much reserves can feed into future production.[lxvii]

Between 20 and 25 per cent of energy use in Australia is gas consumption and the predicted tripling of its price over the next few years will hurt our households and manufacturers. Australia's domestic market for gas had settled at around $3 per gigajoule (into Sydney or Melbourne), reflecting plentiful, easily-accessible reserves in Bass Strait and the Cooper and Bowen basins. Our proven reserves - according to the Prime Minister's Manufacturing Task Force - are 184 years.

The LNG export plants in Queensland are forward-buying as much gas as they can for export, which has removed around 80 per cent of the eastern market's natural gas from the domestic supply. Remaining domestic gas is then re-priced as if it was being sold in the Asian market - a strategy called export parity pricing. Manufacturers have expressed their opposition to export parity pricing, pointing out that countries in Asia pay up to $12 per gigajoule for Australian LNG because they are gas-poor countries who must import. Australian industry operates in a gas-rich environment - the previous $3 per gigajoule gas supply reflected the reality of this abundance of natural gas. Furthermore, because of the size of the LNG export terminals at Gladstone, their forward-buying of gas has taken in the easily-accessed gas from Bass, Cooper and Bowen, which is also the ‘cheap’ gas.

Whether by design or accident, local manufacturers' new gas tariffs are paying for new exploration.[lxviii]

According to the Bureau of Resources & Energy Economics' Australian Energy Projections report from 2011, Australian gas production will increase fourfold to 2035. But prices won't come down. The Prime Minister's Manufacturing Taskforce in 2012 identified that natural gas prices had already risen by 70 per cent and were likely to go higher because of the export LNG market. Moreover, the Australian gas market has none of the competitive tension we associate with a market. There is no spot price for gas, there are no gas-on-gas competitors, entire basins (wells, pipelines, interconnectors) are controlled by single entities, and export parity pricing is based on 20-year supply contracts to north Asia.[lxix]

According to Donnan, 'the scramble to send LNG north to Asia has not only distorted gas pricing, it has made supply uncertain'.[lxx] Already, a number of large chemical enterprises in this country cannot secure supply contracts past 2016 - this is critical because industries such as fertiliser and plastics use gas as a transformational agent in production. Uncertainty over gas means investment into the chemicals industry is not coming to Australian shores because one of our strategic, competitive and available advantages - low and stable gas prices - has ceased to exist. Australia has lost a one billion-dollar investment - from Newcastle to the southern United States - primarily because the company could buy $4 per gigajoule gas in the US compared to the almost $9 gas on offer in Australia.

Value-added industry is crucial for a nation's long term prosperity. According to the National Institute of Economic and Industry Research (NIEIR), for every $1 gained via LNG export, $21 to $24 is foregone in domestic industrial production. Clearly, an export-weighted gas policy is not sustainable. The solution is for government to design a domestic gas policy that creates stability and certainty in the homeland, while allowing a profitable LNG export business.[lxxi]

Australia's proven gas reserves at the start of 2013 were estimated at 1.2trn cubic metres (tcm) by the EIA. Growing commercial and regulatory risks to exploration and production (E&P) in Australia has led us to downgrade our forecast for gas reserves growth. There are still underexplored areas left both offshore and onshore Australia that have hydrocarbon potential. Combined with a relative stable operating environment, this will continue to draw investors in search of safe assets to both Australia's onshore and offshore gas plays. However, the following will likely slow the rate of growth:

- Rising development and production costs in an uncertain gas price environment. In view of high development costs of LNG projects, companies could slow exploration efforts until they can be assured of the commercial viability of any discoveries.
- Uncertainty in the Joint Petroleum Development Area (JPDA) shared between East Timor and Australia. Unhappiness over development of the Greater Sunrise gas fields have seen the East Timor government launch arbitration against Australia in May 2013, leaving the future of E&P in the prospective Timor Sea hanging in the short-term. Lack of clarity over development prospects, even if the Timor Sea does offer high prospects, this will increase investment caution in the short- to medium-term until political tensions are resolved peaceably.
- Tightening of restrictions on CBM operations. A proposal to limit the area of CBM mining in NSW and a more stringent federal approval process on CBM development in view of water protection could restrict or raise the costs of CBM activity. Given that CBM mining remains at a relatively infant stage, these would reduce the risk appetite of producers and slow the discovery and certification of economical CBM deposits.
- Fiscal measures introduced in the 2013-2014 Federal Budget. Under new rules introduced fewer items would be eligible for tax deduction. This could further reduce the economics of project developments at a time when Australian projects are already hit by high costs and do not justify costly exploration campaigns. Hence, exploration could take a back seat as oil and gas companies wait for an improvement in fiscal terms before embarking on expensive drilling activities.[lxxii]

Domestically, Australia’s rich endowment in coal and natural gas resources makes energy a key competitive advantage. Secure and affordable energy underpins investment, employment and living standards. At a time when the manufacturing sector is facing significant challenges from rising labour costs and a soaring exchange rate, competitively priced energy is one of the few advantages Australia has to offer and which government can help deliver. Natural gas fuels 23% of Australia’s primary energy and 15% of its electricity generation. This makes natural gas a critical energy resource.

Demand for natural gas has grown from 1052 petajoules (PJ) in 2004-05 to 1371 PJ in 2009-10, a 30% increase. The Federal Government projects that gas-fired generation could make up 44% of generated electricity by 2050, driven by the implementation of a carbon price. Western Australia is Australia's most gas-dependent state. Natural gas fuels 55% of its primary energy and 73% of its electricity generation.[lxxiii]

Australian Gas Resources Impact on Japan's Energy Security

a. Japan's Energy Security

Japan is the world's fifth largest energy consumer, and a resource-poor country, which imports close to all of its fossil fuel requirements. Large demand for energy and high import dependence has made energy security as one of the priorities of any government in Tokyo, particularly since the two oil crises in the 1970s. The 1973 and 1979 oil crises caused the Japanese economy to record negative growth rates for the first time in its post-war history. Their impact on the lives of ordinary Japanese remains deeply etched on people's minds. As a result, the Japanese government adopted policies aimed at improving energy efficiency and reducing the demand for oil. These policies have resulted in unprecedented success. Consequently, Japan is now the most energy-efficient country in the world.[lxxiv] In addition, Japan's oil demand dropped from 5.4 million barrels per day (bpd) in 1979 to 4.4 million bpd in 2010, due to vehicle efficiency gains and conversion to other electricity sources. The share of oil in total energy consumption has declined from about 72% in 1979 to 40% in 2010.[lxxv] Japan is the most vulnerable of all OECD nations in terms of energy supply security. In 2009, it imported 96% of its primary energy supply. Notably in terms of risk exposure, oil still accounts for nearly 50% of Japan's primary energy consumption and the vast majority of its oil supply (90%) comes from the politically unstable Middle East region.[lxxvi]

Today after three decades, energy security is once again at the centre of attention among Japanese policy-makers and the general public. However, unlike in the 1970s, when the focus was on affordability and security of oil supplies, the current challenge is multidimensional. While the renewed interest in energy security issues was triggered by record oil prices in 2008, it was brought to the forefront of public debate in the aftermath of March 11, 2011 (hitherto referred to as 3/11) earthquake and tsunami, which caused a nuclear catastrophe in TEPCO's Fukushima Daiichi nuclear power plant. Such was the extent of the shock caused by the events on 3/11 on Japan's economy, the existing energy system and energy security, that in 2011 Japan recorded its first trade deficit

(¥2.5 trillion) since the aftermath of the oil crisis in 1980. This trade deficit was mainly caused by a jump of 25.2% (¥4.3 trillion) in fossil fuel imports, which in 2011 made up close to one-third of Japan's import spending.[lxxvii]

The challenge associated with Japan's increased demand for imported fossil fuels is exacerbated by the fact that major economies in the Asia-Pacific region are competing for supplies of fossil fuels, and particularly oil. The Asia-Pacific region's energy demand, especially China's and India's, has grown rapidly over the past two decades and most projections suggest their voracious thirst for energy will further expand in the coming decades.[lxxviii] In the past decade, Japan has been competing with China, India and South Korea to secure long-term oil supply contracts with suppliers in the Middle East and other regions, often failing to outbid Chinese national oil companies who are backed by deep pockets of their home government. What further limits the security of Japan's oil imports is Tokyo's close security alliance with the US, which constrains Japan's relations with oil exporters that are at odds with the US. In 2010, Japanese oil company Inpex, which was to be a major developer of Iran's Azadegan oil field, abandoned its stake in the project facing the prospect of being denied access to US financial institutions. In January 2012, Washington applied pressure on Tokyo to reduce dependency on Iranian oil and natural gas. This would be a further blow to Japan's already low diversified oil import portfolio. In 2011, Iranian crude oil made up 10% of Japan's oil imports. PM Yoshihiko Noda's government has indicated its desire to cooperate.[lxxix] Yet, cutting Iranian imports carries risks for Japan as the country's reliance on imported energy has increased since the 3/11 disaster.

Japan is the world's largest importer of liquefied natural gas (LNG) and coal and the third-largest importer of oil. As Japan is heavily dependent on energy imports, the government has been promoting nuclear energy as a means to diversify its energy sources. The realities of energy transitions and the particularities of Japan's energy system hinder any quick move away from fossil fuels. Japan has reduced its nuclear power output and this reduction is likely to remain for the foreseeable future. In January 2012, only 3 out of 54 of Japan's commercial nuclear reactors have been operating. Japan will lose its last nuclear- generated power in April at the current rate of shutting down reactors for safety checks.[lxxx] Although many of these reactors might restart once the government and regulators reassure the public that operation can safely recommence, the only viable short to medium term alternative to nuclear power is fossil fuels.

In addition, short of a major technological breakthrough, which makes renewable energy competitive with other energy sources on a large scale, it will take decades before renewable energy becomes competitive with fossil fuels in electricity generation and transportation sectors. A glance at past energy consumption trends indicates that, with the exception of hydroelectric power, renewable energy is a newcomer. Other renewable energy sources are negligent as sources of energy in the current global energy system. The same applies for Japan, where they start from a very small base. In Japan, they account for only 1% of both electricity and primary energy supply. While the share of renewable energy in global terms and Japan's energy mix will grow, this will happen at a very slow pace due to relative higher costs and other structural impediments that inhibit a fast uptake of renewables.

b. Australia's Role in Japan's Energy Security

Australia's primary LNG markets of Japan, South Korea and Taiwan are limited by the lack of their own energy resources, and as a result are heavily reliant on fossil fuel imports. The Fukushima nuclear disaster caused by the 9.0 magnitude earthquake and consequent tsunamis that struck eastern Japan in March 2011 caused Japan to shut down its nuclear generating capacity until July 2012. The resulting increase in demand for oil, coal and LNG during that period was significant. The public outcry over the deficiencies found in Japan's nuclear industry as a result of post-disaster inquiries and a growing mistrust of the nuclear authorities suggest Japan is unlikely to expand its nuclear capacity in the medium term. Consequently, Japanese LNG demand is likely to increase as its economy recovers, potentially underpinning further long-term investment in the development of Australia's LNG export projects. However, Japan has in 2012 stated its desire to move away from oil-indexed pricing for its imported LNG in the future and involve Henry Hub gas prices in its future pricing formulae.[lxxxi]

Currently providing significant amounts of gas and coal to Japan, but with the potential to provide more, Australia is an attractive energy supply partner to Japan. Australia is a developed liberal democracy, with very little risk of unrest or upheaval disrupting the provision of agreed energy resources. Australia is not growing at such a rate that it will need vastly increasing amounts of energy to power its own domestic needs, so should have no trouble servicing its own economy. Geographic proximity to Japan keeps transport costs relatively low and minimises potential risks to the safe transport of energy resources to Japan. Australia and Japan are natural partners with shared strategic interests – both democracies, both allies of the US. Australia and Japan have a relatively strong defence and security relationship already, with some criticism that it is too focused on these areas.[lxxxii] Increased energy cooperation could serve to broaden bilateral cooperation.

During a visit to Australia in May 2012, former METI Minister and current vice president of the Japanese upper house Masayuki Naoshima said, 'Australia is one of the most important countries for Japan in terms of natural resources supply'.[lxxxiii] During his visit to meet with Prime Minister Gillard he told The Canberra Times that LNG and coal are on top of Japan's shopping list. Japan has been increasing its import of Australian LNG in recent years. While US shale gas projects are coming on-line and US prices are currently lower than what is paid for Australian LNG, as supply security is so important to Japan, Japan is likely to continue to pay a premium.

While Japan was already involved in buying Australian energy resources before the triple disaster, as Japan has turned to fossil fuels to fill the gap created in electricity production left by nuclear power, Japan has stepped up efforts to ensure access to Australian LNG. Tokyo Electric Power signed a deal with Chevron in 2011 to buy 3.1 million tonnes of LNG a year for 20 years from the Wheatstone gas project in Western Australia. Tohoku Electric Power signed a preliminary agreement with Chevron in May 2012 for 1 million tonnes a year of LNG from Wheatstone for 20 years.[lxxxiv]

Japan's access to Australia's Gas Resources in Order to Secure Access to Energy at a Time of Rising Asian Demand

The Japanese natural gas production industry is expected to experience revenue growth and decelerated production volumes during 2011-2016. The Japanese natural gas production industry had a total revenue of $688.7 million in 2011, representing a compound annual rate of change (CARC) of -10.6% between 2007 and 2011. In comparison, the Chinese industry declined with a CARC of -1.3%, and the Indian industry increased with a compound annual growth rate (CAGR) of 4.3%, over the same period, to reach respective values of $14.5 billion and $8.4 billion in 2011. Industry production volumes increased with a CAGR of 0.6% between 2007 and 2011, to reach a total of 5 billion cubic meters in 2011. The industry's volume is expected to fall to 4.9 billion cubic meters by the end of 2016, representing a CARC of -0.4% for the 2011-2016 period.

The performance of the industry is forecast to accelerate, with an anticipated CAGR of 0.8% for the five-year period 2011 - 2016, which is expected to drive the industry to a value of $717.2 million by the end of 2016. Comparatively, the Chinese and Indian industries will grow with CAGRs of 12.1%

and 9.9% respectively, over the same period, to reach respective values of $25.7 billion and $13.5 billion in 2016.[lxxxv]

The demand of energy is increasing rapidly across the world. In such a scenario, natural gas is increasingly being considered as the fuel of choice for the near future, as it is less polluting than oil and coal. The market for LNG has been growing at a fast pace for the past few years on the back of factors like, environmental concerns, high energy demand, government support, and huge investments. The world is witnessing a significant level of development in the global LNG trade with imports and exports of LNG forming a vital part of countries' relationships with each other. Especially the Asia Pacific countries, due to greater economic growth, are pushing themselves to develop and enhance the natural gas and LNG industry.

LNG has become an increasingly important supply source in meeting the Asia Pacific energy needs. As majority of Asia Pacific countries are importers of LNG, the region represents a big LNG market. According to a new research report Asia Pacific LNG Market Outlook 2020, Asia Pacific represents more than 60% of the world LNG demand.

This report by Research and Markets identified the major countries of the Asia Pacific region in terms of demand and supply. Each of the countries is studied thoroughly with special focus on demand and supply scenario of the country; major LNG receiving terminals/production plants; under construction and proposed LNG receiving terminals/production plants; and medium and long term receiving/supply contracts. Forecasting of LNG demand/supply for 2015 and 2020 of each country is also provided in the report.[lxxxvi]

According to the report, Japan accounts for the majority of Asia Pacific LNG demand in 2011. After the nuclear reactor failures due to March 2011 earthquake and tsunami, Japan's LNG demand increased significantly. Other countries such as China, India and South Korea also contribute to a significant share in the region's total demand. Moreover, China is emerging as the fastest growing LNG market.[lxxxvii]

On the supply side, Australia ranked third in the Asia Pacific region LNG supply in 2011, and is expected to outpace Malaysia and Indonesia to become top most LNG supplier in future. With a number of under construction and proposed LNG liquefaction plants, huge investments and various LNG supply contracts, Australia is well placed to take advantage of the considerable opportunities presented by the strong demand for energy resources.

Analysts cite the demand for LNG in northern Asia as the driving force for expansion. Australia is ideally positioned to offer that market a reliable and efficient LNG supply. It can take as little as a week for a cargo from Australia to reach customers in Japan, China and Korea, which is roughly half the time it can take to transport from the Gulf. To underline this point, the 21 Australian LNG projects already have 27 separate off take agreements in place.[lxxxviii]

Australia's stable political landscape and operating record also give strong assurances towards security of supply. In addition, the problems faced by the Fukushima power plant in Japan following the devastating earthquake and tsunami could increase scrutiny of nuclear power in the region. Japanese purchasers account for ten of the Australian LNG programme's 27 offtakers, with JX Nippon, Kyushu Electric, Osaka Gas, Tokyo Gas, Tokyo Electric and Kansai Energy leading the charge.

All of this means Australia could become the largest supplier in the Pacific Basin market. But its projects come with considerable technical and cost issues. 'Australian LNG projects are ex-pensive to develop', explains Giles Farrer, analyst in the global LNG group at Wood Mackenzie.[lxxxix] On the west coast, the reserves are in challenging offshore reservoirs, often far from landfall. For many years, potential LNG projects in Australia were not developed because the major LNG buyers in Japan and South Korea were able to source cheaper LNG from elsewhere.

'Demand has risen as the market has tightened', he adds. 'LNG demand in markets like China, India and South Korea has surged and sup-ply has struggled to keep pace with demand. With the rise in LNG prices, Australian LNG schemes are now more viable to develop'.[xc]

The Australian unincorporated joint venture (JV) also facilitates confidence. It is a well-established structure and, as many LNG schemes are undertaken using a JV model, is an attractive option for structuring multi-party transactions and getting international lenders comfortable with LNG projects as a whole. 'Financiers can take direct security over an unincorporated joint venture participant's individual interest in the assets, whether of the venture assets as a tenant in common or of their separate assets associated with the joint venture, and therefore rank ahead of unsecured creditors, and share-holders of the participant', Craig Rogers, a partner in the Brisbane office of Mallesons Stephen Jaques, says. 'However, the financiers' security interest over a participant's interest in a joint venture will be subject to, and subordinated to, the interests of the other joint ventures, at least to some degree'.[xci]

Conclusion

The tight global supply of crude oil means that it is unlikely to meet future energy demand at economic prices, due to the declining production rates in many major global oil provinces. This situation creates an ever-increasing desire for alternative energy resources. Natural gas and coal are the only two alternatives that have sufficient scalability to fill this increased demand in the medium term. Much of the growth in energy demand is for transportation traditionally filled by liquid fuels. Natural gas being more environmentally-friendly than coal, makes it the desirable alternative, which suggests that demand for natural gas should increase adding further strength to Australia's rapidly growing gas industry.

The Natural gas industry in Australia has shown a remarkable growth over the past few decades and this is therefore predicted to continue. Significant increases in LNG exports, dedicated research in gas-to-liquids and more investments in compressed natural gas for natural gas vehicles, should also lead to increases in domestic gas demand, and assist the move away from thermal coal resources for power generation.

Australia is expected to significantly expand LNG exports over the next two decades. This reflects not only Australia's abundant gas reserves and their proximity to growing Asian Pacific markets, but also Australia's attractiveness as a reliable and stable destination for investment. CSG fuelled LNG is also expected to contribute significantly to the growth of the sector. The exploration and development of other unconventional gas reserves is yet to unfold. It is first necessary to determine the extent and the quality of the resources present. Though sentiment for shale gas is optimistic, this should be tempered with the realism that several Asian gas-consuming regions (e.g. China, India and Indonesia) are also in competition to develop their own shale gas reserves.

Gas investment should provide tens of thousands of jobs for Australians create substantial additional taxation revenue for both state and federal governments and lead to greater uptake of cleaner energy. However, concerns remain in determining the best mechanisms of domestic support to facilitate adding value adding to gas resources by promoting the development of domestic manufacturing and chemical industries. Economies of scale are required to fully develop Australian reserves; this scale rests primarily on increased anticipated domestic and international demand for gas over coming decades. Such scale advantages can only be realised by maintaining an economical advantage for equity investors in resource development projects. Cost control issues and impacts of inflation rates for services and skilled labour costs in Australia that are significantly higher than for competing gas supply regions are causes for concern. Such issues need to be addressed if development aspirations for Australia's gas resources are to be achieved.

Table 1

Table 1. Snap shot of Australia's gas resources in a global context according to BP's Statistical Review of June 2012 (BP, 2012). Note: (*) Australia's pipeline trade includes imports from East Timor Offshore Joint venture, but not domestic internal trade.

Status & exploitation of natural gas resources		
Global	Trillion cubic feet (tcf)	Billion cubic meters (bcm)
Gas reserves (Proven)	7359	208,400
Gas production	115	3276
R/P ratio (years)	64	64
Gas consumption	113	3223
Gas pipeline trade	24.5	965
LNG trade	11.6	331

Australia	Percentage of Global	Trillion Cubic Feet (tcf)	Billion Cubic Meters (bcm)
Gas reserves (Proven)	1.8%	132.8	3800
Gas production	1.4%	1.59	45
R/P ratio (years)		84	84
Gas consumption	0.7%	0.82	23
Gas pipeline trade*	0.9%	0.22	6
LNG trade	7.8%	0.9	26

Data source: BP Statistical Review June 2012.

Table 2

Table 2. Proved natural gas reserves as of 1st Jan 2012 ranked by country for the top 25 resource holders, based upon data from the BP Statistical Review of June 2012 (Wood et al., 2012).

Proved natural gas reserves for top 25 countries ranked at 1 Jan 2012

Total world	7361	208	100%	100%	63.6
Country	Trillion Cubic Feet (tcf)	Trillion Cubic Metres (tcm)	Share of total	Cumulative share of total	Reserves/Production (R/P) years
Russian Federation	1575	44.6	21.4%	21.4%	73.5
Iran	1169	33.1	15.9%	37.3%	>100
Qatar	885	25.0	12.0%	49.3%	>100
Turkmenistan	859	24.3	11.7%	61.0%	>100
US	300	8.5	4.1%	65.0%	13.0
Saudi Arabia	288	8.2	3.9%	68.9%	82.1
United Arab Emirates	215	6.1	2.9%	71.9%	>100
Venezuela	195	5.5	2.7%	74.5%	>100
Nigeria	180	5.1	2.5%	77.0%	>100
Algeria	159	4.5	2.2%	79.1%	57.7
Australia	**133**	**3.8**	**1.8%**	**80.9%**	**83.6**
Iraq	127	3.6	1.7%	82.6%	>100
China	108	3.1	1.5%	84.1%	29.8
Indonesia	105	3.0	1.4%	85.5%	39.2
Malaysia	86	2.4	1.2%	86.7%	39.4
Egypt	77	2.2	1.1%	87.8%	35.7
Norway	73	2.1	1.0%	88.7%	20.4
Canada	70	2.0	1.0%	89.7%	12.4
Kazakhstan	66	1.9	0.9%	90.6%	97.6
Kuwait	63	1.8	0.9%	91.5%	>100
Uzbekistan	57	1.6	0.8%	92.2%	28.1
Libya	53	1.5	0.7%	92.9%	>100
Azerbaijan	45	1.3	0.6%	93.6%	85.8
India	44	1.2	0.6%	94.1%	26.9
Netherlands	39	1.1	0.5%	94.7%	17.2
Sum of top 25 Countries	**6969**	**197.3**	**94.7%**		
Rest of World	**392**	**11.1**	**5.3%**		

Data Source: BP Statistical Review June 2012; David Wood & Associates.

8. Japan and Australia – A Symbiotic Relationship in an Energy-Dependent, Low-Carbon Era

Robert Pritchard, Energy Policy Institute of Australia

Introduction

Australia and Japan need to deepen and strengthen their established relationship to take account of Japan's continuing dependence on imported energy and the need of both countries to play an effective part in reducing global greenhouse gas emissions. Australia not only needs to be a reliable supplier but it needs to provide a more conducive place to invest, so that a greater measure of vertical integration can take place. Global greenhouse gas emissions continue to rise and the spectre of climate change continues to loom. Closer collaboration on energy-related, low-carbon science and technology and policy measures has therefore become a more important priority. An enhanced Australia-Japan relationship that addresses these needs could be a model for Australia's relationships with its other major trading partners.

Historical Background

In the 40 years that followed the 1973 oil crisis, Australia and Japan constructed a highly successful, symbiotic relationship in the field of energy; that is, a relationship in which the two economies became entwined by mutuality of interest. The relationship mainly involved the building up of Australian exports to Japan of coal, natural gas and uranium but also involved the attraction of Japanese foreign direct investment. Essentially, the Australian version of the original deal was 'we would like the money, you need the energy.' This was against the background of Japan actively pursuing a policy of diversification of its energy sources and searching for alternatives, which continues to this day.

Japan has turned out to be a great partner for Australia. It remains by far Australia's largest energy customer, accounting in the 2012-2013 year for 41% of Australia's energy exports with a value of

A$28.5 billion.[xcii] Australia's total energy exports in the 2012-2013 year had a value of A$69.5 billion, 87% of which went to Asia. In that year, after Japan with 41%, China was Australia's next largest customer, with 15%. China's share is increasing but, were it not for Japan, Australia's coal and LNG industries would not be anything like they are today.

Australia and Japan have nurtured their energy partnership through a highly successful forum known as the Japan-Australia High Level Group on Energy and Minerals Consultation (HLG), which meets alternately in Australia and Japan. The 34th HLG meeting was held in Melbourne on 11 March 2011, the day of the Great East Japan Earthquake, which had such a devastating impact on the entire Japanese nation, not just on its energy security. The meeting heard the news and concluded in great consternation. The 35th HLG meeting has been scheduled for 5 February 2014 in Tokyo.

Because of its historical dependence on imported energy, Japan has always been interested in alternative energy, evidenced amongst other things by the establishment in 1980 of its New Energy and Industrial Technology Development Organization (NEDO). One of the earliest activities funded by NEDO was the Brown Coal Liquefaction Victoria (BCLV) pilot plant project in Morwell, Victoria which successfully demonstrated that Australian brown coal could be converted by a process of hydrogenation into high quality petroleum products. It was however uneconomic at the oil prices of the time. NEDO also established an office in Sydney devoted to solar and other alternative technologies but it was closed down after some years due, amongst other things, to lack of promising research subjects and a relative lack of interest in long-term collaboration on the Australian side.

20 Years of Pervasive Changes

Over the last 20 years, the entire Asian region has experienced a number of pervasive and all-encompassing changes:

1) First, there has been rapid economic growth, led mainly by China. The good news is that, over the decade to 2010, economic growth in the World Bank's East Asia and Pacific region more than halved the number of people living below the poverty line. The number is projected to halve again over the five years to 2015.[xciii]

2) A second change has been increased use of energy. Furthermore, the US Energy Information Administration has projected that, by 2040, global energy use will increase by over 56%.[xciv] Energy is an essential enabler of economic development; the increased use of energy is largely a function of low-income economies becoming high-income economies and using more energy.

3) A third change has been increased dependence on imports of energy, in particular oil. This has caused a rise in energy security tensions – and energy security is central to every country's national security. In this regard, there is no international organisation that can supply energy - each importing nation must accept the responsibility of securing its own requirements and managing its own energy affairs.[xcv]

4) A fourth change, the most pervasive and concerning of all, has been the rise in global greenhouse gas emissions. The energy sector is responsible for two-thirds of global emissions. According to the IPCC Fifth Assessment Report, limiting climate change will require substantial and sustained reductions of emissions.[xcvi] The International Energy Agency (IEA) has warned that the world is not on track to limit the long-term rise in the average global temperature to 2 degrees Celsius.[xcvii] The US Energy Information Administration has projected that, by 2040, global emissions will increase by 46%.[xcviii] A very rapid increase has been experienced over the last decade, with only a minor faltering for the GFC.[xcix] Although renewable energy forms have begun to displace fossil fuels, the problem is that they have not done so at a pace to keep up with the rise in energy use.[c]

We can all rejoice in the first change, economic growth, but we must apply all of our ingenuity to find solutions to the challenges posed by the other three: the rise in energy use, the rise in energy dependency (with its increased energy security tensions) and the rise in greenhouse gas emissions.

As if these region-wide, all-encompassing changes were not challenging enough, the Australia/Japan energy relationship has, over the last five years, had to deal with the impact of a series of unprecedented events:

- in 2008, oil prices soared to record levels, peaking mid-year at US$147/barrel;
- the world was soon after shaken by the GFC, a global financial crisis of historic severity; [ci]

- in 2009, the oil price bottomed at US$35/barrel;
- in December 2009, the UN negotiations in Copenhagen on a successor treaty to the Kyoto Protocol stalled;
- from early 2011, the Middle East and North African region became engulfed by a devastating series of internal political upheavals, the so-called 'Arab Spring'; [cii]
- during the period, the United States proved up vast quantities of shale gas and, with Canada, entered the regional LNG market as a supplier; and
- most recently, Japan was dealt its own devastating blow by the Great East Japan Earthquake, which caused its entire nuclear power generation fleet to shut down for safety reviews and resulted in a loss of 28% of its electricity generating capacity for an indeterminate period. [ciii] Whether over the long term the Japanese economy could function efficiently without nuclear power seems very doubtful.

Reviewing Energy and Climate Policies and Strategies – Is It Time to Explore Bottom-Up Solutions?

Both Australia and Japan are presently reviewing their energy policies: Australia's new government has commenced drafting an Energy White Paper and Japan a new Basic Energy Plan. As a net exporter of energy, security of supply is not a central concern for Australia but it certainly is for its trading partners; it calls for special attention in Australia's policymaking, along with the imperative of reducing global greenhouse gas emissions.

The supply of energy is no longer a subject confined to domestic policymaking and the reduction of global emissions never has been. Increasingly, individual countries are unable to set their energy and climate policies independently of each other. Energy and climate policies don't need to be exactly the same in every country but they do need to be set in a realistic international context and, as between trading partners, they also need to be based on a shared vision and technology strategy, as the Energy Policy Institute of Australia advocated to the Australian government in 2009:

> International energy and climate policy development may be founded on the shared vision of a sustainable future that first brought the UNFCCC parties together in 1992. However, global emission reduction targets must be integrated with a low-emission technology strategy. Put simply, international agreements must not only set targets: they must initiate a strategy to deliver the abatement required by the targets. Furthermore, the targets themselves should be informed by a rigorous and objective analysis of the technology development and commercialisation

> pathway to ensure that the targets are achievable at acceptable cost. Then international agreements must be equitable in order to have the necessary longevity.[civ]

The modern Australian version of the original Australia-Japan deal might therefore be: 'We can't do without the money, you certainly can't do without the energy; but we both need to work together on getting the emissions down.'

A beacon of light may have shone through when the Abbott Government's election policy in September 2013 acknowledged that Australia needed an integrated national energy policy. We should now ask ourselves: for how long can the two close trading partners expect the unending UN climate negotiating process to solve the global emissions problem? Is it now time for Australia and Japan to seriously explore sectoral, bottom-up solutions?[cv] This has been raised before in Australia but parked to one side during the domestic debate over a carbon price.[cvi] The solutions will not be easy or fast but the emissions problem does not admit of easy or fast solutions.

Vertical Integration

Australia today faces increasingly stiff competition in its energy export markets. The leading Japanese LNG importer Tokyo Gas Co Ltd became a foundation customer of the North West Shelf LNG Project in 1989 and subsequently invested in five Australian LNG production projects (the Darwin, Pluto, Gorgon, Queensland Curtis and Ichthys projects). Today, however, Australia is competing in the LNG market against the likes of Brunei, Canada, Indonesia, Malaysia, Mozambique, PNG, Qatar, Russia, and the US.

At government level, the challenge for Australia is to set policies that will accelerate the transformation of Australia's traditional role of supplier of coal, LNG, uranium and energy-intensive goods, into a more closely-integrated relationship with its trading partners that enhances their energy security. At industry level, a greater measure of vertical integration may be required, with Australia accommodating the concerns of its customers to reduce their risks and transaction costs.

Australia's Japanese customers have been long aware of the value of investing in upstream production instead of relying simply on contractual arrangements. From the 1970s, there was a stream of successful Japanese investment in iron ore, coal, uranium, alumina and aluminium production in Australia, followed more recently in LNG. Much of the early Japanese investment was intermediated by the *soga shosha,* who have in recent years become significant investors in their own right. For example, Itochu Corporation now holds interests in eight Australian coal projects.

If vertical integration is to be facilitated, Australia must provide a conducive and competitive investment environment. Basic things like political stability and a welcoming mat are necessary but, these days, they are not by any means sufficient.

Is Australia Still a Reliable Supplier? Some Puzzling Messages from Down Under

Clearly, what matters above all else to Australia's energy customers is their own security of supply. They have found it reassuring that successive Australian governments have consistently relied on free and open global energy markets and have left it to market participants to carry out all commercial negotiations without government intervention.

Australia's LNG customers must have also found it reassuring that, unlike the 13 members of the Doha-based Gas Exporting Counties Forum (GECF), Australia has shown no interest in becoming a member of, or even an observer at, the GECF. This may be even more reassuring since, at its recent summit in Moscow, the GECF declared its common determination to 'enhance global-scale coordination of actions to protect the interests of the Gas Exporting Countries …'.[cvii] This is a strange statement in anyone's language. Nonetheless, in recent years, Australia has been sending some puzzling messages to its customers and its potential investors.

To start with, Australian political leaders have frequently talked of Australia as an 'energy super-power.' Apart from sounding egotistical, this is factually wrong. It will only encourage its customers to further diversify their supply sources. Since the 1973 oil crisis, there have only been two countries that could rightfully claim to be energy super-powers: Russia and Saudi Arabia. With the recent shale gas boom, the United States may now also have a serious claim to the title. Australia should reiterate its unequivocal commitment to its customers to remain a reliable supplier and should drop any pretence of energy super-power status.

Another puzzling message from Australia relates to uranium supply. Australia has uranium resources in abundance yet the government has shown disdain for the development of a domestic nuclear power industry and there is a legislative prohibition against it. Some Australian states do not even allow uranium exploration and mining. Whether Australia will be allowed to develop nuclear power generation in the future, as have the UAE and Saudi Arabia, is not known. In this context, a technological breakthrough seems to be occurring with the advent of small modular reactors, where safety systems are built into the basic plant design.[cviii]

Another puzzling message from Australia was conveyed by its relinquishment in 2008 of its longstanding role of Lead Shepherd of the APEC Energy Working Group. This did little to enhance Australia's standing with its customers in Asia. Yet another puzzling message related to taxation policy, where the last government sought to 'share the benefits' by increasing the already high tax burden on the mining and petroleum industries. The state governments also sought to increase state-based royalties.

By far Australia's most damaging message to its customers and investors related to climate policy. There were two aspects to this. First, following the election of the Rudd Government in November 2007, it took it five years to draft an energy policy, one in which energy policy was subjugated to climate policy. The energy industry was disconcerted and Australia's investment reputation suffered.

The second aspect was that, in 2011, the Gillard government imposed a carbon price of A$23 per tonne (which the Abbott government is now in the process of repealing). This sent a signal to Australia's trading partners that Australia was willing to bear some of the burden of combating climate change but would expect them to pay higher energy prices. It did not provide any incentive for the reduction of their own emissions. The carbon price caused economic hardship for Australia's energy-intensive industries and reduced their competitiveness.[cix] The virtue of the carbon price was to increase the competitiveness of renewable energy in generating electricity in Australia. However, this could never have been of any advantage to Asian customers because Australia is surrounded by water and long-distance undersea transmission of electricity is not feasible.

Shortly before the Australian federal election in September 2013, the Energy Policy Institute of Australia was motivated to call for Australia to establish a National Energy Commission to integrate its future energy and climate policies:

> Australia's existing energy and climate policies and measures are in disarray. They lack any unity of purpose and they lack any enabling mechanism to work towards any unity of purpose. Because of this, they do not enjoy an adequate level of industry or community trust. Australia's lack of policy integration causes inefficiency, it damages the nation's investment reputation and it diminishes the nation's international competitiveness.[cx]

Australia's climate policy also did not directly address the actual problem: the technological challenge of how to reduce emissions.

The Technological Challenge

Australia and Japan each have reason to be proud of their scientific and technological achievements and they are each intensifying their respective research efforts. In Australia, the CSIRO Energy Transformed Flagship research project has been leading the domestic search for low-carbon energy solutions. The Australia government provides financial assistance to innovators, such as through the Australian Renewable Energy Agency (ARENA).

The international search for low-carbon solutions must nonetheless be intensified. There may be no easy alternatives to fossil fuels but Australia needs to lift its technological collaboration with its trading partners. Australia and Japan for their part need to take 'a coordinated approach, linking interests and resources across business, science and research organisations and government.'[cxi] The technological fields that may offer most potential for international collaboration are likely to include energy efficiency measures,[cxii] solar power, clean coal measures and electric power storage technologies. Others may be management systems for water, industrial waste and nuclear waste management. It is, however, essential to take a technology-neutral approach.

Over many years, there have been repeated efforts to promote technological collaboration both bilaterally and multilaterally. At the bilateral level between Australia and Japan, considerable work has been carried out by NEDO, JCOAL, CSIRO, ACALET and Brown Coal Innovation Australia, albeit with varied success. The MFP project of the late 1980s, which only partly related to energy collaboration, failed dismally because of a fundamental mismatch between its aspirations and its resources.[cxiii] At the multilateral level, Australia and Japan have participated in many multilateral mechanisms. However, many of the 'new energy' research initiatives have struggled to gain and maintain traction. The IEA Energy Technology Network has perhaps been the most successful, with its series of over 40 Implementing Agreements and over 1200 completed projects. Generally, however, with international collaboration in science and technology, there has not been consistent commitment by government or by business and there has been much jumping from one field of interest to another.

There is a need to design a more stable international platform, or a network of connected platforms, for collaboration and continuous innovation, with shared objectives that are capable of achievement within agreed parameters. For long-term success, it is imperative not to raise unrealistic expectations. It is also imperative to lock in business support. In this regard, Australia's cooperative research centres (CRCs) have achieved some limited success.[cxiv] A recent initiative to establish 'industry innovation precincts' is currently being considered by the Australian government. A specific proposal by the University of Newcastle to facilitate energy industry innovation across organisational boundaries has created wide interest amongst business and universities and a decision on whether the government will provide financial support is presently awaited.

The principal difficulty facing designers of collaboration and information platforms for innovative low-carbon technologies emanates, in the view of this author, from the fact that the discharge of greenhouse gas emissions is deeply entangled with modern fossil fuel-based energy systems. The task of disentanglement is proving to be far more problematic than anyone envisaged, even a few years ago. As well, many of the new energy technologies have been shown to be incapable of being scaled up to make any real difference.

The glib economic explanation that global climate change is a consequence of 'market failure', and that it can be rectified by costing the environmental externalities of energy transactions, is irrelevant to the problem, if not completely false. Certainly, the domestic political solution of intervening in energy markets by imposing carbon prices to make up for the alleged market failure is now widely viewed as simplistic, disruptive and unaffordable, as well as ineffective.

So what should we do? Almost every day, we hear that wind power and solar power are becoming more competitive; and that electric cars are just around the corner. So they are – but progress with low-carbon energy technologies has not kept up with the increase in global emissions.

There is a wide range of potential options available. 17 technology roadmaps were outlined in the first edition of the International Energy Agency's *Energy Technology Perspectives* in 2008. They are listed in the table below:

The IEA's Technology Roadmaps	
Supply - Side Technologies	**Demand - Side Technologies**
1. CCS fossil-fuel power generation 2. Nuclear power plants 3. Onshore and offshore wind 4. Biomass integrated-gasification combined-cycle and co-combustion 5. Photovoltaic systems 6. Concentrating solar power 7. Coal: integrated-gasification combined-cycle 8. Coal: ultra-supercritical 9. Second-generation biofuels	1. Energy efficiency in buildings and appliances 2. Heat pumps 3. Solar space and water heating 4. Energy efficiency in transport 5. Electric and plug-in vehicles 6. H_2 fuel cell vehicles 7. CCS in industry, H2 and fuel transformation 8. Industrial motor systems

In 2013, in response to the persistent concern that the world was not on track to limit the long-term global temperature rise to the target of 2 degrees Celsius, the IEA in a Special Report specified four policy measures that it considered could 'help keep the door open' to the 2 degrees target through to 2020 at no net economic cost:

> The policies in the 4-for-2°C Scenario have been selected because they meet key criteria: they can deliver significant reductions in energy-sector emissions by 2020 (as a bridge to further action); they rely only on existing technologies; they have already been adopted and proven in several countries and, taken together, their widespread adoption would not harm economic growth in any country or region. The four policies are:
> 1) Adopting specific energy efficiency measures (49% of the emissions savings).
> 2) Limiting the construction and use of the least-efficient coal-fired power plants (21%).

3) Minimizing methane (CH_4) emissions from upstream oil and gas production (18%).

4) Accelerating the (partial) phase-out of subsidies to fossil-fuel consumption (12%).'[cxv]

Many countries, including Australia and Japan, are already implementing these policies to some extent or another but it is obviously incumbent on all countries to speed up their efforts.

As for the long-term, the emissions reduction problem is mainly a problem of scale and interconnectedness. Modern electricity systems are massive interlocked machines that provide light for our homes, our places of work and public facilities and provide the essential power for electric motors in industry, computer systems, telephone systems and communications systems, which are in turn critical to the supply of petrol and other transport fuels and the supply of water and sewerage services. Electricity systems must constantly respond to demand and cannot remain static – they must be enlarged to accommodate whatever may be the load.

The long-term emissions reduction problem has also to do with affordability, historically measured by reference to the global oil price. The main driver of low-carbon research spending is the prospect of finding lower-cost alternatives to oil and other fossil fuels and fossil fuel-based energy production systems, although government research subsidies have a role to play.

With the possible exception of nuclear power, there does not appear to be any immediate prospect of an affordable substitute for fossil fuel-based electricity generation of industrial scale. Nuclear power therefore remains an important option for Japan, as well as for other countries, even if only for risk diversification.

According to the Energy Research Institute of China, a reduction in emissions of the magnitude necessary to meet the 2 degrees centigrade target in the next 40 years will require China to cut its emissions by more than 70% relative to 2020 levels. This would require the near-simultaneous and successful deployment of all the available low-carbon energy technologies and massive international cooperation.[cxvi]

Investment Risk

To a large extent, the surge of foreign investment in Australian coal and LNG-export projects over the last 20 years is testament to Australia's stable investment environment. There is however a more straightforward explanation: the global oil price has soared and energy has become more scarce, with only a short pause for the global financial crisis.

Fund managers will not invest in new ventures and new technologies unless they fully understand the risks that are involved and have the capacity to manage these types of investments. There are trillions of dollars of funds under management around the world looking for a home but they cannot find safe places to go.

Unless investment risks are seen as manageable, and export prices are high enough to satisfy investors' hurdle rates of return, the optimal level of investment will not happen. Despite signs that fund managers may be looking to invest further in Australia, most remain nervous about Australian energy policy. A study was carried out during 2012 by KPMG and the Energy Policy Institute of Australia on the financing implications of Australian energy policy. The study made a number of key recommendations under four headings:

(i) Market impediments to financing innovation should be removed, requiring limited tax changes and the further development of bond markets;
(ii) A better market framework should be developed to improve the energy investment environment and attract finance;
(iii) An 'investment grade' energy policy should be created, requiring regulatory reform at federal and state levels, greater transparency for investors and a periodic report by government that tracks its progress in energy policy reform, involving stakeholders in the process; and
(iv) The corporate sector should move to a more integrated financial reporting model to support investment decisions at corporate level.[cxvii]

Investors in Australian energy projects are particularly concerned that their exports will be threatened by changes in environmental regulations. Foreign investors are also particularly concerned that Australian customers are lobbying federal and state governments for preferential treatment. Investors will not hurry to any country that poses unmanageable risks. However, this will never show up in any statistics; no record is kept of what might have happened if investment conditions had been more conducive.

Some Conclusions and Remaining Questions

Some firm conclusions may be expressed, although some fundamental questions remain to be answered:

1) Reliability and affordability of supply

Their own energy security remains the paramount concern of all Asian energy importers; it is central to the functioning of their economies and to their national security. This requires Australia to continue to show that it is a more reliable and competitive energy supplier than its competitors. Whether, in the long run, the Japanese economy could function efficiently without the reliable and affordable supply of oil, coal, LNG and uranium seems very doubtful, if not impossible. In particular, subject to the satisfactory completion of all post-Fukushima safety inspections, it would be very brave for Japan to phase out nuclear power.

2) A conducive place to invest

Australia needs to provide a more conducive and safe investment environment. Asian investors have not been impressed by Australia's recent attempts to boost its export markets by, in one breath, claiming it is an energy super-power and, in the next breath, announcing a domestic carbon price and other policy changes that make it more costly to produce and export fossil fuels. These have been unsettling messages for Australia to send to its customers; so the new Abbott Government has much lost time to make up.

3) Industrial competitiveness

Whether, and to what extent, the climate policies of either Australia or Japan could lead to a loss of their industrial competitiveness is a serious question for each of them to consider in formulating their respective policies.

4) Enhanced collaboration

The economic interdependence of the Asian region demands a renewed level of collaboration on energy supply, bilaterally and through multilateral mechanisms, such as the APEC Energy Working Group. One priority for both Australia and Japan is to further consider and implement the IEA's four recommended policy measures of June 2013. Another priority for both countries is to lift the intensity of their collaboration on science and technology as it impacts on the supply and use of energy, especially in relation to low-carbon technologies. As the IEA emphasised in its June 2011 Clean Energy Update: 'International collaboration is key to ensuring that momentum is maintained and gaps are addressed'. Sectoral, bottom-up solutions should be seriously explored, with business support from both countries; and there should be complete neutrality when it comes to the choice of technologies.

5) A strengthened bilateral relationship tailored to the demands of the time

Overall, Australia and Japan need to strengthen their relationship to take greater account of Japan's continuing dependence on imported energy and Australia's continuing need for energy export revenues. A strengthened Australia-Japan relationship could be a model for Australia's relationships with its other major trading partners.

6) Integrating energy and climate policies in each country

Finally, the spectre of climate change continues to loom and some fundamental questions remain. Have we been over-optimistic about mitigation measures? Are we already too late to limit the global temperature rise to 2 degrees Celsius, as the IEA has suggested? Is there a reliable correlation between emissions reduction and climate system improvement? Could it take up to a century for concentrations of greenhouse gases to be stabilised at a safe level? If so, what will happen in the meantime? How are energy and climate policies to be best integrated in each country?

The Energy Policy Institute of Australia is an independent, apolitical, technology-neutral energy policy body. The Institute advocates a secure investment climate to ensure that Australia remains internationally competitive.

9. Australia's Energy Policy: Towards a Secure Energy Future?

Dr Vlado Vivoda

Research Fellow, Centre for Social Responsibility in Mining, Sustainable Minerals Institute

The University of Queensland, St. Lucia, QLD 4072, Australia.

E-mail: v.vivoda@uq.edu.au

Introduction

With the change in government following the September 2013 election, the newly created Department of Industry is currently in the process of drafting Australia's new *Energy White Paper* (EWP). In the past, Australian governments adopted a *laissez faire* approach to energy markets, largely behaving as a facilitator of investment in upstream activities and it is unlikely that the general policy direction in the new EWP will stray from its predecessors. This paper analyzes Australia's energy policy, arguing that bipartisan 'hands-off' approach and general public complacency regarding Australia's energy future may not serve the national interest in the long run. The paper proceeds as follows: Section 1 outlines the two ideal type energy policy approaches – statist and free-market. In the former case, energy is considered a strategic commodity and a matter of national security, and is therefore securitized. In the latter case, energy commodities are regarded as any other commodities, and government interference in energy markets is perceived as undesirable (Hancock and Vivoda, 2014). By analysing historical legacies and recent examples, Section 2 demonstrates that Australia remains committed to a market approach. Section 3 discusses major deficiencies in Australia's energy policy approach. The conclusion summarizes the main findings.

1. Energy Policy Approaches: Two Ideal Types

There are two ideal-type approaches to energy policy. On one hand, based on the statist approach, both energy importing and exporting states should not rely on energy markets to provide optimal energy outcomes but rather should steer markets to benefit the state. In this context, national energy policy is considered a security challenge and as such ‘securitized’ (Phillips, 2013). According to securitization theory, a policy problem becomes a security issue if an agent manages to cast it as an ‘existential threat’, or a ‘supreme priority’ which requires treatment and intervention by extraordinary means (Buzan, et al, 1998). Echoing this logic, an energy policy problem is an energy security issue if it is presented and perceived as affecting the stability (and in critical situations, the survival) of a nation, the functioning and continuity of the economy or the realization of major national values and objectives (Cherp and Jewell 2011; Winzer, 2011). Energy markets are not perceived to be serving the best interests of states, and state interference is crucial. A statist approach emphasizes state control of resources and favours a major role by the government in sponsoring energy-related activities, such as support for specific energy sources, direct participation in domestic energy production and equity participation in the upstream sectors of producer states. Other components of the state approach include the pursuit of diplomatic activity designed to enhance access to energy resources and energy security (energy diplomacy) and provision of foreign assistance (Vivoda and Manicom, 2011; Stoddard, 2013; Hancock and Vivoda, 2014).

In contrast, a market approach seeks to mitigate the risk of supply disruption by enhancing the efficiency of domestic and international markets. According to proponents of this approach, energy is conceived of as no different from any other commodity. Consequently, energy markets should receive no special consideration and should be exposed to the same conditions as other commodity markets. Correspondingly, energy policies adopted by states should be aimed at ensuring the free functioning of energy markets. It is believed that private companies deliver energy at best prices and ensure adequate and reliable supplies, and that government interference should be minimal, and is only needed in times of market failure (Vivoda and Manicom, 2011). The move to more efficient markets is encouraged by, for example, removing subsidies for energy and maintaining transparent trading rules. The belief is that if markets are open, economic forces will naturally encourage greater efficiency (Deutch, et al, 2005). A liberal approach is characterized by agnosticism regarding the source of energy imports; eschewal of policies that seek to promote the interests of national over foreign firms; liberalization of domestic resource sectors and integration with international markets through open trade and investment policies; and foreign policy cooperation with other states to improve the functioning of international resource markets on a multilateral basis (Hancock and Vivoda, 2014; Wilson, 2014).

Energy exporters, such as the member states of the Organization of Petroleum Exporting Countries (OPEC) or Russia have generally adopted statist policies, while energy importers, particularly members of the IEA, such as the United States, have adopted market strategies. However, as the following section demonstrates, although it is a significant net-energy exporter (Table 1), Australia has adopted a free market energy policy.

Table 1*: Australia's Energy Profile*

Oil	
production	416,000 bpd
consumption	1,026,000 bpd
import dependence	59%
Natural Gas	
production	42.9 bcm
consumption	17.9 bcm
import dependence	-
Coal	
production	269.1 mtoe
consumption	45.0 mtoe
import dependence	-

Source: BP (2014).

2. Australia's Free Market Approach

In spite of a growing deficit in the liquid fuels balance, Australia has for some decades been the world's largest exporter of coal by a considerable margin. Likewise, Australia recently emerged as the region's largest liquefied natural gas (LNG) exporter, bypassing Indonesia and Malaysia. Its conventional gas reserves are also the largest in the region. Moreover, approximately 60 per cent of the global planned LNG liquefaction projects are in Australia, with $200 billion worth of largely Asian-financed LNG projects either planned or under construction. LNG accounts for the bulk of recent resources and energy investment boom in Australia, and if projects under construction go ahead, Australia is predicted to become the largest global LNG exporter by 2017, overtaking Qatar (Bloxham and Hartigan, 2012). It is unlikely, furthermore, that domestic energy requirements, although buoyant, will diminish any of these export profiles: Australia consumes too little natural gas, and low-grade coal that is not exported. Hence, in a region where the general trend is clearly towards lower levels of energy self-sufficiency, Australia is already a net energy exporter of considerable significance – and the degree of that significance looks likely to increase.

Australia's approach to energy has been largely market-based or liberal, where limited government interference in the energy markets. The underlying assumption is that free markets and private companies will best serve Australia's interests and provide optimal market outcomes both in terms of price and balancing supply and demand. Australian governments have been supportive of the role of markets in aspects of international energy.

The first concrete piece of evidence of Australia's market approach was published in 2004 when Australia's first-ever *Energy White Paper* was released by the Howard Government (Energy Task Force, 2004). At its centre, it openly acknowledged the decline of Australia's liquid fuels balance. But instead of raising its profile as a potential energy security issue, the tendency to liquid fuel deficits was argued to be overwhelmed by the countervailing tendency to export surpluses in all other energy categories - gas, uranium and coal. The policy implication was clear: so long as Australia remained a net energy exporter, the liquid fuels balance did not matter, and energy liberalization was in Australia's national interest (Leaver, 2009). In this respect, the document was the latest testament to the continuing power of free-market thinking. None of this changed with Labour's return to power in Canberra, following Kevin Rudd's victory in 2007.

In November 2012, the Department of Resources, Energy and Tourism (RET) issued the *Energy White Paper 2012 - Australia's Energy Transformation* (Department of Energy, Resources and Tourism, 2012). The transformation refers to the intent to redevelop Australia's energy sector and wider economy to reduce environmental impacts including contributions to global warming. Indeed, one could be forgiven for forming the view that climate change and related energy technology transformation to reduce greenhouse gas emissions are the big strategic issues confronting Australia's energy policy makers. Similar to its predecessor, the 2012 *Energy White Paper* (EWP) struck a positive tone based upon Australia's position as the ninth largest energy producer worldwide and a net exporter of energy, which implies that Australia is energy secure. In conceiving the 2012 EWP, RET considered the international marketplace so resilient that supply of crude oil and refined products to Australia could not be denied, and that Australia would have the wealth to purchase energy supplies irrespective of market price movement. The 2012 EWP indicated a continuation of an essentially *laissez faire* approach to the design and operation of Australian energy systems.

As conventionally understood in terms of the potential for supply disruptions, Australia's energy security hardly seems to be a pressing national problem, especially when compared to the acute import predicaments faced by Japan and other Asian states (Leaver 2007). Australian energy policy is driven by a win-win market-driven outcome from Australia's energy exports to the region due to perceived complementarities between the strong Australian export positions on coal and LNG and their reverse deficits in most East Asian economies. Canberra perceives that all that is necessary for Australia to reap the benefits of increased Asian hunger for its hydrocarbons is to clear away whatever domestic political obstacles to enhanced supply and then stand aside while the hidden hand of the market works its usual effect.

Australia's complacency regarding its growing dependence on imported liquid fuels can be traced back to the timely mid-1960s discovery of its largest oil province in Bass Strait (Wilkinson, 1983). While not large by world standards, these reserves proved sufficient to rapidly increase self-sufficiency. Australia moved from 10 per cent to 70 per cent self-sufficiency in oil during the years leading up to the first OPEC oil shock. This put it on a par with the United States when the oil shock arrived (Leaver, 2009).

The energy sector is an important element of the national economy and contributes significantly to national wealth; however, in line with broader complacency regarding energy security issues, there is only sparse specialist media coverage and limited public interest. In fact, the Australian public has only a limited interest in energy issues and does not exert concerted pressure on the Australian government. This is not an inevitable outcome, as the spirited public debate about energy exports currently underway in the US illustrates. Memories in Australia of the oil price shocks of the 1970s have largely faded, replaced by an experience of persistently, but slowly growing, fuel prices and generally very good supply continuity. Failures like the 1998 explosion at Esso's Longford gas plant in Victoria, the persistent problems with gas availability and cost in Western Australia (WA) or the more recent tanker truck accident in New South Wales demonstrate that there are vulnerabilities in the energy supply system. In fact, energy security issues can impact ordinary Australians very directly through high consumer prices, fuel shortages and the environmental impacts associated with energy generation. However, they do not mobilize a deep and persistent popular interest in energy security. According to ASPI's analysis, only one per cent of Australians considered 'energy crisis / petrol price / depletion of fossil fuels' as an issue of public concern (Australian Strategic Policy Institute, 2013).

It is important to highlight the influence of the private sector on Australia's energy policy process. This is evident both in their participation in the policy process through the EWP, and as a consequence, in policy preferences expressed throughout the document. First, the government, as expressed in the 2012 EWP, is opposed to reserving a share of natural gas produced in Australia for domestic consumption, which serves as evidence of a 'hands-off' approach to energy policy, supported by industry. This is in stark contrast to the United States, where a lively debate regarding the viability of LNG exports materialized since commercialization of shale gas in recent years. Instead, the Australian government supports rapid development of both conventional and unconventional gas in Australia with a view to becoming the largest global LNG exporter over the next decade.

Although Australia's gas reserves constitute a world-class resource, domestic sales from these fields have been severely restricted. Despite Federal Government opposition, WA is the only jurisdiction that has a domestic reservation policy. LNG producers in WA are obliged to make available domestic gas equivalent to 15 per cent of LNG production from each LNG export project (Government of Western Australia, 2011). With LNG exports from Queensland commencing in late 2014, East Coast gas market will be linked to the Asian market, with prices projected to double. Anticipating a supply crunch and a significant increase in gas prices, end-users have increasingly shifted to other energy sources, with Australia's gas consumption dropping by 28.8 per cent between 2011 and 2013 (BP, 2014). Moreover, with the highest grades of thermal coal committed to export, the Australian electricity generation sector uses lower grades that have dubious thermal and environmental qualities. The export-first policy for both gas and coal and growing domestic gas prices indicate a high level of policy influence by industry actors (Burrell, 2012).

Second, the petroleum refining industry exerted significant influence on the Senate inquiry into Australia's refining industry (The Parliament of the Commonwealth of Australia, 2013). Concentrated foreign ownership and a transnational approach to profitability meant that industry input on the contraction of Australia's refineries was the prerogative of a few foreign-owned multinational corporations. Ultimately, the inquiry led the Government to agree to continue an import-based liquid fuel strategy despite the attendant and largely unmitigated security vulnerabilities. The Australian refining industry has undergone persistent contraction to the point where only four refineries remain due to a range of factors including high labour costs, strong regional competition, low Australian productivity and the technological obsolescence of facilities, a trend which is forecast to continue. As such, most of the liquid fuel consumed in Australia's transportation sector is imported.

Third, the potential for diversion of shipments in transit by international oil companies according to their parent nation interests was not considered in the 2012 EWP or the underlying *National Energy Security Assessment* (NESA) of 2011, even though this occurred routinely during the oil shocks of the 1970s (Department of Resources, Energy and Tourism, 2011; 2012). The sole published supply chain risk assessment informing the 2012 EWP, which considers one very narrow scenario, was produced not by RET staff but a contracted team from a private consultancy. The very narrowness of the scope of this investigation, which considered only a short disruption to supplies from the regional refining hub in Singapore, where numerous alternative supply arrangements exist, is further indication of private industry influence on energy policy. Despite a report identifying significant economic impacts to Australia were Middle East oil supplies to be impacted by even a brief closure of the Straits of Hormuz (ACIL Tasman, 2012), the 2012 EWP focused on a more benign scenario where supplies from Singapore are interrupted for 30 days. Yet, Australia is the only IEA member nation which fails to meet the oil reserve recommended holdings of 90 days of net imports, a situation compounded when the analysis underpinning the claimed 51 days' worth of reserves is critically analysed (International Energy Agency, 2014), with some commentators suggesting the exploitable on-shore reserve stands at 23 days net consumption (Blackburn, 2013), or less than the 30-day hypothetical interruption to Singaporean supplies.

While the private sector exerts undue influence on policy process, agencies of government with relevant expertise and information on related security issues do not appear to be considering energy security adequately in their own internal analyses such as the *Defence White Paper* of 2013 (Department of Defence, 2013). The traditional security agencies including Defence and Foreign Affairs have not been challenged to contribute their critical evaluation capabilities to analysis of energy security by other government departments. An investigation of stakeholder participation in the 2011 NESA, which underpinned the 2012 EWP, suggests a predominance of consultants, commercial interests and some state level involvement. Neither Defence nor Foreign Affairs appears to have made a submission during the consultation process (Department of Resources, Energy and Tourism, 2011).

As of mid-2014, the Coalition Government's newly created Department of Industry is leading the development of new *Energy White Paper* which will be released in late 2014. The background paper points out that energy policy should encourage continued investment in exploration and production to meet demand and support Australia's economic growth, and that the Government is exploring ways to increase energy export opportunities (Department of Industry, 2014). Consequently, it is unlikely that policy direction in the new EWP will stray from its predecessors.

3. A Critical evaluation of Australia's Energy Policy

Having illustrated the characteristics of Australia's approach to energy policy, this section discusses its major deficiencies. Specifically, this section questions the rationale for Australia's continued market approach in the context of statist approaches adopted by its customers. Moreover, it highlights dangers for Australia stemming from complacency regarding its growing oil import cost bill and failure to analyse future market demand for its energy exports.

Australia's positive headline statistics on energy exports mask a more complex situation which may represent a significant economic and energy security risk. Underlying assumptions behind Australia's EWPs have been centred on the continued operation of the global marketplace for energy. However, there are significant risks that stem from free market thinking which dominates Australia's energy policy statements. For a start, free market thinking ignores the fact that free market agents no longer dominate global energy markets, if indeed they ever did. In coal, for example, the national organization of consumers on the demand side of the market contrasts with their disorganization on the supply side – a disorganization that, in Australia, extends down to the level of the firm, and speaks volumes of the unwillingness of federal governments to intervene in the organization of production (Ekawan, et al, 2006; Leaver, 2009). The world's oil and gas markets are more than ever before dominated by national companies on the supply side, and the trend that started in this direction over four decades ago in the Middle East is now permeating through to major non-OPEC producers. Despite the trend in Australia to *laissez faire* service delivery, most oil producing countries have effectively nationalized production in order to control prices and deliver profits directly to the government, with 90 per cent of world oil reserves now controlled by states and national oil companies (Hancock and Vivoda, 2014). In fact, outside Australia, when international energy issues are discussed in terms of market theories, it is the theme of market failure that is most often at the forefront.

There is tension between the singular Australian government attachment to free energy markets and the more general regional scepticism about this liberal approach. Australia has become the largest non-oil energy exporter in the global economy. It has been the largest exporter of coal for several decades and has recently emerged as the region's largest LNG exporter. Energy resources have acquired an unprecedented presence in Australia's export profile. Although many consumer nations would envy these positions, historically, Australia has not sought to assert its influence on key commodity markets or to leverage its energy exports for broader national interest calculations. Energy diplomacy has been an underdeveloped concept in Australia's strategic posture. Although previous Australian governments have, on occasions, attempted to link Australia's natural resource base to broader foreign and security policy outcomes, this has not been done in any systematic or sustained way. As a country committed to free market principles, the idea of 'natural power' has not been at the centre of the national political debate and there has been no sustained line of thinking about leveraging the power of the national resource base (Leaver and Ungerer, 2010).

The proposition that LNG, coal and uranium markets move according to commercial rather than governmental preferences is not tenable. Indeed, the leading customers for Australian coal and LNG have always regarded their purchases as serving national strategic goals. When the main customer in a market follows a logic of strategic calculations, the failure of the main supplier to accept the customer's definition of the game sets the supplier up to receive what Leaver and Ungerer (2010) have referred to as 'the sucker's payoff': oversupply, followed by falling prices. Sheer size, usually the main objective of Australian policy, is a self-defeating asset for a commodity supplier unless accompanied by self-restraint. Strategic influence will not arise directly out of market share, but from meaningful adjustments to the ends served by energy sales. Leaver and Ungerer (2010) argue that, as a net energy exporter in a region of importers, Australia needs to leave behind the outmoded view that commodity markets move in response to normal commercial forces. Instead, Australia ought to 'trade up' its conceptions of how these markets work and how they do not. In the absence of these measures, Australia's economy will be increasingly exposed to potentially vicious boom and bust movements of speculative forces—an unacceptably high risk in volatile times when energy exports loom larger than ever in the trade balance (Leaver and Ungerer, 2010).

The 2004 *Energy White Paper* was evidence of Australia's decision to pursue a policy that depends on an interconnected globalized energy market. Currently, Australia imports approximately 59 per cent of its daily crude oil and petroleum product requirements and this figure is expected to increase due to production declines and refinery shutdowns (BP, 2014). Also, unlike other IEA member countries, Australia does not hold government owned reserve stocks, nor is it planning to purchase them. Australia relies on the open markets to manage liquid fuel supply without the need for government intervention. While Australia remains faithful to the basic principles of free market economics, if they are wrong the consequences could be dire for the economy.

A specific concern relates to the lack of scrutiny awarded to Australia's growing oil import bill. In 2000, Australia's net oil imports stood at 12,500 barrels per day (kbpd), costing approximately $173 million, or 0.02 per cent of GDP (BP, 2014; The World Bank, 2013). A consumption surge coupled with production decline has meant that by 2013, Australia's net oil imports stood at 610,000 bpd. High oil prices have meant that in 2013 net oil imports cost Australia $21.8 billion, or 1.6 per cent of GDP (BP, 2014; The World Bank, 2013). This transformation in Australia's position in the international liquid fuel markets and the effect this has had on Australia's balance of payments has largely gone unnoticed in Canberra and has been downplayed in the 2004 and 2012 EWP. Most commonly, Australia's growing energy exports are cited as the main reason for continued complacency regarding liquid fuel imports. However, petroleum products by and large cannot be substituted by natural gas or coal, particularly in the transportation sector.

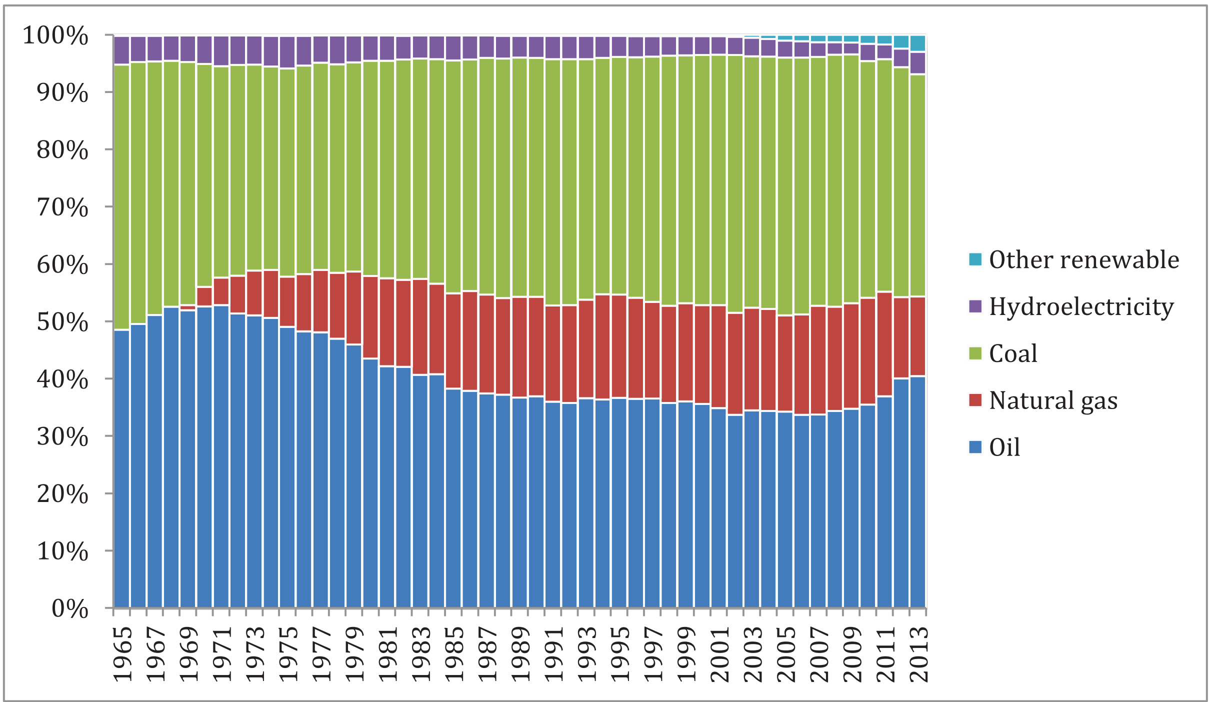
An additional concern relates to the absence of future LNG market analysis in Australia's energy policy thinking. According to the 2012 EWP, export development will continue to play a critical role in Australia's energy future, bringing substantial economic benefits by maximizing the returns from its resources (Department of Resources, Energy and Tourism, 2012). While maintaining its exports-first policy, the 2012 EWP neglected the threat to the pricing structure and future viability of Australian LNG projects and exports to Asia posed by potential oversupply and looming US exports to Asia under Henry Hub pricing.

Gas production is capital intensive and competition is increasing. According to McKinsey & Company (2013) and the International Energy Agency (2013), Australian LNG projects are more costly than its competitors in North America or Africa. Australia's Asian customers are increasingly critical of Australian pricing and they have employed a range of strategies to reduce procurement costs and diversify pricing models. There is even evidence of Asian buyer cooperation, which has been unprecedented. Japan's effort has already paid off. According to Japan's Customs data, in 2010, Australian LNG was 8.78 per cent more expensive than the LNG that Japan sourced from other countries. However, in 2013, Australia's LNG has been 8.01 per cent cheaper than LNG imported from other sources (Ministry of Finance, 2014). Yet, maintaining their commitment to export as much LNG to Asia in the shortest time possible, Australia's energy policymakers have not addressed the potential threat of market oversupply and other demand-side risks. In 2012, Australian energy exports accounted for 23 per cent of overall export revenues. By 2017, LNG exports are expected to increase by 360 per cent from their 2012 level, with LNG and coal forecast to account for $124 billion in export revenues (Heber, 2013). Given that Australian LNG projects are more expensive than their competitors, how long will the price differential be viable for their future development?

Although Australia is rich in energy resources, Schott and Campbell (2013) find it surprising that its energy policy documents do not address export market or demand security as a threat to Australia's overall economic future. Australian energy policy documents raise no concerns about energy markets that are not open, transparent and that do not have clear and competitive price signals, without which energy trade is dictated by geopolitical processes. Australia's complacency about energy security appears inconsistent with other regional and international views. A bipartisan 'hands-off' approach and general public complacency regarding Australia's energy future may not serve the national interest in the long run.

Based on the historical evolution of the energy mix in Australia (see Figure 1), it is apparent that Australia's market approach is not conducive to change in the country's energy mix. In fact, in the case of Australia, where government prioritizes energy exports, coal remains the largest source of energy with 39 per cent, regardless of its negative environmental effects. Despite its appeal as a cleaner fuel and Australia's growing natural gas production, driven by exports-first policy and in anticipation of a supply crunch and higher domestic prices following the start of LNG exports from Queensland, between 2011 and 2013, consumption has dropped by 29 per cent. Fuelled by a growing population and vehicle fleet, and exacerbated by the absence of policy measures aimed at curbing demand growth, oil consumption has increased by 20 per cent over the past decade. Moreover, there is evidence of a slow uptake of renewable energy in Australia relative to other OECD countries, and this is despite enormous potential. Excluding hydroelectricity, renewable energy sources account for only 2.9 per cent of overall energy consumption in Australia compared to the 3.5 per cent OECD average (all data cited in this paragraph is from BP, 2014).

Figure 2: Australia's Energy Mix (1965-2013)



Source: BP (2014).

Processes related to energy transitions are affected by the nature of state-market interaction. Specifically, renewable energy sources require policy support either through direct subsidies, feed-in-tariffs or emissions trading schemes. Australia's market-based energy policy is unlikely to have a significant effect on the pace and scale of energy transition and a potential move away from fossil fuels or, at the very least, towards cleaner fossil fuels, such as natural gas.

Conclusion

The general perception in Australia, shared by the government and majority of the public, is that Australia is energy-rich and not vulnerable to risks in the supply chain. In consequence, Australia has been complacent regarding its energy situation and it has adopted a 'hands-off' approach to energy policy. This paper demonstrates that history is important: Australia has been the 'lucky country', largely unscathed by energy crises and in the past decade blessed by growing Asian demand for its energy riches. The paper also demonstrates that Australia's energy policy approach is not free from influence by powerful non-governmental interests. While value-laden statements regarding preference for market or statist approach are inappropriate, it is apparent that Australia's regionally unique market approach and energy security complacency may be incompatible with an otherwise securitized conceptualization of energy security across the region. A complacent and overly optimistic approach regarding future export markets in Asia may be detrimental to the nation's economic future, particularly given that energy exports constitute a significant and growing proportion of Australia's export earnings. This market approach may not produce optimal outcomes for the economy, the environment or energy security in the long-term. Moreover, as illustrated in the final section, Australia's market approach and its preoccupation with energy exports, is not conducive to a move away from coal and towards cleaner sources, such as natural gas and renewable energy. I am not arguing that energy should become more securitized in Australia, but that the Australian government and the public need to become less complacent about Australia's position in the international energy market.

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[xlii] The East China Sea covers approximately 482,000 square miles, and consists mostly of the continental shelf and Xihu/Okinawa trough. The area has significant proven and probable oil and natural gas resources, with further finds possible but yet to be confirmed. The US Energy Information Administration (EIA) estimates that the East China Sea has between 60 and 100 million barrels of oil. Chinese sources, however, claim that undiscovered resources could run be as great as 70 to 160 billion barrels. EIA also estimates natural gas reserves in the East China Sea to be between one and two trillion cubic feet (TCF); Chinese sources believe there be as much as 250 Tcf in undiscovered resources (EIA, 2012). The surrounding waters also hold rich fishing grounds and include strategically vital shipping lanes relied on by both China and Japan for energy imports and the import/export of other goods.

[xliii] See for example, Manning, 2000; Dannreuther, 2003; Xu, 2007; Choi, 2009; Harris, 2008.

[xliv] The security dilemma is arguably most important to defensive realists, since under their interpretation it purportedly explains how conflict can still occur among security-seeking, status quo states harbouring no aggressive intentions. The security dilemma, therefore, provides defensive realists with the conditions under which the anarchical nature of the international system is most likely to cause conflict between states outside of instances where non-security seeking states foolishly seek power for other purposes such as self aggrandisement or revenge. In contrast, offensive realists argue instead that conflict between states occurs -- regardless of their type since all states are rational actors -- because anarchy

drives states to maximise their power at every opportunity. Thus for defensive realists, normally security seeking states come into conflict because of misunderstandings over each others' intentions created by the security dilemma. For offensive realists, states come into conflict with each other and wars are inevitable simply because they are always insecure and always therefore seeking opportunities to increase their power in order to increase their security.

[xlv] Existential threat definitions normally require the following two conditions to be met: that a state possesses both the material capability *and* motivation/intent to negatively affect the security interests of another state or states.

[xlvi] For my argument, whether or not the certainty is 'misplaced' is irrelevant, not to mention unknowable without the benefit of hindsight and perhaps not even then. This qualifier is only relevant for the defensive realist assumption that most states are security seekers rather than security maximisers.

[xlvii] As Schweller has observed, it is difficult to see how a dilemma can exist over the intentions of other states under the offensive realist schema given that all 'rational' states are assumed to be constantly power seeking rather than at least potentially security satisficers. Under this assumption, one would logically conclude that all states are out to increase power at the expense of others, thereby removing uncertainty over their intentions.

[xlviii] According to Hugh White, the US needs to accommodate rather than attempt to contain China's growing military and economic power by allowing the rise of a new regional strategic order. The alternative of attempting to maintain US hegemony in the face of growing Chinese power will, in White's view, almost certainly lead to regional conflict (White 2010: 36–47). White's analysis sparked considerable debate in Australia, and received harsh criticism from some quarters, particularly from *Australian* journalist and commentator Greg Sheridan (2010).

[xlix] According to Robert Jervis (1978: 174-175), 'The more states value their security above all else …, the more they are likely to be sensitive to even minimal threats, and to demand high levels of arms. And if arms are positively valued because of pressures from a military-industrial complex [or entrenched fears of being exploited by other states], it will be especially hard for status quo powers to cooperate.'

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[lviii] BREE, *Gas Market Report* (July 2012).

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[lxiv]OECD Library, Natural Gas Information, (2009).

[lxv] *Australia Oil and Gas Report Q4* (Business Monitor International, 2013) p.6.

[lxvi] Asia Pacific Economic Cooperation (APEC), *Energy Overview*, Report No. APEC 212-RE-01.12, (Tokyo: Asia Pacific Energy Research Centre(APERC), 2012).

[lxvii] *Australia Oil and Gas Report Q4* (Business Monitor International, 2013), p. 10.

[lxviii] Margaret Donnan, 'Competitive Gas- Why we need a domestic gas policy', *Manufacturers' Monthly*, 16 August 2013.

[lxix] Ibid.

[lxx] Ibid.

[lxxi] Ibid.

[lxxii] *Australia Oil and Gas Report Q4* (Business Monitor International, 2013), p. 11.

[lxxiii] Glen Gil, *Australia's Domestic Gas Security* (Western Australia: DomGas Alliance, November 2012)

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[lxxxiv] Andrew Burrell, 'Japan to spend $4.4bn on gas stake', *The Australian,* 16 May 2012.

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[xcvii] International Energy Agency, *Redrawing the Energy-Climate Map*, World Energy Outlook Special Report (Paris, France: IEA, 10 June 2013), p.9.

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[ciii] The case for Japan retaining nuclear-generated electricity remains strong: see Linda McCann, 'Japan's Energy Security Challenges', *Australian Defence Force Journal*, Issue 190 (2013) pp.83 - 94.

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[cv] UN Environment Programme, *Industry Sectoral Approaches and Climate Action: From Global to Local Level in a Post-2012 Climate Framework*, UNEP Department of Technology, Industry and Economics Discussion Paper DTI/1242/PA (Paris:UNEP, 2009).

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[cxiii] Peter Parker, *The Multi-Function Polis 1987-97: an International Failure or Innovative Local Project?* Pacific Economic Paper No 283, Australia-Japan Research Centre, Australian National University (Canberra, ACT: ANU, September 1998).

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[cxvii] KPMG & Energy Policy Institute of Australia(EPIA), *Australia’s Energy Financing Challenge*, KPMG and EPIA Special Report (Sydney: KPMG, March 2013).

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