



MELBOURNE
ENERGY INSTITUTE

The Environment and Communications References Committee
Parliament House
Canberra
ACT 2600

10th November 2016

Dear Committee Members,

Please find attached a submission from the University of Melbourne regarding the Committee's *Inquiry into the retirement of coal-fired power stations*.

This submission comments only on part c) of the Inquiry's Terms of Reference (ToR). We have chosen not to comment on parts a), b) and d), as others are better placed to comment on these matters.

The retirement of coal-fired power stations, when seen as part of a broader plan to decarbonise our electricity system, is a complex technical and economic challenge that needs to be guided by independent electricity market design and planning that is in the national interest. The University of Melbourne has a team of specialists in such matters, and we would welcome working with Government, the electricity market agencies and other organizations on this important problem.

Representatives from the University are also available to give evidence at a public hearing should the Committee request. These representatives will be drawn from the contributing authors to this submission.

The University does not wish this submission to be confidential.

Sincerely,

Michael Brear
Director, Melbourne Energy Institute

Melbourne Energy Institute

Mechanical Engineering, University of Melbourne, Victoria 3010, Australia

T: E: mei-info@unimelb.edu.au W: www.energy.unimelb.edu.au

**A submission from the University of Melbourne
to the Environment and Communications References Committee's**

Inquiry into the retirement of coal-fired power stations

Summary

The retirement of coal-fired power stations, when seen as part of a broader plan to decarbonise our electricity system, is a complex technical and economic challenge that needs to be guided by independent electricity market design and planning that is in the national interest. This submission therefore comments only on part c) of the Inquiry's Terms of Reference (ToR), which we again state:

“(c) policy mechanisms to encourage retirement of coal-fired power stations from the National Electricity Market, having regard to:

- (i) the 'Paris Agreement' to keep global warming below 2 degrees Celsius, and ideally below 1.5 degrees Celsius,*
- (ii) the state and expected life span of Australia's coal-fired power plants.*
- (iii) the increasing amount of electricity generated by renewable energy and likely future electricity demand,*
- (iv) maintenance of electricity supply, affordability and security,”*

We make two recommendations in response to part c) of these ToR.

Recommendation 1: That Government determines whether redesign of our wholesale electricity markets is required, such that they can better accommodate the significant growth of renewable energy and other emerging technologies and rely less on conventional, coal-fired power.

Recommendation 2: That independent, co-optimised planning and procurement for our national electricity and natural gas systems be implemented, so that these systems deliver reliable and least-cost energy that meets our obligations arising from the Paris Agreement and likely subsequent agreements.

In making a submission that is specific to part c) of these Terms of Reference, we also do not understate the importance of parts a), b) and d), which are concerned with the impact that coal-fired power station retirements will have on workers and their communities. We consider that others are better placed to comment on these matters and, in particular, we respectfully defer to the views of these workers and their communities.

Supporting information

Recommendation 1: That Government determines whether redesign of our wholesale electricity markets is required, such that they can better accommodate the significant growth of renewable energy and other emerging technologies and rely less on conventional, coal-fired power.

For many years, our National Electricity Market (NEM) has reliably delivered competitively priced electricity. However, we are of the view that significant redesign of our wholesale electricity markets is likely to be required for two reasons. First, our NEM does not have some well established features of other wholesale electricity markets that should assist its reliable operation with increasing renewable generation and more flexible demand. Perhaps

most significantly, the so-called *unit commitment problem* isn't formally solved for the NEM, in which the system operator decides which units will be available in a subsequent period (for instance, the next 24 hours). Solving this problem for the forecasted renewable generation *and* the forecasted demand then allows the system operator to *commit* these resources to satisfy system security requirements in this increasingly uncertain problem. At the moment, the NEM relies on individual generators to decide whether to commit to the market or not, and these generators have no formal role in ensuring system security.

Second, the NEM does not adequately reward all valuable services that different market participants may provide, particularly those that have been traditionally provided by coal-fired power stations and other so-called *synchronous generators* that help maintain network stability. The increasing penetration of intermittent renewable energy increases the need for the aforementioned *ancillary services* for frequency control and, to some extent, for voltage control too. At the same time, renewables are encouraging the withdrawal of synchronous generators by suppressing wholesale electricity prices.

Design of the best forms of ancillary services in a future market should be therefore based on a *technologically agnostic and deep understanding of what our future electricity system needs in order to operate securely*. These needs can then be formulated as market products that can be transacted in redesigned ancillary services markets. The market design should not assume that particular technologies will be the sole provider of a given ancillary service, since this locks in benefits for some technologies and their owners whilst excluding others. We are therefore wary of *inertia* markets, for example, since inertia is only one means of enhancing system security, and will clearly reward incumbent, coal-fired generators; the very type of plant that needs to retire for environmental reasons.

In contrast, there is an array of new technologies that could provide different ancillary services and thus reduce the need for conventional generators, including reducing the need for services associated with the traditional concept of inertia. These include different types of energy storage and demand side technologies that can react much more quickly than conventional, fossil fuelled generators.

Recommendation 2: That independent, co-optimised planning and procurement for our national electricity and natural gas systems be implemented, so that these systems deliver reliable and least-cost energy that meets our obligations arising from the Paris Agreement and likely subsequent agreements.

In our view, Australia needs to revise its approach to electricity (and energy) sector planning in order to have a reasonable chance of meeting our obligations arising from the Paris Agreement and likely subsequent agreements. This planning needs to be done independently, take a more expansive view of the energy sector, and be able to implement its planning decisions. Such approaches need to acknowledge several important factors and the large degree of uncertainty, all of which can be accommodated by existing planning tools, e.g.

- the uncertain annual future abatement required by the electricity sector versus other sectors;
- our uncertain future population, economy and energy demand;
- the inter-connection between our electricity and natural gas systems; and
- which future technologies will prove most cost-effective in helping enable a reliable and clean electricity system.

In making this recommendation, we acknowledge the National Transmission Network Development Plan (NTNDP) and other documents published by the Australian Energy Market Operator (AEMO). However, whilst these documents give AEMO's view on what *might* be done, AEMO does not model deep abatement and *cannot implement* these plans.

We also acknowledge that 'planning' of electricity systems is not favoured by those who prefer solely market based approaches. However, our electricity and natural gas network assets are better described as natural monopolies. Purely market based arguments may simply not apply to such systems. Second, the current approach often limits competition within a given distribution or transmission network. In contrast, an independent body can open the procurement processes for a given network asset, thereby likely *increasing* competition.

It is also less commonly appreciated that networks effectively *compete* with generators and customers in servicing a given location in a market. For example, it may be preferable *at a system level* for new natural gas network to be built to a given location, thereby enabling new local gas fired generation, rather than adding more electricity transmission to that location and importing electricity from elsewhere. Unless both networks are *co-optimised* (i.e. planned simultaneously) in the long term, public interest, such solutions are unlikely to appear. Thus, a contemporary approach to planning uses markets to drive public benefits where appropriate, whilst acknowledging that markets alone might not (and possibly never) fully solve the planning problem.

Indeed, over the last few years the NEM has seen either weakly growing or declining electricity demand, and this may be a longer term trend. In such cases, reliance on the wholesale electricity market combined with a likely form of greenhouse gas regulation to signal divestment in fossil generating plant exposes all consumers to increasing risks. This is because such markets can have several generators earning low rates of return, and there is no guarantee that those whom the system most wants to stay for reasons of system security will actually do so. A 'disorderly exit' that compromises system security is a possibility.

A suite of measures to address the 'retirement' problem is therefore likely required, of course including the regulation of greenhouse gas emissions. Whilst we do not wish to propose definitive solutions here, several ideas warrant further consideration, including reverse auctions for generator retirement and changes to the issuance and renewal of generation licenses. Ultimately, a issuance of generation licenses for fixed periods should occur. However, since 10 of the 23 currently operating coal-fired power stations in the NEM have technical lives that will last beyond 2040, such an approach is likely to be gradual and will not address the retirement problem in the shorter term.

Contributing authors

Prof. Michael Brear, Director, Melbourne Energy Institute

Prof. Robin Batterham, School of Engineering

Dr. Roger Dargaville, Deputy Director, Melbourne Energy Institute

Prof. Robin Evans, School of Engineering

Prof. Ross Garnaut, Faculty of Business and Economics

Dr. Matthew Jeppesen, School of Engineering

Prof. Pierluigi Mancarella, School of Engineering

Prof. Iven Mareels, School of Engineering