MARCHMENT HILL CONSULTING

Friday, 3 March 2017

Dr Alan Finkel AO,
Chairperson
Independent Review into the Future Security of the NEM
Department of the Environment and Energy

Submitted via email at NEMSecurityReview@environment.gov.au

Dear Dr Finkel,

RE: Marchment Hill Consulting Submission to the Independent Review

Marchment Hill Consulting (MHC) welcomes the opportunity to respond to the **Independent Review into the Future Security of the National Electricity Market's Preliminary Report**.

MHC is a management consulting firm determined to make a difference by serving the needs of the energy and water industries. Founded in 2004 we have worked for hundreds of clients across the electricity value chain in Australia. The challenges the industry currently face are the most significant we have seen – the transformation required is unprecedented. We are therefore naturally encouraged by the focus these issues have received through your review.

Having worked closely with many of the industry stakeholders at the cutting edge of innovation in distributed energy technologies, we believe there is enormous potential for the "grid edge" to support a secure electricity supply system, particularly through the effective integration of small scale solar and battery storage systems. However, the cost of battery storage in particular remains a barrier to more widespread adoption.

So, while there are many fascinating aspects of your consultation, we write specifically about the cross-cutting challenge of financing distributed battery storage. As such, this may be an unusual response, but we hope you will consider our analysis and we look forward to your queries.

We believe that a potential solution to many of the issues you identify might lie in repurposing the existing, committed state-level premium feed-in-tariffs (PFiTs) to a subsidy for distributed battery storage.

Our analysis indicates that many of states have over 10 years remaining for the PFiT subsidy and across Australia the residual PFiT subsidies are worth approximately A5.4 billion. These funds could be used to directly finance around 960MW of distributed

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storage that would deliver significant benefits to the Australian National Electricity Market (NEM), the broader customer base, state governments and the power system.

Effectively, if all of the customers across Australia with a PFiT subsidy used the residual value of that subsidy to purchase a battery storage system, Australia could have a 960MW virtual power plant, at no additional cost to customers.

In fact, using the approach suggested in this submission, costs to the residual customer base will be reduced, the ability of the power system to transition to a low carbon future is improved immensely, and the timeframe for implementation is only limited by the markets ability to respond to customer demand.

Thank you for your time in considering this submission, we would welcome the opportunity to present to your expert panel and provide our more detailed modelling and research on this topic.

Kind Regards,

Ryan Wavish

Chief Executive Officer

Marchment Hill Consulting

Review of your interim report

MHC would like to endorse and highlight some of your specific conclusions:

- **new distributed storage and control technologies are emerging rapidly** and their prices are likely to fall in line with AECOM's expectations (p.13) – or perhaps even faster if a larger domestic market were created;
- **these technologies can facilitate the integration of higher levels of renewable generation** (p.12) and **offer the opportunity for consumers to create independent or micro-grids** (p.16);
- **residential consumers wish to exercise increased choice** in how they engage with the electricity market and/or its client-facing representatives (p.14);
- the **cost of achieving security can be lowered by actively managing demand** and deferring or avoiding network upgrades (p.17).

Overall, we agree with your analysis that a distributed PV system, combined with a battery storage system and aggregated as a virtual power plant (VPP), can provide additional benefits to the wider customer base and the NEM, including demand response at critical peak periods, ancillary services, improved local power quality and reduced network augmentation costs.

We also share your reservations that:

- a **sub-optimal implementation could have a detrimental impact on overall system security** (p.14) – whether that be because of exogenous delays or unplanned, unmonitored installation;
- **appropriate price signals and incentives are not currently in place** to bring forward storage technologies or incentivise their benefits – and even risk passing the impacts of future grid defection to the most vulnerable or least able to afford their own distributed resources (p.15, 17 and 18);
- **consumers' limited ability to pay large up-front costs** or privately obtain finance for new technologies **risks delaying the growth of this market** and the participation of vulnerable groups (p.18);

Of these, we believe the issue of funding distributed energy storage technologies is the most pressing – and that if 'intelligently' financed, battery storage can deliver energy system security benefits and help ensure consumers are rewarded for paying a part in the stability of the NEM.

Converting PFiTs

As has been recognised elsewhere, PFiT schemes were successful in accelerating the deployment of distributed residential PV, but have several limitations. While they offer a long-term but high-cost subsidy for emissions reduction, their provision offers a significant financial disincentive for the uptake of energy storage (and particularly for the earliest PV adopters who would arguably otherwise be most interested in battery storage technology). They also offer limited (if any) network support function as they incentivise maximum feed-in regardless of time, location or grid condition. PFiTs create a significant cross-subsidy from customers without solar PV to customers with solar PV, with little or no value in return.

Approximately one third of Australia's solar PV installations (approximately 500,000 customers) currently benefit from a state-level PFiT, which have a total residual value of approximately A5.4 billion.

We believe that, if given the choice, many consumers would be willing to convert their residual PFiT subsidy into a battery storage subsidy (BSS) - an up-front lump sum to offset all or part of the cost of a battery storage system. And, they would be willing to accept a BSS at a discount to the estimated residual value of their PFiT subsidy in order to secure and enjoy more benefit upfront.

The current PFiT subsidy is recovered from the entire customer base through the environmental charges included in retail tariffs. The BSS would be recovered in the same way. However, as the BSS provides an upfront benefit, rather than ongoing payments, in order to prevent a spike in the pass-through cost to the entire customer base this upfront cost would need to passed through over time – the same timeframe as the current PFiT subsidy. It is proposed that the distribution network service provider (DNSP) bears the upfront cost of the BSS and finances this via a low cost debt facility. The DNSP passes through the principal and interest payments on the debt and any administration costs for the scheme to the customer base via their network charges.

Overall, as long as the discount accepted by the customer on the residual value of their PFiT is greater than the financing and administration costs of the BSS, then the cost passed through to the customer base of the BSS is less than the PFiT subsidy. These constraints can be applied at both an annual level and over the lifetime of the scheme to ensure that:

- the overall cost of this committed subsidy is reduced
- in every year of the scheme, the annual environmental charges are reduced for all customers

This scenario is shown in Figures 1 and 2 below.

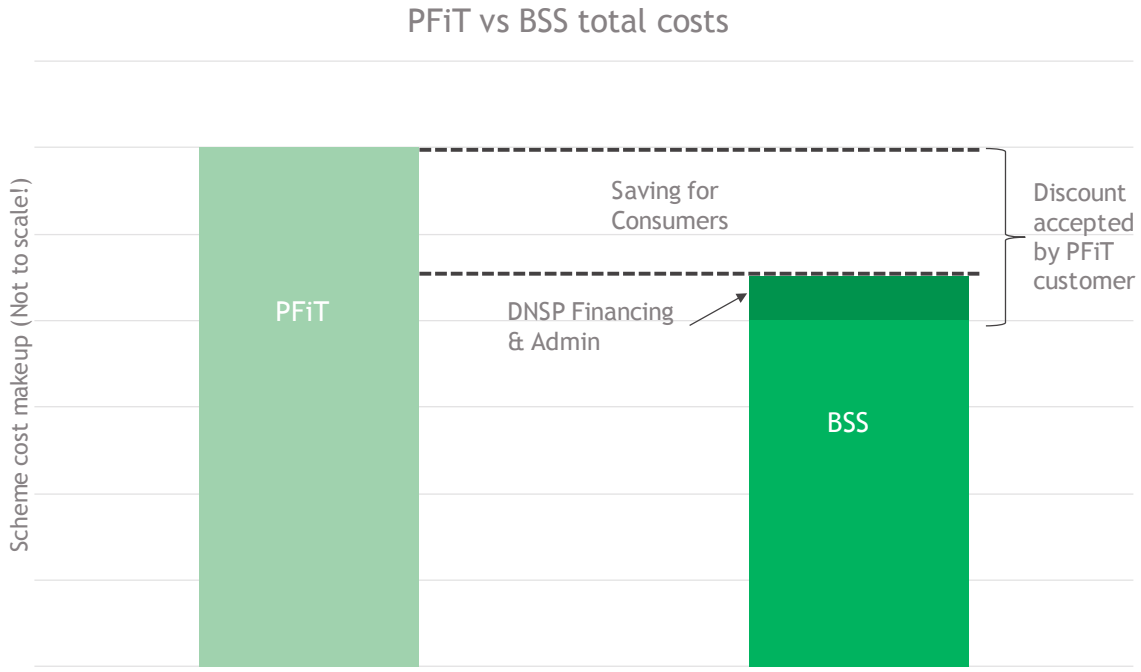

Figure 1: The total cost of the BSS scheme is less than the PFiT, representing a saving to all electricity customers

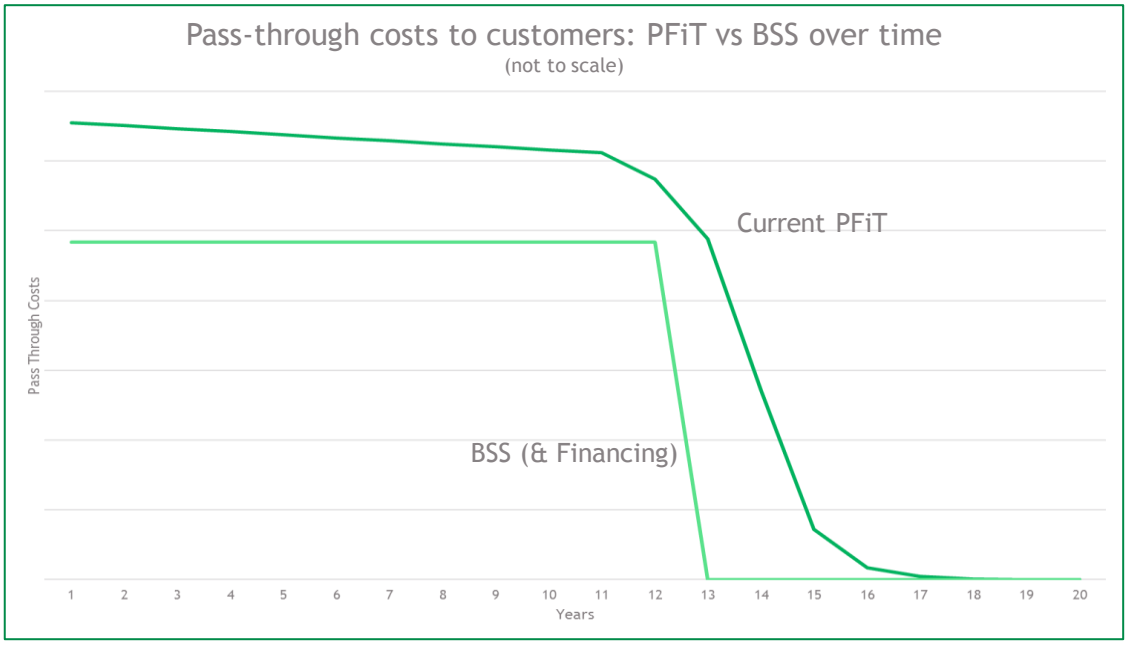

Figure 2: The scheme can be designed so that in each year, the pass-through costs to the customer base are reduced.

The introduction of a BSS would also enable the state government to define the minimum standards for eligibility – ensuring high quality systems and installation. Eligibility would also be contingent upon the battery storage system being integrated into a virtual power plant. This would provide additional benefit for the system owner, as they could access value streams from external markets and additional benefits for the remaining customer base from aggregated demand response at critical peak periods, improved local power quality and reduced network augmentation costs. This could have a significant impact on both network charges (due to reduced network capital costs) and wholesale energy costs (due to reduced market volatility).

Essentially, the broader customer base would receive both a reduction in the quantum of the subsidy that they are funding, plus a significant increase in the benefit they receive from that expense.

And the impact is substantial.

Our analysis suggests that the financial legacy of the state PFiT policies could be used to catalyse the installation of up to 960MW of distributed storage across Australia – at no cost to the customer base. Specifically, we estimate that the impact on each customer's bill due to the reduced environmental charges from the BSS would be, on average, $8/year.

If individuals chose to supplement the value of the BSS with additional funds to purchase a larger sized battery storage system commensurate with their solar PV specifications, the scale of the distributed storage could rise to 1.24GW.

Please see Appendix A for further detail on the potential scale of battery storage investment the BSS could generate in each state, plus the resulting bill saving for the residual customer base. Assumptions used in our modelling are detailed in Appendix B.

Realising the shift from PFiT to BSS – how the scheme could work

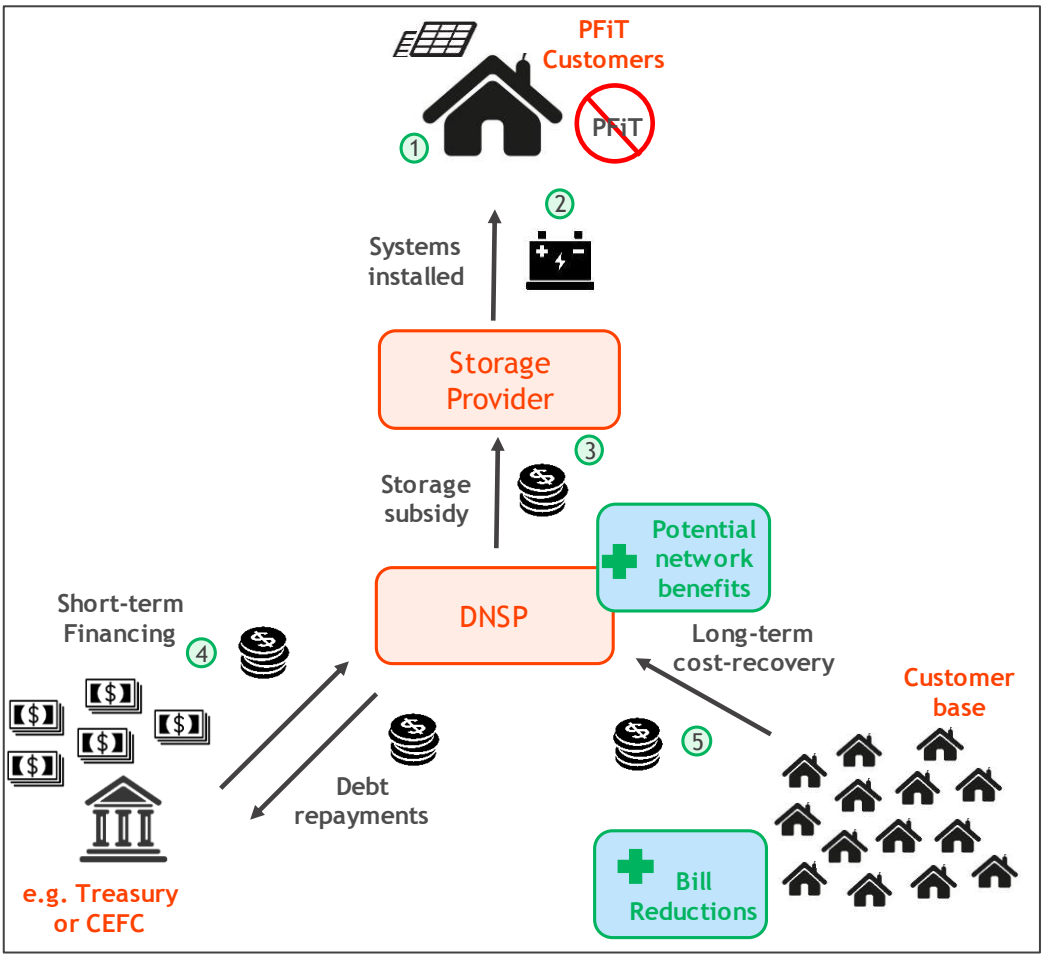

Figure 3: Schematic of the PFiT to BSS conversion

We suggest BSS scheme could be delivered as follows:

1. A customer chooses to convert the residual value of their PFiT subsidy, *at a discount*[1], into a subsidy to put towards a battery storage system. The BSS may cover the full cost of the battery and installation, or the customer can choose to co-invest in a system[2].
2. An eligible storage system – all of which are "VPP enabled" – is installed by an accredited installer.
3. The storage provider receives the lump sum subsidy from the DNSP and passes the saving onto the customer in the form of a discount off the listed price.
4. The DNSP covers the upfront cost of the BSS via a financing agreement at a low interest rate (possibly via State Treasuries or the Clean Energy Financing Corporation, alternately via other national or international sources of low-cost clean energy dedicated finance[3]).

[1] We have assumed that all customers accept a 15% discount on the future value of their PFiT

[2] In our modelling, the consumer can either chose a storage system that fits within their residual PFiT $ value ("Option 1"), or chose to invest an additional lump sum of their own to purchase a 5kW storage system ("Option 2") – if their subsidy rebate does not enable them to purchase that scale already. Please see Appendix A for the different impacts.

[3] Various internationally traded green bonds may also be interested in this innovative financing opportunity.

5. The DNSP recovers the cost of the BSS from the customer base via their network charges over the life of the scheme[4].

The storage financing charges are ***less*** than the discount off the original PFiT scheme, so the overall subsidy cost pass through to the customer base is reduced, as well as wider storage benefits being realised.

There are benefits for all stakeholders

The National Electricity Market, localised networks and network operators benefit from greater access to the value of battery storage for network services and support, improved power quality, reduced or delayed network augmentation expenditure and reduced volatility in the wholesale market. Overall, the impact on system security is significant. So to is the ability of the grid to integrate increased levels of intermittent renewable energy.

PFiT customers secure and realise the future value of their PFiT now. They can then be directly incentivised to be more active in new technologies, to increase the asset value of their property and gain facilitated, informed access to higher quality storage and related technology products and services. Depending on their energy use profile and tariff structure, they could also see their electricity bills reduced.

Non-PFiT customers benefit from the downward pressure on prices based on network cost saving and reduced wholesale market volatility, as well as the reduced cross-subsidy to their solar PV neighbours. They also accrue secondary benefits from an accelerated energy services markets (improved and lower cost energy products and services).

State and Commonwealth governments reduce the subsidy burden for the bulk of their constituents, improve power system security and reduce the risk of network events. (If that way designed, the detailed policies to implement this idea could also accrue system benefits discretely to low income or otherwise vulnerable customers.) The scheme also has the potential to stimulate significant jobs growth and the development of export markets in virtual power plant software and control systems.

The battery storage industry will grow into an accelerated market, with the opportunity for product innovation and significant catalyst for the development of high quality hardware and software that facilitates the virtual power plant concept. Significant employment opportunities in battery storage system sales, marketing, installation and maintenance would be created through the enactment of this scheme, just as the original PFiT policies created jobs and growth in the solar PV industry. The storage industry also has an incentive for high quality products and installation - ensuring that standards are maintained.

DNSPs benefit from greater access (via price signals to VPPs) to the value of battery storage for network services and support. This enables improved power quality and reduced network augmentation costs. The rapid uptake of battery storage also accelerates the transition to new, more innovative network business and operating models. Battery storage systems linked to a subsidy are also registered – so networks and other energy system stakeholders will have greater visibility of location and characteristics of installed systems. The BSS could also be linked to the uptake of cost reflective network tariffs (as these typically provide greater benefit to customers with

[4] We have assumed that the life of the BSS scheme in each state is equal to the remaining life of the PFiT scheme in that state.

battery storage systems) so this scheme could also accelerate the uptake of these new pricing approaches.

The wider energy services market benefits from a platform to accelerate the transition to new, innovative business models and the use of VPP products and services. Finally, the Australian energy sector will benefit from the real-world experience of the characteristics and optimisation of installed storage devices which can be exported and replicated elsewhere.

Unintended consequences need to be analysed and mitigated

We have identified some risks and challenges to the concept of converting the existing PFiT schemes to the BSS scheme. We would welcome the opportunity to work these through with yourselves and other interested parties.

Potential Issue	Initial Comment on Mitigation
Poor quality products and installations create commercial and physical risks for customers	Ensure appropriate Australian standards for storage products and installations are in place prior to scheme commencement Strict enforcement of product and installation standards via the BSS scheme's eligibility criteria
Domestic storage and installation industry is not prepared for demand	Staged BSS scheme tranches could limit the up-take of the scheme over a period. E.g. scheme funding released in 6 month blocks over a period of 2 years. Could be staged geographically, i.e. on the basis of where the network needs support most or where the most early-uptake (maximum value) PFiT accounts lie
Network prices increase due to increase in self-consumption (i.e. a further extension of the death spiral)	Any forecast impact on network prices could be offset by an increase in the discount offered to PFiT customers as part of the scheme Impact could be offset by the impact of controllable (e.g. via incentives and markets like deX) distributed battery storage on network CAPEX and OPEX Scheme could be linked to the take up of a cost reflective network tariff (demand tariff) by BSS recipients More detailed modelling is required on the overall impact on network prices based on reduced grid consumption and reduced network expenditure.
Reduced wholesale market volatility shuts down large scale generators	More detailed modelling is required on the impact on wholesale market volatility and subsequent contract prices and retail electricity prices – this could actually result in an additional saving for customers, without placing additional risk on energy supply.

Potential Issue	Initial Comment on Mitigation
Exploitation of scheme by customers e.g. customers intending to move house receive a windfall gain, customers with a faulty PV system receive a benefit	The scheme is designed to avoid cash payments, so customers cannot "take the cash and run" The scheme links the storage system to the PV system – so they must be co-located, so a battery system linked to a faulty PV system would still be of no value to the customer. Most PFiT schemes are attached to an address, so even if a customer moves house, the PFiT is transferrable to the new owner, so there is an ongoing liability under the PFiT scheme. Under the BSS scheme the customer could choose to relocate the entire PV/storage system when moving house, but this would not impact scheme benefits – and is unlikely[5]

[5] The Queensland Productivity Commission electricity pricing inquiry (2016) considered a premium feed-in tariff buyback option, where customers would essentially get cash in return for relinquishing their subsidy (i.e. it was not linked to the purchase of a battery storage system). The Commission dismissed the idea on the basis that scheme participants would be incentivised to accept a payout if they had intentions to sell their properties soon (ref: http://www.qpc.qld.gov.au/inquiries/electricity-pricing/). In Queensland, the PFiT is linked to the customer, not the address – so if the customer moves house the offer is extinguished. This is not the case in other states where the PFiT is linked to the address and is more transferrable to the new owners of a property.

Appendix A: PFiT subsidy restructure analysis by state

State	Number of PFiT Customers	PFiT Details	Residual PFiT Value	MW Storage - Option 1	MW Storage - Option 2	Avg. Customer Co-Invest for Option 2	Avg. savings for customer base
			Undiscounted	*Discounted cash-out only - no further investment by customers*	*Additional customer co-investment up to purchase of 5kW storage system*	*$/account*	*$/account/ year*
VIC	88,000	Net, $0.60/kWh, expires 2024	$700M	161 MW	224 MW	$2,270	$0.5/year
QLD	238,000	Net, $0.44/kWh, expires 2028	$3,590M	595 MW	607 MW	$151	$10/year
SA	70,000	Net, $0.44/kWh, expires 2028	$690M	115 MW	178 MW	$2,870	$8/year
ACT	10,000	Gross, $0.50/kWh - $0.30/kWh, expires between 2029 -2035	$190M	25 MW	25 MW	$0	$6/year
WA	Estimate 85,000	Net, $0.40/kWh expires 2021	$270M	66 MW	220 MW	$5,600	$12/year
Total	**491,000**		**$5,440M**	**962 MW**	**1,254 MW**	**$1,860 (w.avg)**	**$8/year (w.avg)**

Appendix B: Key model assumptions

BSS Scheme Assumptions

- Customers accept a 15% discount on the residual value of their PFiT subsidy
- Customers can only spend this money on an approved battery storage system
- The upfront payment to the battery storage provider is funded by the DNSP, who secures financing at an interest rate of 6% for a term equal to the remaining period of the PFiT scheme
- 100% of PFiT customers voluntarily take up the offer in the first year of the scheme

Average PV system assumptions

- Capacity factor is 15%
- Degradation rate of 0.5% p.a.
- 50% of energy generated is exported

Average storage system assumptions

- Cost per kWh of storage is $1,610/kWh (based on the average of 34 storage solutions, includes installation and inverter costs)
- Average power (kW) to storage (kWh) ratio is 51% (based on the average of 34 storage solutions)
- Average storage size is 5 kWh

Average customer assumptions

- Annual consumption is 7.441MWh (based on the ACT's assumptions for a typical 4 person household)

Other

- Estimated number of WA PFiT customers based on total MW of installed capacity across the duration of the scheme (based on APVI data) divided by an assumed average system size of 2.5kW.