Submission

No 3

Inquiry into the Economics of Energy Generation

Organisation:

Name: Miss Penelope Crossley

Telephone: [redacted]

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Theme:

Summary

Penelope Crossley

[redacted]

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The Committee Manager

Public Accounts Committee (PAC)

Parliament House

Macquarie St

Sydney NSW 2000

Fax: 02-9230 3052

To whom it may concern

Public Accounts Committee Inquiry into the economics of energy generation

Thank you for the opportunity to comment on the Inquiry into the economics of energy generation. My expertise in this area was developed as an Energy and Infrastructure lawyer working for a large international law firm in London and Beijing. I have also previously worked as an in-house counsel for the alternative energy division of a supermajor energy company. I am currently employed as a Lecturer in Energy and Resources Law at the University of Sydney.

My submission focuses on the role of electricity generation, particularly renewable generation, in the context of three of the areas highlighted in the terms of reference:

1. the mix of energy sources;
2. issues relating to long term energy security; and
3. best practice in alternative energy generation in other jurisdictions.

The submission is in part derived from a paper that I was invited to give as part of an International Expert Panel to the Korean Legislative Research Institute and the Korean Presidential Green Growth Council in Seoul, Korea in 2011, entitled, 'The Role of Renewable Energy Regulation in Ensuring a Sustainable and Secure Energy Future.'

I am available to elaborate on this submission by making a verbal presentation to the Committee should you require it.

Yours sincerely

[redacted]

Penelope Crossley

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1. The mix of energy sources

1.1 Electricity is a "mixed good" which warrants regulatory intervention in determining a secure and sustainable energy mix

Electricity is a secondary source of energy and an essential component of the modern economy. It has traditionally been generated from fossil fuels such as coal, oil and natural gas, though an increasing quantity is now generated from renewable and nuclear sources.

Economists and regulatory theorists define electricity as a "mixed good" which possesses characteristics of both a private good which would be best regulated by market forces, and a public good which would be best regulated by public policy.[1] Similar to a private good, electricity is rivalrous and excludable, but it also provides non-rivalrous and non-excludable public benefits for which preferences are not effectively revealed by market mechanisms. The characteristics that support the definition of electricity as a "mixed good" warranting regulatory intervention in determining a secure and sustainable energy mix include:

1. Electricity is essential for individual welfare and economic development;
2. Electricity generation is interdependent with other fuel supply systems;
3. Electricity pricing does not accurately reflect the cost of electricity generation due to the presence of externalities and information asymmetries;
4. Demand for electricity is uneven and unresponsive to short-term price spikes;
5. Electricity cannot be economically stored; and
6. There is typically significant market concentration in the electricity sector.

[1] Mark Jaccard, 'Oscillating Currents - The Changing Rationale for Government Intervention in the Electricity Industry' (1995) 23(7) *Energy Policy* 579, 582.

These characteristics may prevent the market being the most efficient and effective mechanism for ensuring the allocative efficiency in the energy supply mix, thereby inhibiting socially optimal levels of investment.

1.2 The need to factor in externalities when comparing different energy sources

A particular concern for NSW in determining the optimal energy supply mix is that there are significant social and environmental externalities associated with electricity generation, with 'externality' best understood as 'a negative or positive effect of some activity that is experienced by a third party, but is not accounted for in an associated purchase transaction or payment for damage.'[2] The pricing of coal based electricity generation fails to adequately price the externalities associated with its use including air pollution, high greenhouse gas emissions and higher rates of asthma suffered in communities surrounding coal fired generation plants.[3] The issue of greenhouse gas emissions is particularly acute, as electricity generation accounts for 41 per cent of global energy-related carbon dioxide emissions.[4] As the costs of these negative externalities are not incorporated into electricity prices, the market will encourage a level of fossil fuel generation that is economically inefficient and sub-optimal for society as a whole.[5]

Electricity pricing not only neglects to price negative externalities but it also fails to ascribe an appropriate value to positive externalities such as the benefit of increased energy security derived from having a diversified supply mix. This is likely to be because while some large industrial electricity consumers have sufficient information to cost the loss of a

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[2] Ibid, 582.

[3] See for example, Shruti Khadka Mishra, *Estimation of Externality Costs of Electricity Generation from Coal: An OH-Markal Extension* (PhD Thesis, Ohio State University, 2009).

[4] William Blyth, 'The Economics of Transition in the Power Sector' (International Energy Agency, January 2010), 5.

[5] See note 1.

fuel source due to market or physical disruption, the average domestic consumer or small or even medium business owner does not.[6] As a result, only large industrial consumers can make informed decisions as to the cost of taking remedial steps to ensure they can utilise diverse fuel sources. The benefit of this information is shown by the prevalence of mining processing companies constructing back-up coal-fired or diesel-fired generators that may be used in the event that natural gas is unavailable.[7] The presence of information asymmetries in the electricity sector has led Adetoro to state that '...policy makers in the energy industries have to contend with ... a monopoly in the supply of information.'[8]

Clement-Davies has proposed that cost efficiency projections over the life of the project by undertaken for all new energy projects to ensure that renewable generation with its higher upfront capital costs is evaluated on a more even playing field.[9] Such a move would include the initial capital costs, fuel stock costs, maintenance costs and decommissioning costs. However, given the volatility in fossil fuel commodities prices and the absence of a global regulatory regime for greenhouse gas emissions post the Kyoto Protocol,[10] these models can be unreliable.[11] Indeed, studies have shown that models of fossil fuel generation often fail to adequately account for price rises in the fuel stock over time or alternatively, assume

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[6] McLennan Magasanik Associates, 'Final Report to the Garnaut Climate Change Review: NEM Market Failures and Governance Barriers for New Technologies' (1 July 2008), 15-16.

[7] See for example, Energy Infrastructure Assurance Advisory Group and National Oil Supplies Emergency Committee, 'Diesel Fuel & Back-Up Generation: Issues for CEOs, Risk Managers and Diesel Users' (December 2009).

[8] David O. Adetoro, 'Can the Imposition of a Regulator in Any Liberalised Energy Market Be Justified by Market Behaviours?' (2006) 24(3) *Journal of Energy & Natural Resources Law* 384, 398.

[9] Christopher Clement-Davies et al, 'Renewables Investment' (2009) 6 *International Energy Law Review* 213, 213-4.

[10] *Kyoto Protocol to the United Nations Framework Convention on Climate Change*, opened for signature 11 December 1997, 37 ILM 22 (entered into force 16 February 2005).

[11] See for example, note 9.

that there will be no price rise at all.[12] Further, they still fail to ascribe a value to externalities.

It can be challenging to price an externality, as it 'involves identifying the nature of the external impacts, identifying the parties affected, and estimating implied costs.'[13] The IEA has argued that this process is difficult because:

1. ' impacts can be widely diffused and exhaustively identifying all parties affected may be impossible;
2. estimating costs requires distinguishing the externality from other market imperfections which can also be difficult; and
3. external impacts can involve considerations related to health, the environment or equity, which can be difficult to evaluate in monetary terms.'[14]

Thus, in order to be able to make a sensible comparison of different energy sources, there needs to be a consistent model used to internalise externality costs across all of the competing energy forms or technologies.[15] This does not seem to presently exist in the NSW energy sector.

1. Issues relating to long term energy security

2.1 The need for renewable energy regulation to address energy security concerns

Environmental issues are commonly cited as justifications for regulatory intervention in the energy sector, and in particular, the renewable energy sector. However, a compelling argument can also be made that regulatory intervention is required in the sector because of the important role that renewable energy will play in ensuring energy security.

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[12] See note 7.
[13] International Energy Agency, 'Energy Security and Climate Policy - Assessing Interactions' (Organisation for Economic Co-Operation and Development, 2007), 3.
[14] Ibid, 3.
[15] See note 1, 583.

2.2 Defining energy security

David Porter from the Renewable Energy Association in the United Kingdom has identified three competing priorities in energy policy, which have to be addressed through regulatory intervention to ensure energy security.[16] The first involves security of supply, which means limiting vulnerability to disruption by ensuring diversity in the generation mix and preventing over dependence on imported fuel.[17] The second priority involves the provision of adequate supply for rising demand at reasonable prices. This priority seeks to balance market choices with prescribed outcomes.[18] The third priority is the energy-related environmental challenge. The energy system needs to operate within the constraints of 'sustainable development,' which means taking a long-term view to de-carbonise the energy sector to tackle climate change and the other associated environmental externalities.[19]

Porter's view is reflected in the competing measures for the success of energy policy. The IEA defines energy security to be "secure" if it is 'adequate, affordable and reliable.'[20] A similar approach is adopted by the Federal Government in Australia, which defines energy security as 'the adequate, reliable and affordable supply of energy to support the functioning of the economy and social development, where:

- *adequacy* is the provision of sufficient energy to support economic and social activity;
- *reliability* is the provision of energy with minimal disruption to supply; and

[16] David Porter, 'The growth of renewable energy in a changing UK electricity market' (Paper presented at the World Renewable Energy Network, Brighton, United Kingdom, December 2010).
[17] Ibid.
[18] Ibid.
[19] William Martin, Ryukichi Imai and Helga Steeg, *Maintaining Energy Security in a Global Context: A Report to the Trilateral Commission* (The Trilateral Commission, 1996), 4.
[20] Samantha Olz, Ralph Sims and Nicolai Kirchner, 'Contribution of Renewables to Energy Security' (International Energy Agency, April 2007), 13.

- *affordability* is the provision of energy at a price which does not adversely impact on the competitiveness of the economy and which supports continued investment in the energy sector.

The three dimensions are interrelated and, to a large extent, mutually reinforcing.'[21] While the European Commission defined energy security in its Green Paper 'Towards a European strategy for the security of energy supply,' as 'the uninterrupted physical availability of energy products on the market at a price which is affordable for all consumers (private and industrial).'[22]

2.3 Measuring energy security

Common energy security indicators include the level of oil and gas import dependence and retail energy prices.[23] However, the problem with defining energy security is that there are so many different types of risk that may cause a supply disruption that may not be caught by these indicators.

A broader view might consider a range of factors that impact on energy security including:

1. the make-up of the market to assess issues such as market concentration and foreign ownership;
2. the mix of energy sources and location of those sources to assess geopolitical risks;
3. the contribution to innovation and technology to assess the benefits of greater efficiency; and

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[21] Commonwealth, 'National Energy Security Assessment 2009' (Assessment, Department of Resources, Energy and Tourism (Cth), March 2009), 1.

[22] European Commission, 'Green Paper: Towards a European strategy for the security of energy supply' (29 November 2000).

[23] Benjamin K. Sovacool, 'Competing Dimensions of Energy Security: An International Perspective' (Paper presented at the Conference on Sustainable Development of Energy, Water, and Environment Systems, Dubrovnik, Croatia, 29 September - 3 October 2009).

4. the additions to local skills and knowledge.

The use of a broader range of measures is arguably more useful in assessing the true state of the NSW energy security profile. The use of such measures enables regulators to look beyond fossil fuel import dependence and assess the contribution of renewable energy in the generation mix.

2.4 The role of renewable energy in ensuring energy security

Renewable energy may mitigate the risks to energy supply through reducing the risk of energy market instabilities, technical system failures and physical security threats including terrorism and extreme weather events.[24] It does this through:

1. diversifying the fuel sources used in electricity generation;
2. encouraging distributed generation which reduces geographic risks;
3. minimising import dependence;
4. reducing fuel price risk and exposure to external shocks;
5. encouraging innovation and domestic economic growth; and
6. helping to meet sustainability goals.

2. Best practice in alternative energy generation in other jurisdictions

In 2009, renewable energy comprised one quarter of global power capacity from all sources and delivered 18 per cent of global electricity supply.[25] Further, investment in new renewable energy generation capacity now exceeds that for new fossil fuel capacity.[26] This growth reflects the role that

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[24] See note 20, 13.
[25] REN21 Secretariat, 'Renewables 2010 Global Status Report' (Global Status Report No. 6, Renewable Energy Policy Network for the 21st Century, 2010), 16.
[26] Ibid, Foreword.

governments believe renewable energy will play in ensuring energy security, combating climate change and sustainably meeting rising energy demands.[27]

Despite this pattern of high growth, it is unlikely that there will be sufficient supplies of renewable energy to meet the International Energy Agency's ("IEA") emission reduction target of 50% by 2050[28] and energy security needs without the assistance of significant regulatory intervention.[29] However, such intervention by government in promoting renewable generation remains controversial because it distorts market signals and may lead to government trying to "pick winners" with insufficient information and expertise.[30] These concerns were recently recognised in government reviews in Australia and the United Kingdom: *'Adapting to Climate Change in Australia – An Australian Government Position Paper,'*[31] and *'The UK Renewable Energy Strategy.'*[32] Nonetheless, there seems to be a growing international consensus that:

> ...tackling climate change and ensuring continued security of energy supply are increasingly urgent concerns. Market forces on their own will not achieve the necessary change towards a low-carbon energy mix sufficiently quickly and radically.[33]

Without regulatory intervention, this market failure would mean that renewable energy technologies would not have a sufficient market, price or profitability potential to warrant improving existing technologies, reducing their costs and the development of new technologies.[34] This need for regulatory intervention 'in settling frameworks in which markets can operate fairly and

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[27] See for example, ibid, 4; OECD/IEA, 'Deploying Renewables - Principles for Effective Policies' (2008); and The Green New Deal Group, 'A Green New Deal: Joined up policies to solve the triple crunch of the credit crisis, climate change and high oil prices' (New Economics Foundation, July 2008).
[28] See OECD/IEA, note 27, 1.
[29] Ibid.
[30] Sara Scatasta and Tim Mennel, 'Comparing Feed-In-Tariffs and Renewable Obligation Certificates – the Case of Wind Farming' (Centre for European Economic Research, 2009), 2.
[31] Department of Climate Change (Cth), 'Adapting to Climate Change in Australia' (Position Paper, Australian Government, 2009), 7-8.
[32] HM Government, 'The UK Renewable Energy Strategy' (2009), 202.
[33] Ibid, 13.
[34] See for example, ibid, 18; Department of Climate Change (Cth), see note 31, 7-8; RE LAW Assist, ' Renewable Energy Law in China – Issues Paper, ' (Australia-China Bilateral Partnership on Climate Change, 2007), 9.

effectively to help the private sector bring technologies through to large-scale deployment,'[35] is increasingly being recognised by governments.

Studies have shown that a combination of regulatory strategies is most effective in encouraging the growth of renewable energy generation.[36] Furthermore, in order for regulation within the renewable energy sector to be successful, it must provide a predictable long-term framework to encourage investment. This is particularly important in liberalised markets as investors make their decisions based on 'the long-term expectations of price developments and costs.'[37]

In order to support a market transition to a greater use of renewable technologies in the generation mix, encourage infrastructure development and create financial incentives, it is argued that two key things need to happen. First, governments need to improve the incentives to lend to or invest in renewable generation by creating a economically viable and stable regulatory environment. Secondly, governments should encourage the broader use of 'smart grid' technologies to enable a greater amount of variable generation to be utilised. This will assist the development of sufficient renewable energy generation capacity to ensure energy security.

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[35] See note 32, 136.

[36] REN 21, 'Renewable Energy Potentials: Opportunities for the the Rapid Deployment of Renewable Energy in Large Economies, It Impacts on Sustainable Development and Appropriate Policies to Achieve It' (Renewable Energy Policy Network the 21st Century, 2008), 17.

[37] Anatole Boute, 'Improving the Climate for European Investments in the Russian Electricity Production Sector: (I) the Role of Investment Protection Law' (2008) 26(2) *Journal of Energy & Natural Resources Law* 267, 270 - 271.