North Adelaide
South Australia 5006
24 May 2017

Rebecca Knights
Director Energy Policy and Projects
Department of Premier and Cabinet
Government of South Australia

By email: DPC.ESTRegulations@sa.gov.au

Dear Ms Knights,

Re: Submission – Energy Security Target

I am writing to respond to the call for submissions on the Government of South Australia's proposed Energy Security Target. A submission is attached.

The submission requests that the Energy Security Target and proposed scheme legislation be withdrawn, and its implementation reviewed, at least until after:

- The Finkel Report and its recommendations are public and able to be considered by COAG, National Electricity Market regulatory agencies and the market operator, AEMO, and
- Additional detailed technical and modelling studies have been conducted to test the dynamic performance of the South Australian grid response to major contingencies, and to test the effectiveness and relative cost of the proposed "rotating iron" Energy Security solution, as well as other modern digitally based solutions (such as batteries, large scale solar PV, advanced wind turbines, and digitally controlled broad scale demand management), to ensure the least cost solution(s) are adopted.

Given the scheme cost of up to $3.5 billion, it is critical that **all resources** able to contribute to grid security are included in any final scheme, to increase supplier competition, lower costs, and provide a pathway for continued technological development, rather than rely solely on 20th century technology and ageing power plants.

Informing my submission is a working life of over 40 years across the energy spectrum. This includes overseeing development and delivery of 3000MW of gas fired generation including the nation's largest combined cycle and open cycle power plants, permitting Australia's largest wind-farm, experience in solar PV and geothermal development, board oversight of financing several $ billion in renewable, low emissions and energy efficiency opportunities, directorships of integrated energy, LNG and nuclear development companies, as well as consulting to grid battery and solar thermal companies.

If you have any questions in regard to my submission, please do not hesitate to contact me at the senders' email address.

Yours sincerely

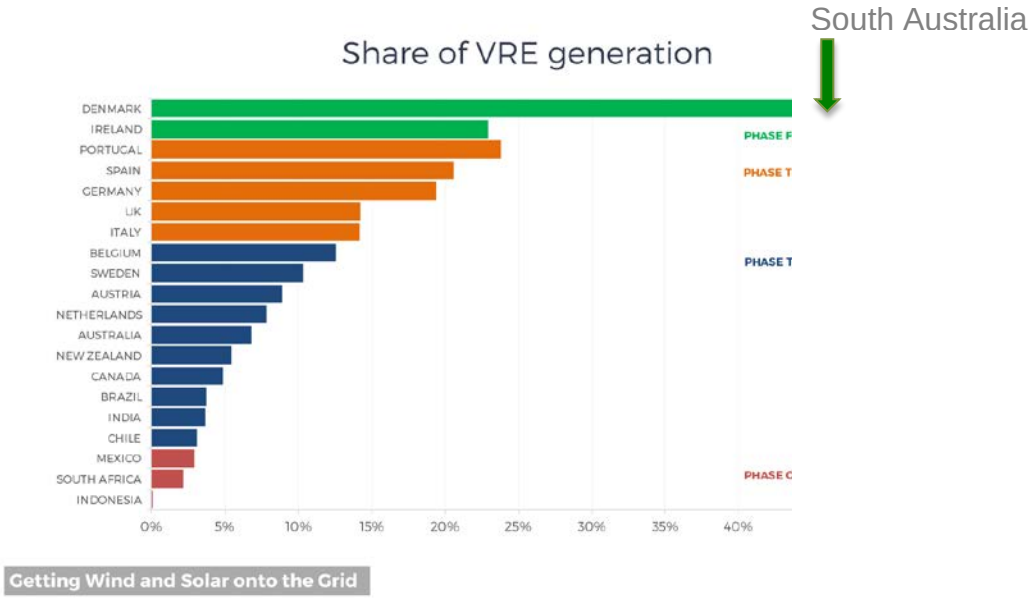
Andrew M Stock

Submission
Energy Security Target
Stakeholder Consultation

24 May 2017

South Australia – A Globally Significant Player

Over the past decade, South Australia has become a global leader in the essential electricity industry transition to dramatically reduce greenhouse gas emissions. Today, it has achieved one of the highest levels of "new renewables" (ie wind and solar PV) of any jurisdiction, globally, with around 50% of its electricity use sourced from variable renewable energy (VRE).



Source: Getting Wind and Sun onto the Grid - IEA 2017, ABC 2017

The actions South Australia takes in response to the challenges presented by this transition and high VRE penetration will have global significance. For example, it is likely to be one reason the CEO of Tesla engaged in dialogue with the South Australian Premier on the role battery storage can play in a transition to high penetration renewables.

Because actions the state takes in responding to these challenges have critical global significance, key elements of the State's Power Plan need to be carefully considered - none more so that the proposed Energy Security Target.

Simple Economic Construct Trying to Address Complex Technical Challenges

The proposed Energy Security Target is a simple economic construct that attempts to address a complex technical issue. However, it is flawed in design:

- Primarily relying on dated technologies, ageing plant, and fossil fuels,

- Increasing South Australian consumers' electricity costs by 12 to 15% per household, in total, up to $3.5 billion over the life of the scheme,
- Further entrenching the market power of gas gentailers in the state,
- Creating market and regulatory barriers to deploying modern technical solutions to grid stability challenges,
- Delivering little assurance grid security will actually be improved, and
- Limiting or forcing reduced renewable generation share and increasing greenhouse gas emissions

For these reasons, I submit that the Energy Security Target, as currently proposed, should be withdrawn and re-designed. The following sections elaborate on the reasons why.

Proposed Energy Security Target Should be Withdrawn and Re-designed

The Energy Security Target and proposed scheme legislation should be withdrawn, and its implementation reviewed, at least until after:

- The Finkel Report and its recommendations are public and able to be considered by COAG, National Electricity Market regulatory agencies and the market operator, AEMO. These matters, including national market regulator and legislative responses, could have major impacts on future national regimes influencing system stability in the State. An added state security regime (if any) should be designed mindful of the Finkel outcomes.
- Additional detailed technical studies and modelling have been conducted to test the dynamic performance of the South Australian grid response to various major contingencies of the type experienced over the past 2 to 3 years, and to test the effectiveness and relative cost of the proposed "rotating iron" Energy Security solution, as well as other modern digitally based solutions (such as batteries, large scale solar PV, advanced wind turbines, and digitally controlled broad scale demand management).

Given the exorbitant $3.5 billion cost of the proposed scheme, it is critical that **all resources** able to contribute to grid security are included in any final scheme, to increase supplier competition, lower costs, and provide a pathway for continued technological development, rather than rely solely on 20th century technology and ageing power plants.

Flawed Design Concept

There is a temporal gulf between the simplistic commercial design of the Security Target and the complex technical factors that influence the stability of the State's electricity supply network. The proposed scheme provides for an obligatory payment by electricity retailers of up to $50/MWh per certificate for a defined *annual percentage* of their sales in the state each year. The acquittal of certificates is proposed to take place *annually after each relevant year*. By contrast, the issue of power system security is governed by *complex technical processes that operate over less than a few seconds at any instant in time*.

The Security Target mechanism provides no assurance that generation assets that *may* be able to provide grid stability in the event of sudden loss of thermal or renewable generation within the state, or of the interconnector with Victoria, will be operating at the instant in time a major event occurs, when the grid is most stressed.

The Security Target favours existing ageing gas generators owned by parties integrated upstream in gas supply and transportation, and downstream in electricity and gas retailing. Understandably, these companies run their electricity and gas supply and trading operations to maximise profits. It is entirely possible that gentailers will direct gas into local generation when it most suits them, rather than when needed for system security. For example, one approach could see these gentailers divert gas required to run their generation assets in the state into other markets (eg gas retail, wholesale and trading sales, interstate generation, or LNG exports) at times of tight South Australian electricity supply-demand balance – which occurs most often when weather is very cold or very hot. Another commercial strategy could involve rationing gas to South Australian generation to drive extreme wholesale prices at times of tight supply-demand (and system stress), while dumping gas into the same generation during shoulder seasons when power prices are already low and gentailers' books are long gas, in order to fulfil their *annual* retail business certificate obligations.

This type of operation is likely to do little for power system security in the state throughout each full year. The Scheme design provides little assurance that the plant being paid to provide so called "real inertia" will be operating when required, despite placing an exorbitant cost burden on state consumers.

Reliance on Dated Technologies

By limiting the solutions which qualify to only those providing "*real inertia*" and "*inertial response*" – being "the *absorption or release of kinetic energy by a rotating mass to arrest a change in frequency*", from an "*eligible fuel source*" meaning "*gas*" or "*eligible renewable energy*", the Scheme excludes technologies which offer most promise for addressing the sorts of contingencies which unfold extremely rapidly and are most likely to lead to widespread load shedding, islanding or system black in South Australia. It places primary reliance for future system security on generators that are not assured to be running at the time of an event, have inadequate fast frequency response (FFR) to arrest the decline in frequency anyway, are out-dated or obsolete technology, and in many cases, already over 40 years old.

Modern technologies with proven capability to provide FFR, primary frequency response (PFR) and inertia are excluded – batteries, advanced wind turbine systems, large-scale solar PV farms, and load demand management resources. The recent report by GE for AEMO (Technology Capabilities for fast Frequency Response, GE Consulting, March 9, 2017) analyses each of these technologies in the context of major disruptive events that have occurred in the state. It makes a

number of salient conclusions that appear to have been overlooked in the design of this scheme including:

- "*Inertia based FFR (also known as synthetic inertia) from wind turbines can make a valuable contribution. PV could be an important FFR contributor in future". "Wind and PV can also contribute to primary frequency response."*
- *"The primary method to manage South Australian islanding should be by SPS (Special Protection System), …and design should be a high priority"*
- *"It is important to ensure system security first and base market constructs on that foundation. Costs of FFR should be compared to the variable cost of alternative operating strategies, and ….FFR options should include the technologies outlined in this report and conventional resources."*
- *"**For the near term*** (emphasis added), *consider system solutions that will maintain a minimum level of inertia".*

GE's analysis further observed in relation to relying on inertial response:

"even at greatly increased inertia, this particular event (the islanding of SA in Nov 2015) still results in UFLS… at roughly twice the highest (inertia) level presently observed in SA (12000 MW-s)",
"committing generation for the sole purpose of adding inertia to improve the frequency nadir and avoid UFLS is not sufficient",
"adding inertia alone is a relatively ineffective means of avoiding UFLS",
"more energy is needed to arrest the (frequency) decline of the heavier grid…said differently, the lighter system requires a faster sharper application of arresting power, but it is easier to "catch" the lighter system."

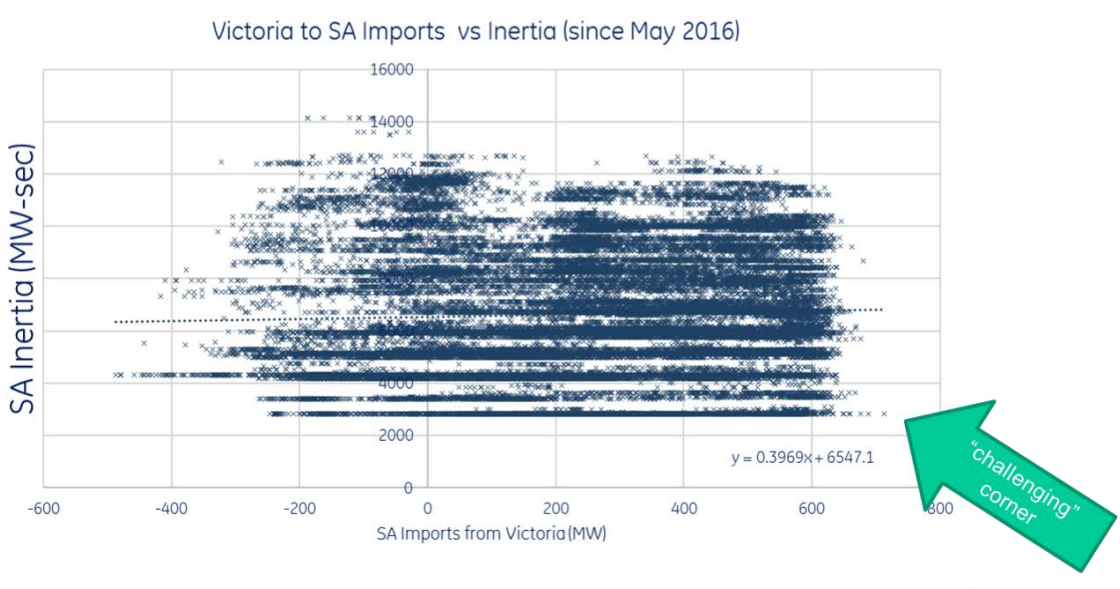
GE observes that FFR is more effective in arresting decline in frequency of a lighter system, and far more cost effective than thermal plant.

Analysis by AEMO conducted in 2014 (Renewable Energy Integration in South Australia, Joint AEMO and Electranet Study, October 2014) similarly concluded:

"The response times of generator governors in SA are too slow to arrest the rapid decline in frequency of the SA power system following separation from Victoria."

Little Assurance Inertia will be Available When Critically Needed

The GE report (Figure 51 – see below) shows there is no historical correlation between SA inertia and imports from Victoria. Separation from Victoria through interconnector failure or trip drives the majority of events most likely to cause major grid instability in South Australia. These events are when it is critical that fast response inertia, FFR and PFR are available.



So unless the in-state inertia, FFR and PFR are available 24x7, 365 days a year, there is a high chance that they will not be available at times of interconnector failure and stability loss in South Australia. As noted above, the Scheme design excludes digital FFR, PFR and some inertia resources completely, and the likely commercial drivers of gentailers provide no such assurance they will be operating when needed. On the other hand, for example, in-state grid scale battery systems are certain to be available within milliseconds of being called to operate, 24x7, 365 days a year, were the Scheme to include them.

Market and Regulatory Barriers to Modern Grid Solutions

The Scheme design creates barriers for over a decade to updating the State's grid by deploying modern rapidly evolving technologies that are able to provide timely near instantaneous responses to grid instability, in amounts of resource most likely to arrest that instability and then provide ongoing energy. The Scheme should provide for FFR and PFR resources (as provided by grid batteries, modern wind farms, large scale solar PV and demand management) to qualify for payments in the same manner that "real inertia" qualifies. The rapid development in these digitally based technologies will likely see major advances in the near term, driven by software innovation and global markets. By locking SA into a Scheme that runs until 2030, relying on dated thermal technologies (rotating iron), it creates barriers to the uptake of new digital technologies, limits technical and commercial innovation of alternative solutions, and fails to mobilise at far lower cost, the inertia, FFR and PFR resources available from advanced wind turbine systems, grid storage, large scale solar PV and digitally controlled wide-scale demand management.

Adoption of the Scheme risks seeing the State stymie innovation in the transition to a zero emission power system essential for the 21st century.

Scheme Costs and Market Power Implications

While ineffective in terms of its stated objective of providing more energy system security for the reasons outlined above, the proposed Security Scheme is extraordinarily costly.

- It will directly increase SA consumer electricity costs over the term of its operation by up to $3.6 billion and increase average household power bills by 12-14%, an extra $300-375/year per household. This cost will increase at more than the annual inflation rate for a decade as the scheme requires a progressive 200GWh/yr increase in the Security Target, each year until 2023/24.
- It will further entrench the market power of the existing gentailers in SA, who already own and/or control around 85 % to 90% of the more efficient gas generators in the state, and increase reliance on gas, which could see further increases in wholesale power costs. These generators, with their dominant market shares, have been shown repeatedly over many years, to be a key to driving extreme wholesale prices in the state, with flow on impacts to retail consumer power bills. By having the effect of reinforcing the market position of high cost gas gentailers through subsidising their existing operations against new entrant low cost (zero fuel cost) competitors, SA consumers are likely to see even higher wholesale power prices from less competition.
- It will provide a barrier to further rollout of renewable solar and wind power in the state. Coupled with advanced battery and control systems, these provide lower cost dispatchable firm power than existing fossil fuelled power stations at current gas costs, let alone at future costs and price volatility given gas is now scarce and linked to oil pricing. The state currently sources over 50% of its power from renewable sources. The obligations of the Scheme are to meet a target that increases by 33% over the next decade while AEMO forecasts local power demand will fall by 10%. This demonstrates that low cost renewables in SA will be forced to reduce in share and absolute GWh generated. Numerous studies have shown how greater uptake of low marginal cost renewable power reduces wholesale power costs, while increased reliance on volatile high priced gas increases wholesale power costs.

Not only is the proposed scheme costly for consumers, it will be costly in terms of the solutions it subsidises (gas generation), the solutions it creates barriers to (batteries, wind and solar PV), and the impediments it creates to continued innovation, through reliance on out-dated technologies and ageing generation plant. The GE report analysis, and overseas analyses, demonstrate clearly that thermal generation provides only limited inertial benefit and system stability at far greater cost than modern FFR assets like batteries, wind farms and solar PV.

Greenhouse Emissions will Increase

Finally, by forcing more old inefficient fossil fuelled power on the state in ever increasing amounts, it will drive up the state's greenhouse gas emissions from the power generation sector (and associated fossil fuel processing infrastructure), at the very time when Australia must achieve a 26-28% reduction in emissions by 2030, and foster investment in a pathway to deliver all the nation's power with zero emissions by 2050. The State's power emissions could increase over the term of the Scheme by 30 to 50 million tonnes.

Andrew Stock

24 May 2017