Project Final Report
Commercialisation Plan

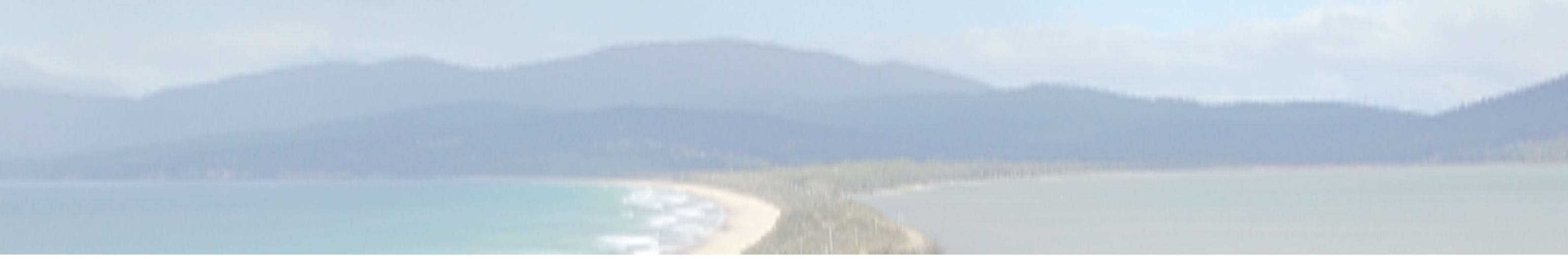
Luke Osborne
Pyramus Pty Ltd

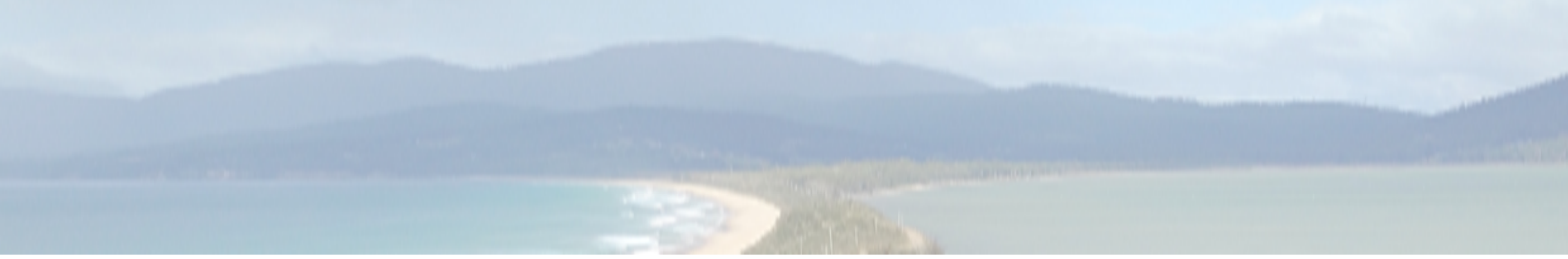
Luke.Osborne@pyramus.com.au

April 2019

http://brunybatterytrial.org

CONSORT: “Consumer Energy Systems Providing Cost-Effective Grid Support” is a collaboration between The Australian National University, The University of Sydney, University of Tasmania, Reposit Power and TasNetworks. The Australian Government, through the Australian Renewable Energy Agency, is providing $2.9m towards the $8m trial under its Research and Development Program.





Executive Summary

Network Aware Coordination (NAC) [1] is an award-winning technology, well-positioned as the marketplace for Australia's rapidly growing fleet of Distributed Energy Resources (DER).

DER are consumer-owned assets which have emerged as the cheapest and most reliable source of 'peaking' capacity. Peaking capacity is increasingly important as coal-fired generators retire at the same time as intermittent renewables come online. DER is set to play a vital role in keeping our future energy system balanced whilst keeping electricity costs in check. However, it is very important that this 'consumer power station' is well integrated with the existing wholesale market and respects the physical limits of the distribution grid. If DER is not well managed, the system will deteriorate; lowering reliability and increasing costs. The NAC is a superior technological solution integrating DER into our system. CSIRO and ENA found that a well integrated 'prosumer power station' will deliver the system a $100 billion benefit over coming decades [2].

It is no easy task to ensure the consumer power station works well for consumers, their retailers, networks, and our market simultaneously. At the time of writing, four models have been suggested by a process called Open Energy Networks [3]. Each model aims to understand and moderate the future behaviour of DER, whilst exposing them to wholesale market prices. The NAC can play a vital role in any of the four architectures.

To help understand the NAC, it is useful to compare it to a wholesale market optimiser called the NEM Dispatch Engine (NEMDE) which underpins the wholesale spot market. In simple terms, every 5 minutes NEMDE accepts bids from generators and then calculates a least-cost power setting for each, taking into account constraints in our transmission system. The NAC does something similar to NEMDE, but dispatching DER instead of generators, and managing the constraints in the much more complex distribution grid instead of the transmission grid. The NAC, using leading-edge computational optimisation, has been demonstrated operating on Bruny Island.

The NAC will automatically enrol DER into NEMDE's existing 'bid-stack', allowing the market operator to treat the DER resources like any other peaking generator. This in turn will make it easy for DER managers to access wholesale market revenues-and-savings without the cost of becoming an official NEM participant. In performing this market-linking role, the NAC will automatically respect grid constraints, allocating scarce capacity to the best economic use.

In our preferred architecture, it is proposed that the NAC be free for all participants, but that a small transaction fee be retained from trades to fund the cost of the platform.

The next step for the NAC is to scale-up operations from the successful Bruny Island trial. Key activities for this next project are to introduce a greater variety of DER, develop systems for bidding into NEMDE, and operate over a greater geographic range. Several funding options are being investigated.

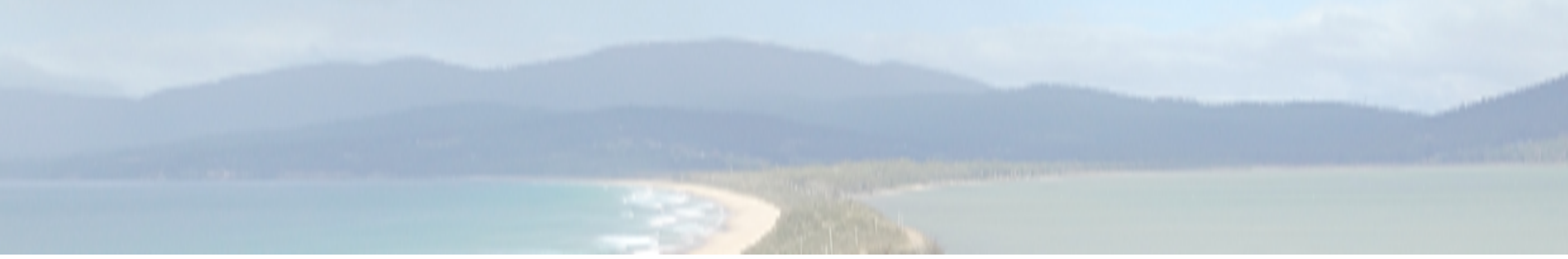
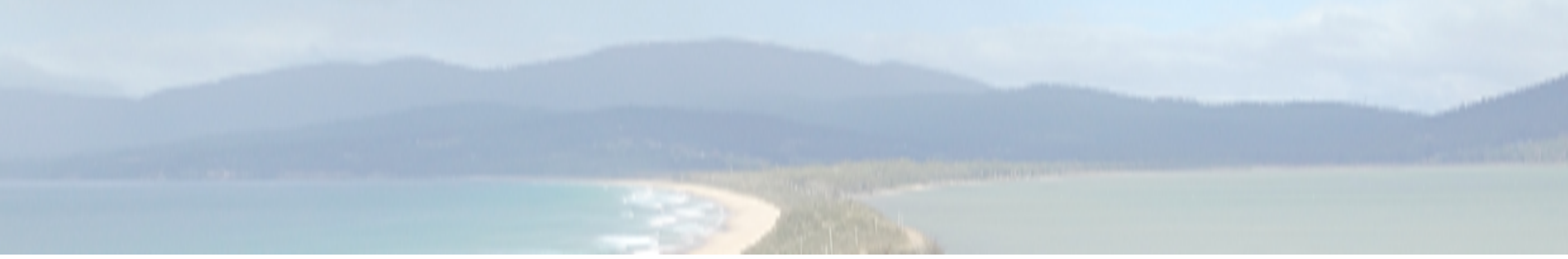


Table of Contents



About this Commercialisation Plan

This commercialisation plan has been prepared for the Australian Renewable Energy Agency (ARENA) on behalf of CONSORT. CONSORT is a collaboration between three universities (The Australian National University, The University of Sydney, and The University of Tasmania), electricity network provider TasNetworks, and Canberra-based DER control provider Reposit Power. CONSORT has developed and implemented technology known as ‘Network Aware Coordination’ (NAC) on Bruny Island, Tasmania [1].

CONSORT has been very successful in delivering the NAC. It has won a number of prestigious awards including:

1. Energy Networks Australia Industry Innovation Award 2018
2. Engineering Australia’s Engineering Excellence Award 2018
3. Clean Energy Council’s Community Engagement Award 2018
4. EESA’s Energy Project of the Year 2018

This commercialisation plan explains, at a high level, why the NAC is important to various parties in Australia’s electricity system. It goes on to describe a bold vision for the technology. This vision is the result of much investigation and analysis by ANU over the project period..

The report is written with the assumption that funding and human resources will be available. This will be needed to implement those parts of the NAC system which have not yet been fully demonstrated, and scale up the successful Bruny Island Battery Trial.

The report assumes a moderate level of knowledge about the Australian National Electricity Market (NEM).

What is the Commercial Vision for the NAC?

The NAC will make it easy to link distributed energy resources (DER) to Australia's existing wholesale electricity market.

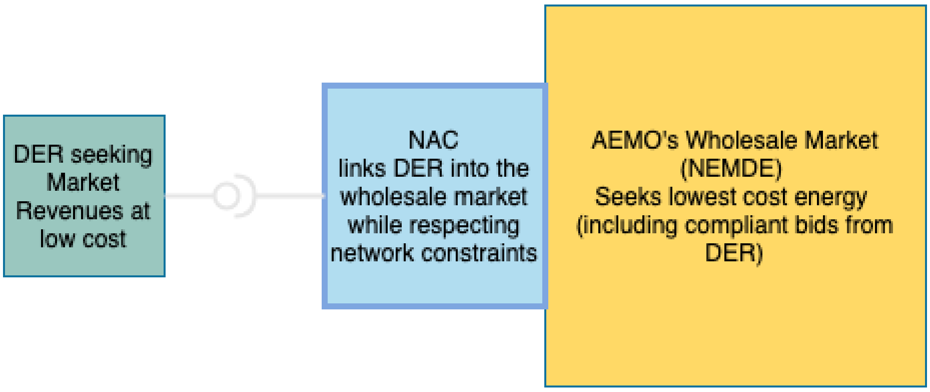


Figure 1. The NAC links DER into the Market.

Unlike competing solutions the NAC will:

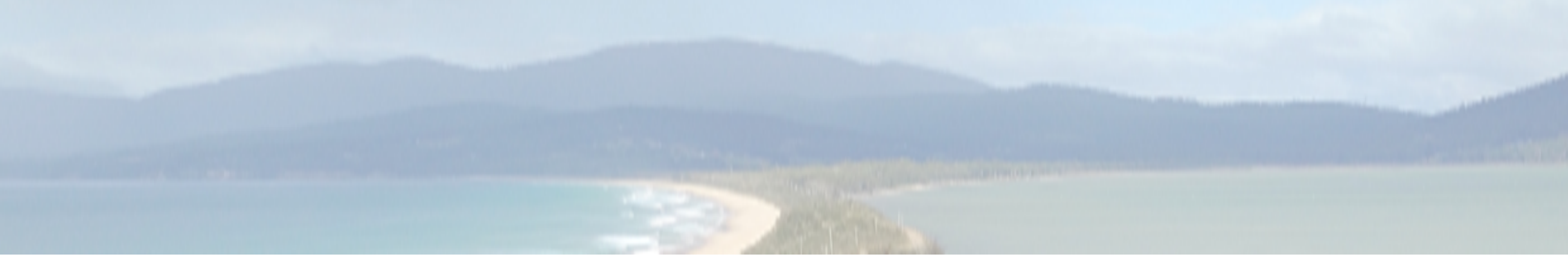
- **Make it easy for DER managers** to access wholesale market revenues-and-savings without the cost of becoming an official NEM participant;
- **Automatically respect grid constraints**, allocating scarce grid capacity to the best economic use;
- **Automatically enrol DER into AEMO's existing 'bid-stack'**, allowing AEMO to treat the DER resources like any other generator;

Unlike alternatives, the NAC will maximise the value of consumer-owned DER to Australia's grid; which is projected by CSIRO and ENA [2] to deliver up to $100 billion of additional value to the system, saving all Australian's up to $600 per annum on their electricity bills.

The Consumer Power Station: a vital contributor to our system

The Promise of the Consumer Power Station.

The NAC is designed to allow for the growth of an enormous new power station. Often this is called a Virtual Power Plant (VPP) but we prefer the alternate name of the Consumer Power Station (CPS) in order to distinguish it from the business entity known as a VPP provider.



The CPS relies on consumers purchasing equipment which can increase and decrease power on their grid connection point ‘on-demand’. Typically, DER include equipment such as solar panels, batteries, pool pumps, air-conditioners and hot-water systems. Harnessing DER to actively participate in markets, often through the internet, creates the CPS.

At the time of writing the CPS has demonstrated technical capability on Bruny Island, in the ACT, South Australia, and elsewhere. But these same trials (and early commercial models) have also highlighted the very real challenges in involving the consumer in an active power station. Uptake rates are slower than hoped, and lessons on Bruny, which has the most thorough social science component in Australia, shows that consumer participation remains uncertain. It is worth asking “is the CPS worth fighting for?” This question is examined briefly below.

The seminal study into the potential of the CPS in Australia was the Network Transformation Roadmap (NTR) developed in partnership by CSIRO and Energy Networks Australia (ENA) and published in 2017 [2]. We will draw on this analysis to describe the potential value of the CPS.

The NTR studied a scenario, which maximised the CPS potential, against a counterfactual business-as-usual approach. It found the CPS would deliver approximately $100 billion to the Australian electricity sector over the next 30 years compared to a future without it. This translates to making each Australian household $600 per annum better off, even those without DER installed.

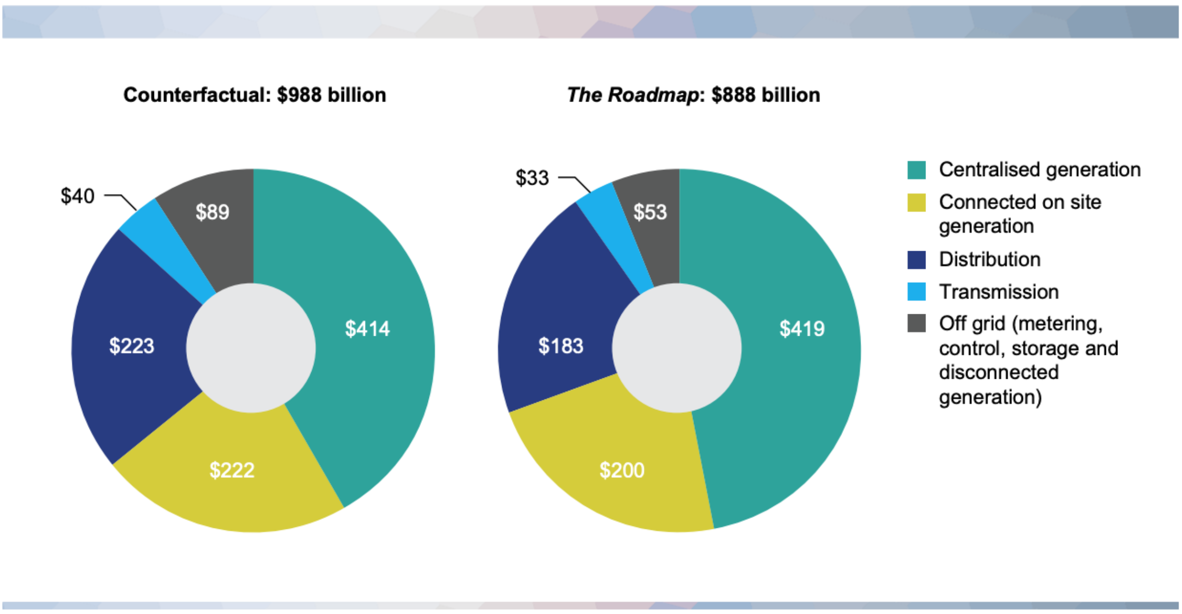


Figure 2 This figure, taken from the NTR, shows significant savings derived from the CPS.

The cost savings will be spread across a number of areas but the following ones dominate:

1. We can save about $40 billion on our distribution grid by running it more efficiently and avoiding peaks in consumption.
2. We can save consumers, who would otherwise defect and go off-grid, $36 billion by allowing them to stay on and preserve the benefits of a shared grid.
3. We can save consumers, who would otherwise over-size their DER investments, $22 billion.

It is helpful to give the CPS value of $100 billion some context:

- It is about the same size of the current market capitalisation of Australia's largest company BHP Ltd ($109 billion at the time of writing);
- This amount would purchase all of the energy generated in the NEM for 6 years;
- Is roughly the same value as the entire national transmission and distribution grid.

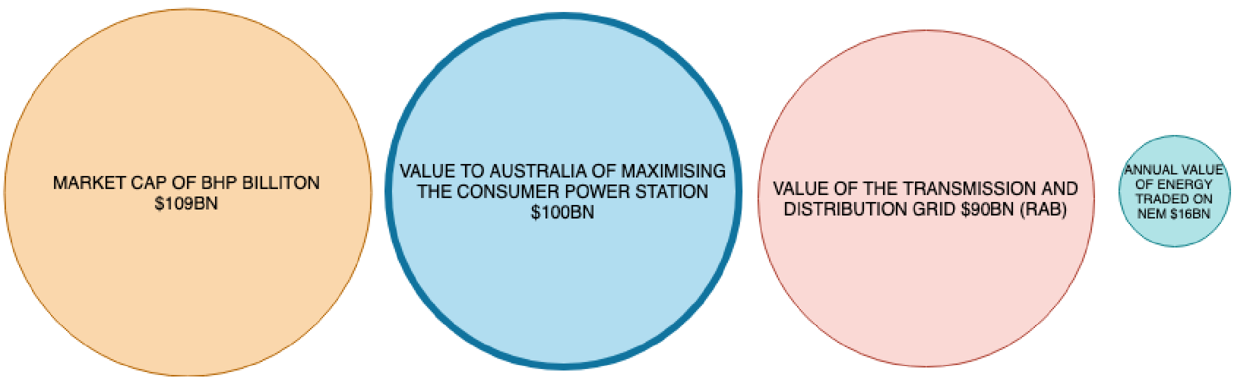
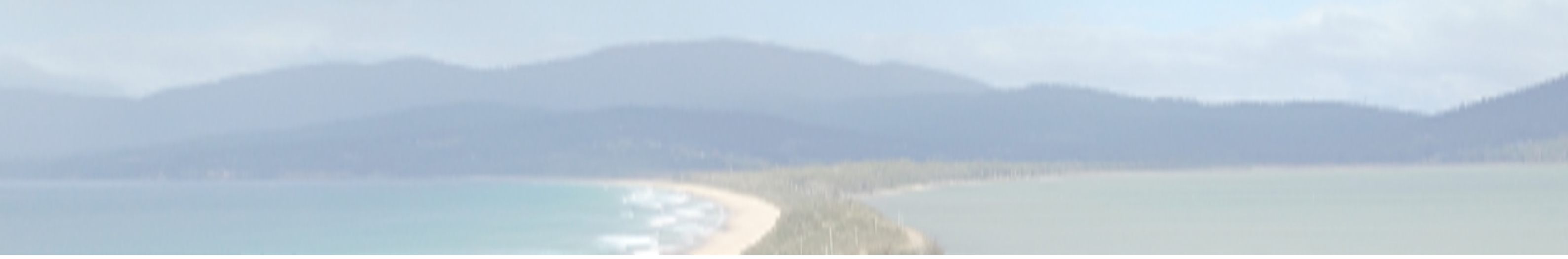


Figure 3 Comparing the Value of the CPS to other well-known quantities helps us to understand its importance.

On top of large savings for consumers, detailed at length in the NTR, there are significant carbon abatement benefits from the CPS. It can be used to complement and facilitate large-scale renewables on the generation side by ramping and reducing the demand-side in sympathy.

The NTR predicted that up to 80GW of capacity would be installed on the demand-side by 2050. This enormous capacity is over double the present peak demand in the NEM. Already over 7GW has been installed.

We can conclude that the concept of a CPS, worth the same as the entire network of poles and wires and producing a substantial proportion of peak generation - is well worth working hard for.



The NAC Technology

This is a commercial document and is not primarily concerned with the internal workings of the NAC. Instead it focuses on benefits for users of the platform, models for commercial operation and discussion of competing solutions. However, it is important to briefly explore the internal operations of the NAC so that a layperson can grasp the important differences between the NAC and other proposed solutions.

Optimal Power Flow (OPF) and the NAC

Optimal Power Flow (OPF) is a well-established subject in electricity grid management; including in the National Electricity Market (NEM). OPF seeks to solve the problem of configuring the electricity system to achieve lowest overall cost whilst at the same time ensuring system security.

Even ignoring the distribution grid, the NEM is very complex, with many generators of different types and running costs, interconnectors, constraints in the network, switches, transformers and variable loads. Without an OPF technology assisting AEMO to select the right settings in the NEM, it would be almost impossible to do anything other than manage the system very conservatively (which implies a very high cost).

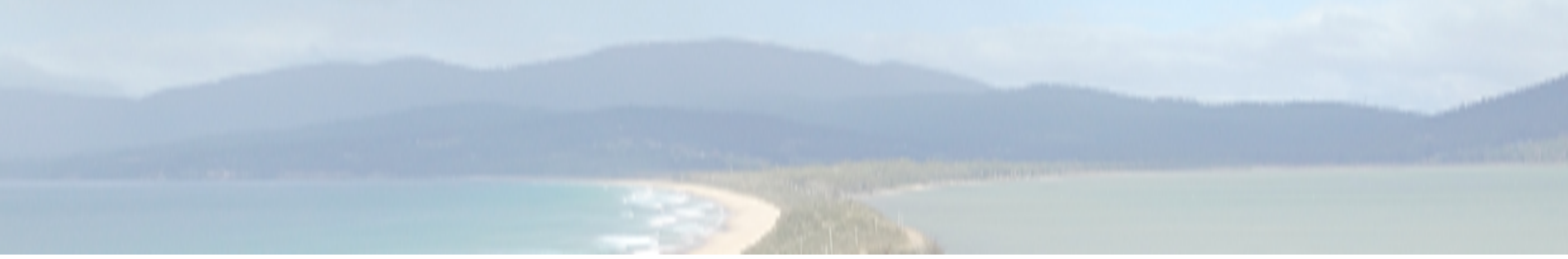
In the NEM, a computational solver known as the NEM Dispatch Engine (NEMDE) solves a simplified version of OPF. It calculates the best ‘dispatch’ power settings for traditional generators and interconnectors (i.e. the macro elements of our system), whilst respecting the physical limitations of the transmission network and our need for system security. Without NEMDE, our electricity would be a lot more expensive because operators would be forced to make more conservative, sub-optimal decisions.

The NAC applies OPF in the distribution grid. Like NEMDE, it seeks to find the economically-optimal dispatch solution for DER whilst respecting physical limits of the network.

Solving OPF at Scale

Optimal power flow achieves the best dispatch of resources, within the network constraints, but it is a fundamentally challenging problem to solve. This means that, independent of what algorithm is used, it may not be possible to solve the most accurate form of OPF in a timely manner for a 5-minute market.

It is vital to understand that this ‘intractability’ is a property of the problem itself. It is NOT a property of the algorithm selected to solve the problem. One cannot make an intractable problem become tractable, no more than one can change the laws of physics. Intractability



means that NO algorithm will be able to find a solution in ALL circumstances in reasonable time.

When faced with an intractable problem, the designer of an algorithm can pursue one of three strategies;

1. Solve a different problem, i.e. a tractable approximation of the problem;
2. Solve the problem directly using clever algorithms likely to work well for most of the cases, and fall back on other strategies to manage the cases where intractability bites; and/or
3. Pre-compute solutions to common scenarios by brute force (over long time periods) and then pick from these pre-calculated solutions as one needs them.

NEMDE mainly uses Strategy 1; it solves a simplified problem at the expense of being somewhat sub-optimal at choosing the least-cost solution (however we don't believe anyone has quantified just how sub-optimal these solutions are). The NAC mainly uses Strategy 2; it fully solves for OPF but falls back on 1 & 3 when it needs to, e.g., by using targeted approximations still produce good solutions, and safe default operating limits in cases of communications outages. Testing to date on Bruny Island suggests that the NAC's strategy works well in the distribution grid. Strategy 3: pre-computation, may work in the short term or for specific simplified settings, but it is unlikely to work well in the general case for the distribution grid, because the number of scenarios is far too large. It is however being proposed by others.

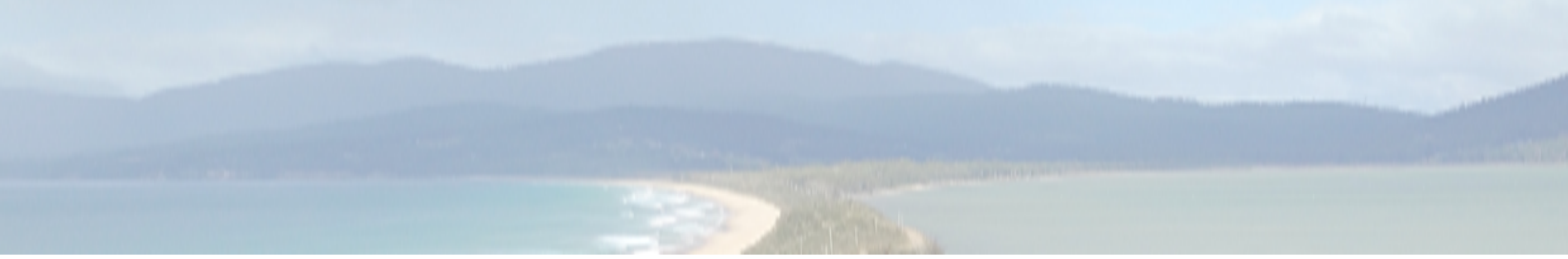
The NAC is developed by the nation's foremost experts in the solutions to such problems. This, of course, is how it should be, just as NEMDE was designed by experts tackling a similar problem. The problem cannot be made tractable. Instead, when choosing how to integrate the CPS into our markets, we must debate the choice of Strategies 1-3.

NAC: A Multi-Sided Marketplace

The NAC is a multi-sided market. Such a platform needs to be good for all participants. In this case there are three direct participants:

- Distribution networks;
- Retailers-with-DER-equipped-consumers; and
- The market operator, AEMO.

There are two indirect participants: consumers and regulators.



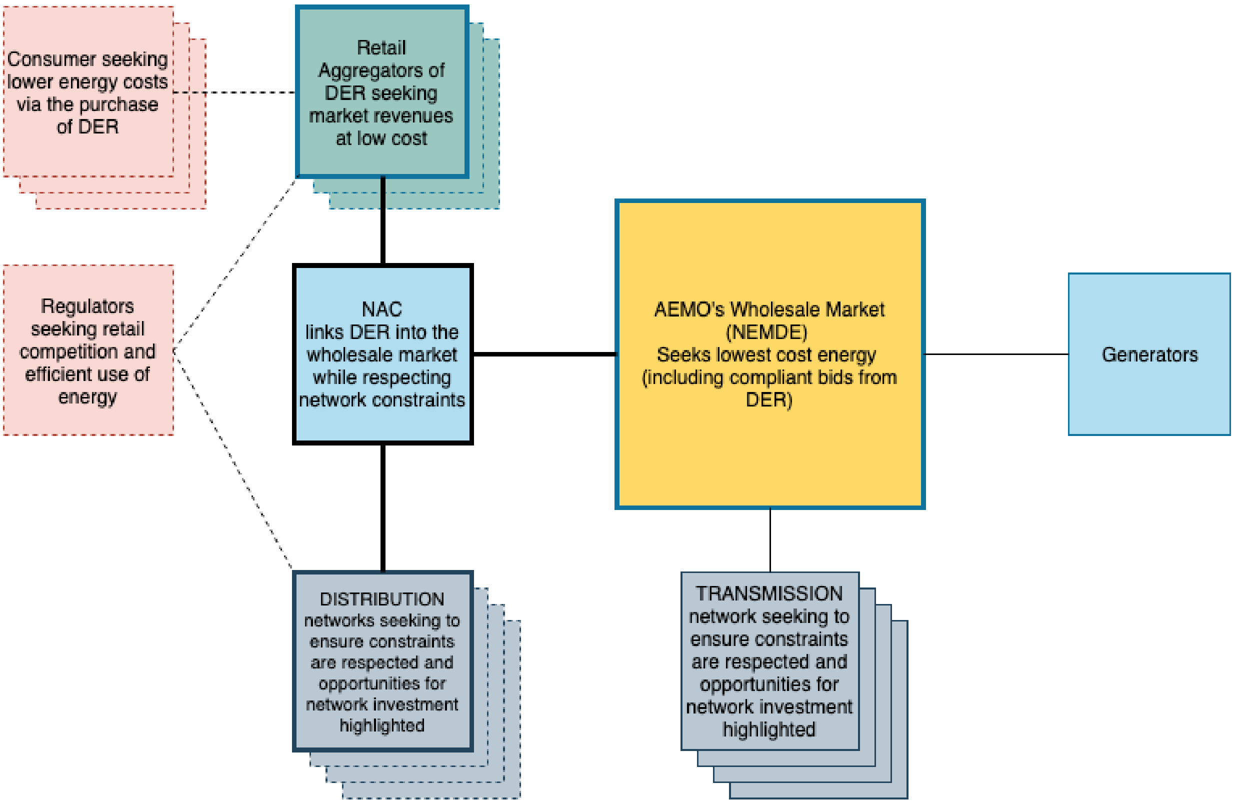


Figure 4 NAC is a multi-sided market with three users: retailers, networks and AEMO. It can meet the needs of each. By doing so, it can also meet the needs of regulators and consumers.

Each of the NAC users is explored further below. The needs of each user are examined and the NAC's value proposition for each explained.

Meeting the Needs of Retailers and Aggregators

Retailers are aggregators of consumer load. Increasingly they are also aggregators of DER and are therefore targeted as users for the NAC.

Retail business models, when analysed dispassionately, have three important measures: the cost of acquiring new customers, the cost of serving existing customers, and the revenue earned per customer. Retailers are interested in DER in order to improve these measures: they desire longer term relationships with customers, they want a differentiated offering in order to attract new customers cheaply, and they want to use the DER to generate additional revenue (which in turn allows a cheaper service offering to customers).

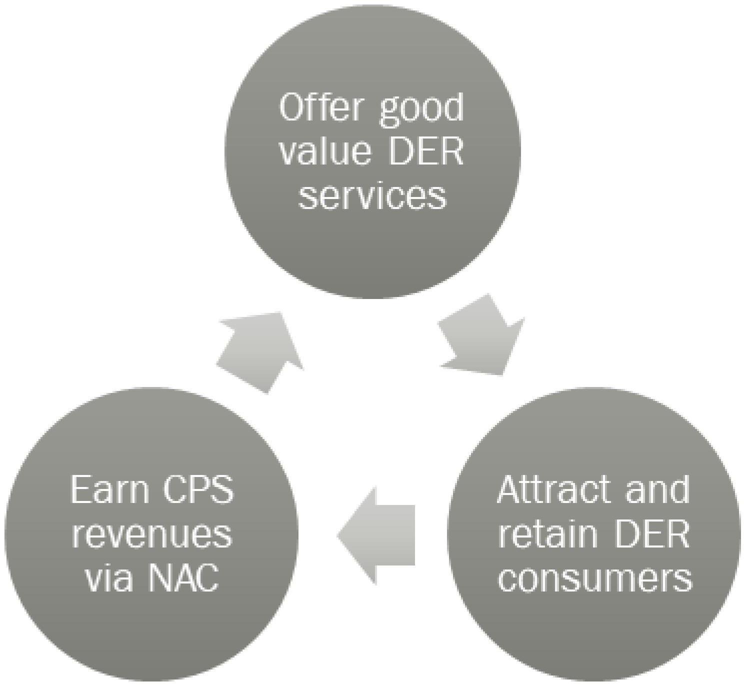


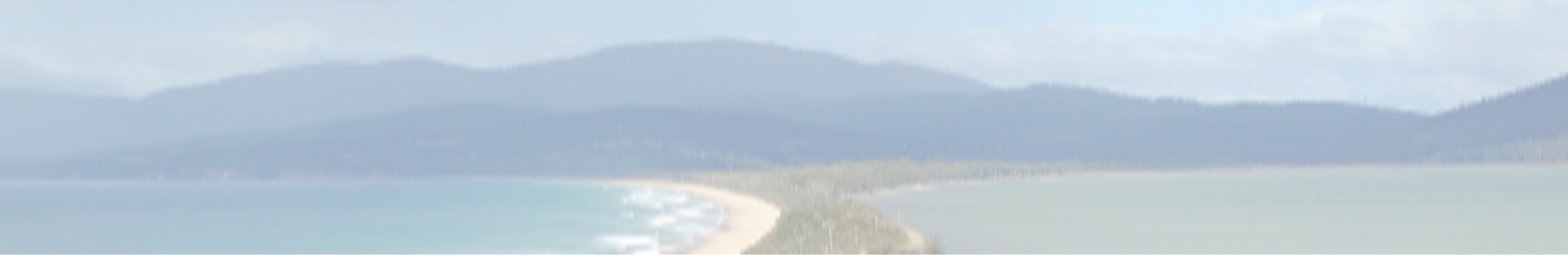
Figure 5 DER, when coupled with the NAC, can transform retail business performance.

Retailers interested in DER are facing difficulties:

1. Market access is difficult. Retailers face considerable barriers when participating in the ancillary markets, which requires an extensive regulatory authorisation process. Further difficulties are encountered in bidding due to a 1MW integer bid requirement and a high speed metering constraint.
2. Regulatory costs are certain to increase. Without the NAC, there will be regulation forcing declaration of dispatch intentions to AEMO and networks, and perhaps greater obligations such as bidding.
3. The Consumer Power Station is shrinking, lowering revenue per customer. CPS outputs are being lowered and made uncertain due to constraints imposed by networks.

These factors, when combined with the difficulty of working with confused consumers and difficult-to-integrate hardware, threaten to kill the CPS before it gets fully started.

The NAC will be an easy single sign-on system, which minimises curtailment for the most competitive DER. NAC has the potential to manage the complexity of interfaces to markets and networks. The NAC will free retailers to focus on offering customers great, competitive energy products and services. The revenues earned via NAC from market participation help retailers thrive in an otherwise unprofitable customer segment.



Meeting the Needs of Networks

Just as transmission providers are vital to generators, distribution networks are vitally important to the CPS. We must only use the CPS within the constraints of the network.

Networks are focused on:

1. Excessive feed in: The need to constrain record levels of roof-top PV. At high penetrations, these generators threaten system security and reliability.
2. Excessive peak demand: As more demand-manageable appliances like pool pumps and batteries enter the market, networks are concerned that these may push up peak demand if used in a non-network aware manner.
3. Electrification of Transport: Finally, networks are concerned about the mooted electrification of transport and the prospect of energy hungry-EVs or on-site hydrogen generators; both are far larger than grid architects anticipated.

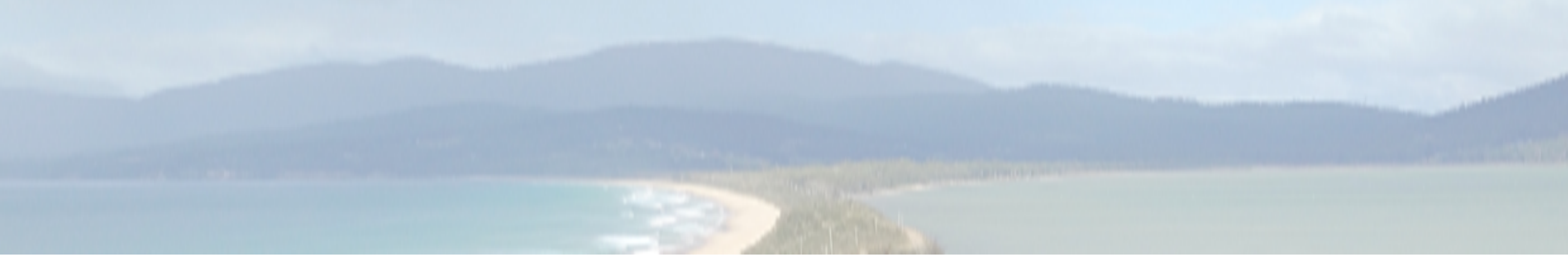
Without taking away from very helpful programs such as the Demand Management Incentive Scheme (DMIS), there are few financial upsides for networks in the rapid changes occurring in distributed energy. We are in a period of network austerity so there is little prospect of profit growth. Market rules mean networks cannot recover costs by charging for feed-in, and there is little to be gained financially from the application of DER to network load management. This is because we reward networks for capital investment and not operational costs. Regulatory ‘ring fencing’ means new DER-related business opportunities are difficult to pursue. In short, networks are (through no fault of their own), significant barriers to realising enormous gains for Australia’s electricity system.

In the present regulatory environment, there is little gain, but there is <u>risk</u>, for networks in DER growth. Risk of community outrage from outages or over-voltages; both of which are potential symptoms of high DER penetration. There is also the opposite – risk of community outrage from denial of export rights.

Networks such as SAPN and EQ are responding by building constraint engines which are designed to send constraint signals to DER (likely to be similar to AS4755 DRED controls which are extensively used for AC control in Queensland and/or based on ISO2030.5 demand response standard). These constraint engines are go by several names, the clearest of which is Dynamic Hosting Capacity Engines (DHCE).

Without well-designed algorithms to deliver OPF (as described above), these constraint engines will suffer problems. They will grossly under-utilise network capacity, having no economic means of allocating available network capacity between multiple parties. Further, such schemes will increase the operational cost of networks in the form of additional staff and software licence fees.

The NAC offers networks a means of ensuring DER respects network constraints, without having to build and operate a DHCE. The networks will be able to publish network models to the NAC on an as-needs basis. Feeders or distributors with few issues will need only basic



network information. Where DER problems exist, a more detailed model can be developed. Ideally these network models are exportable from Advanced Distribution Management System (ADMS) systems.

It should be noted that all networks, with the exception of Evoenergy, have poor data on the LV network. For many good reasons, including interfacing with the NAC, this situation needs to be remedied. NAC can accept basic network models where data has not yet been collected, and information can be improved over time. For example, on Bruny Island , the NAC uses an 11kV model and does not go down the LV level yet.

As a result of its ‘price discovery’ for DER, NAC will be able to highlight hotspots of congestion where the CPS is being heavily constrained. These are areas where the network might justify network augmentation to unlock market benefits. Addressing these needs helps the network generate profit.

Meeting the Needs of the Market Operator

The market operator has a major problem. The proportion of generation over which it has direct control over is diminishing; wind and solar are entering, coal is exiting. This problem is most acute in South Australia which may soon in some intervals have a net demand of zero; the entirety of generation may met by demand-side solar. This makes it very difficult for AEMO to manage security - a sudden fall in solar generation would leave SA short of power, but with no generation side dispatched, there would no be plant available to ramp-up output.

The Consumer Power Station (CPS), a multi-gigawatt flexible resource, would be of great assistance to AEMO in controlling this new portfolio. However, the status quo is unsatisfactory for the following reasons:

- **Barriers to participation:** It is proving difficult and costly for retailers to register DER for ancillary markets.
- **Invisibility:** Treating DER as a negative demand ‘price taker’ in the energy market, which is presently how VPP companies such as Reposit must operate, interferes with the forecasting and bidding processes. DER is helping demand become more responsive to prices, which is a good thing, but AEMO does not have visibility of this new feedback loop. It can never know with certainty what the net load will be without direct participation of the CPS in the market.
- **Constraints are uncertain:** DSO style constraint engines, operated separately from the market, are likely to lead to uncertainty in the quantity of energy available from the CPS.

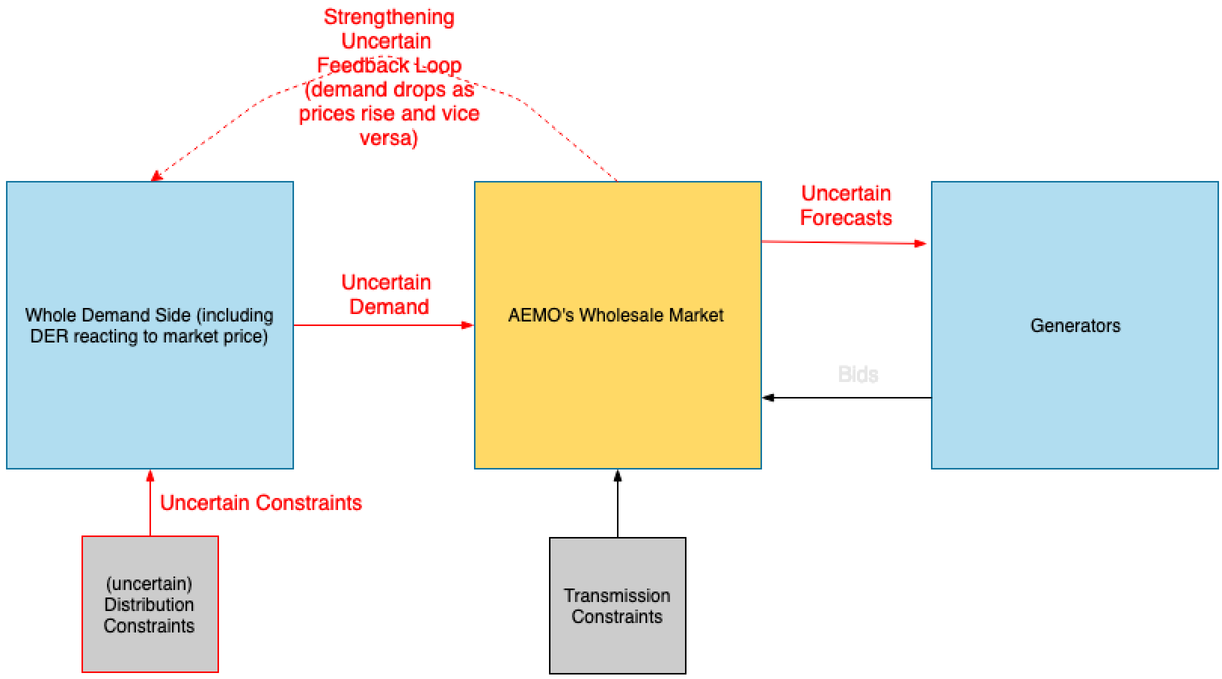


Figure 6. If DER continues to operate as price responsive negative load, then forecasts become increasingly difficult, making dispatch less accurate.

The NAC makes it easy for AEMO to properly integrate the CPS into its markets. Retailers can participate in the energy and ancillary markets simply by enrolling in the NAC. The NAC will be able to aggregate this DER into a NEMDE-compatible bid, meaning that NEMDE does not need to be radically altered. The NAC considers network constraints when formulating bids, so the bids may be considered firm. By separating DER from normal demand, it should facilitate improvements in demand forecasts, thereby improving dispatch accuracy on the generation side.

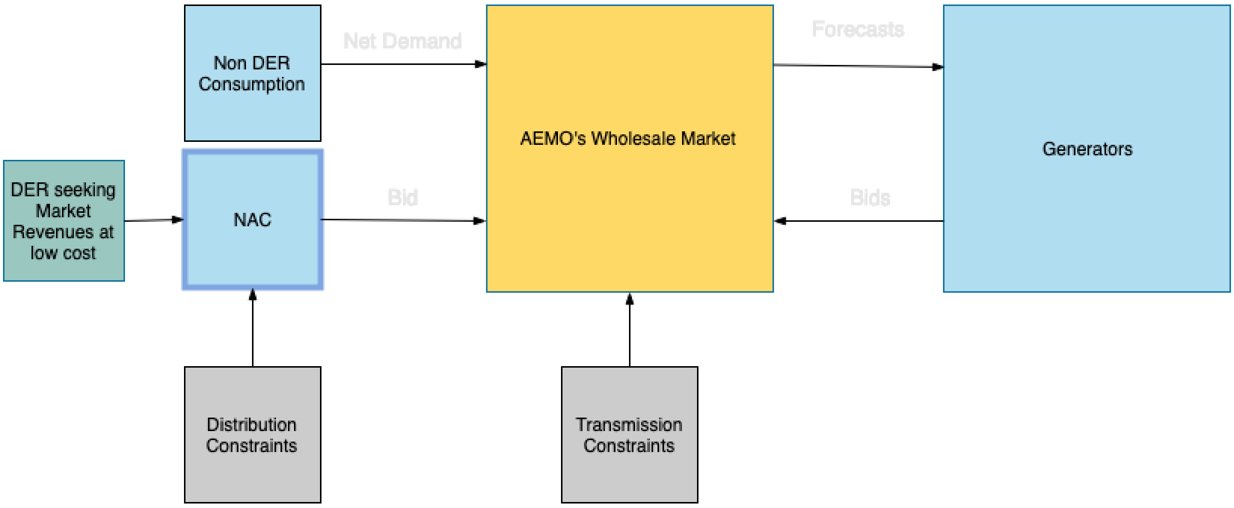


Figure 7. The NAC solves AEMO's problem by separating price-responsive DER from other consumption, and making it explicitly available to NEMDE, improving forecasts, reducing prices and making it more likely that dispatch will equal load.

Meeting the Needs of Regulators.

The electricity system is highly regulated for good reason. Regulators have manifold concerns when it comes to the emerging DER market. Below are two reasons for regulators to support the NAC as it can:

1. **Preserve retail competition;** DER are long-lived physical appliances. DER can be used for 'lock-in' by tightly integrating retail services to operation of the physical device, thereby preventing the consumer from changing retailer. The AER and AEMC are seeking 'interoperability' which allows a consumer to change retailer without loss of functionality. The NAC allows for interoperability;
2. **Ensure economic efficiency;** As discussed above, the CPS is-, and will be-, the most important generation source in our future grid. By properly solving for optimal-power-flows, and allocating the scarce grid resource to the most valuable DER, the NAC is most likely to gain a dividend of up to $100 billion for the nation's electricity market. Further, the NAC will help reveal which grid investments in the distribution grid have the best cost-benefit ratios.

Revenue Model for the NAC

One important aspect of a commercialisation plan is describing a revenue model. This can be challenging for a multi-sided platform such as NAC – which users should pay for it?

It is early in the commercialisation of the NAC so the revenue models here-in are subject to change.

Transaction Levy Based Revenue Model

The transaction levy based revenue model would make the NAC free for networks. It would also be free for retailers (and their VPP partners) to connect. It is proposed that the NAC gathers revenue in the same manner as AEMO, by taking a small levy on trades. This levy would be deducted in the settlement process with retailers. This is depicted in the diagram below.

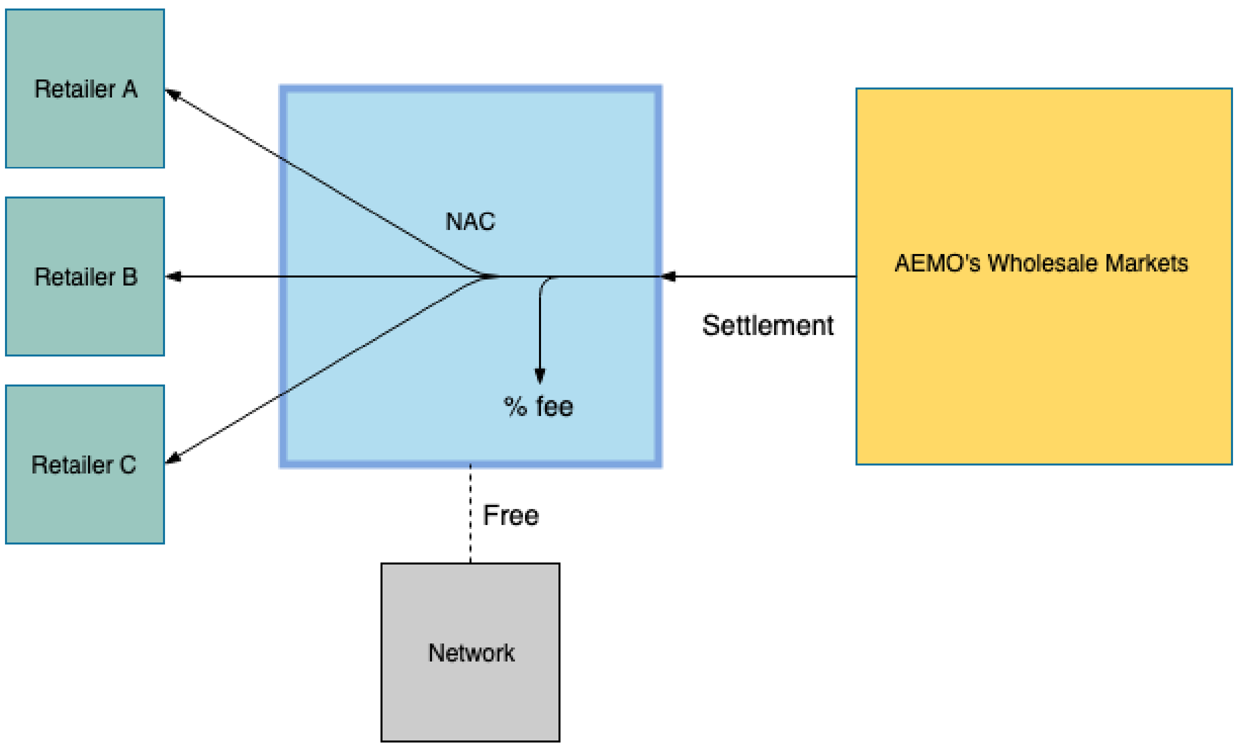


Figure 8 A transaction fee based revenue model

Until trading volume built up to significant levels, the NAC would need its cost-of-operation funded by another source.

Fully Funded by AEMO

Another model is to fully fund the NAC via AEMO (perhaps via incorporating NAC within AEMO). This is justified as the NAC may be perceived as a natural extension of AEMO's role. AEMO itself recovers its costs as a fee on trades, so part of this revenue would be redirected to the NAC.

In this model, the NAC would be free for both retailers and networks

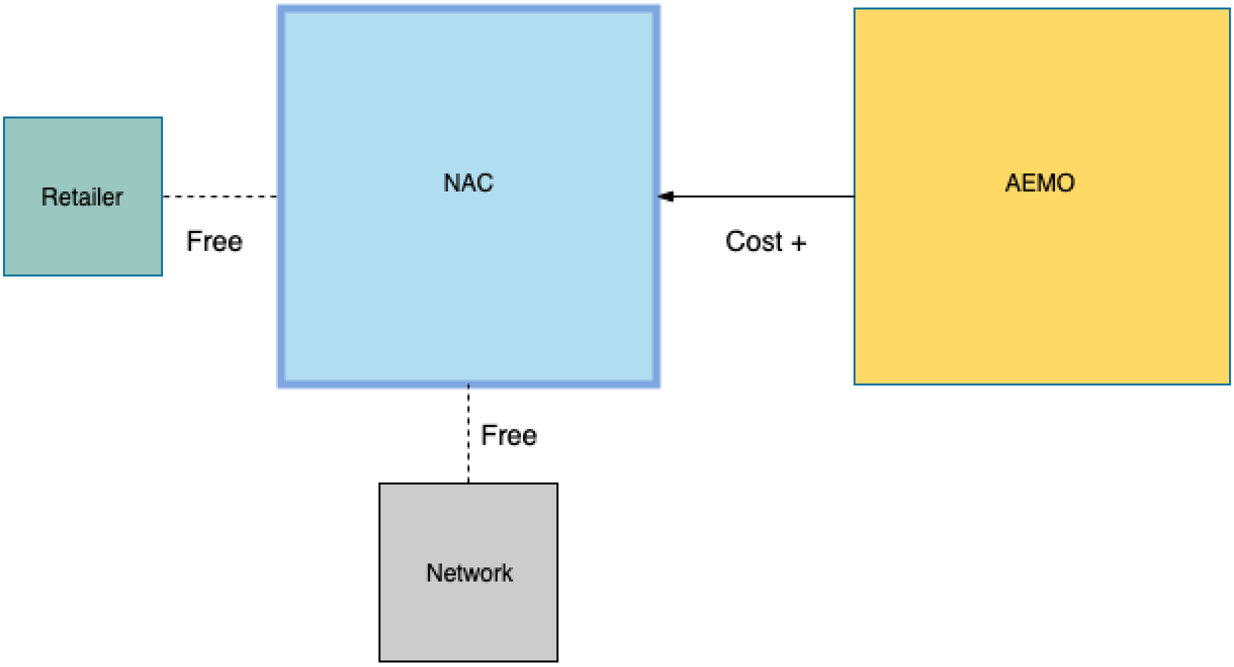
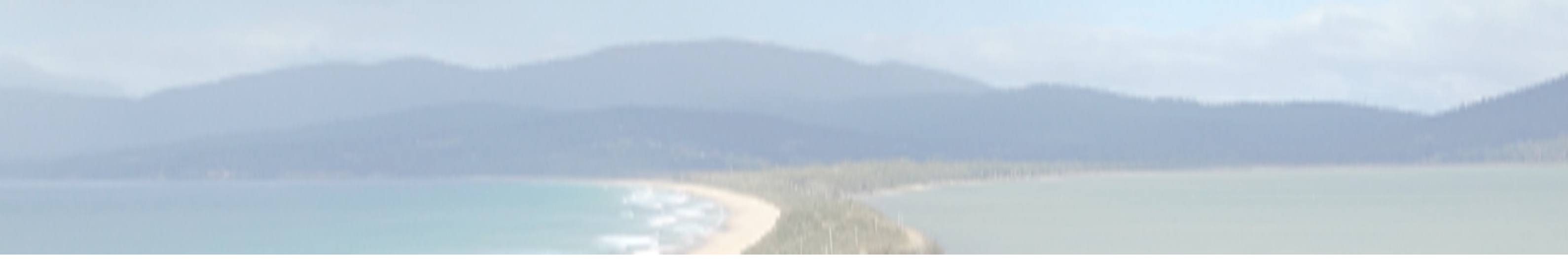


Figure 9 A cost recovery model based on AEMO reimbursement



Other Emerging Technologies and Models

The NAC is a principled tool for network-aware orchestration. It can support different system architectures. The AEMO & ENA 'Open Energy Networks' project outlined four potential models [3]. The NAC can play a vital role in each.

It is first worth noting that each of the four models seeks to do the same thing: understand and modify the future power-set-points of DER. The aim for every model is cheaper AND more reliable energy system; a result of offering new DER peaking capacity into the market, whilst at the same time respecting network limitations. The models differ only in ownership of certain functions, allocation of costs, and degree of modularity.

These differences have important implications for the NAC. Some players, such as networks, are less likely to adopt a principled Optimal Power Flow tool. Their immediate interests may be met by simpler, less optimal tools such as constraint engines. We therefore favour models which have independent, or AEMO-controlled responsibility for OPF.

Our preferred model is is close to each of the models known as the Single Integrated Platform, the Hybrid Model, and the Independent DSO. For the reasons outlined above, we are less inclined to believe the Two Step Tiered Model is well suited to the NAC.

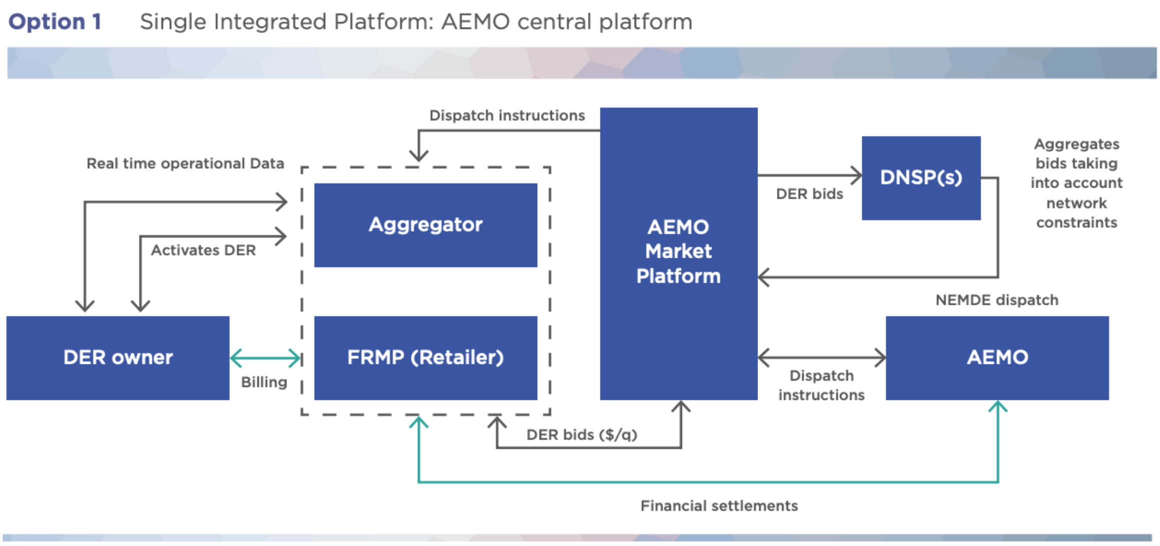
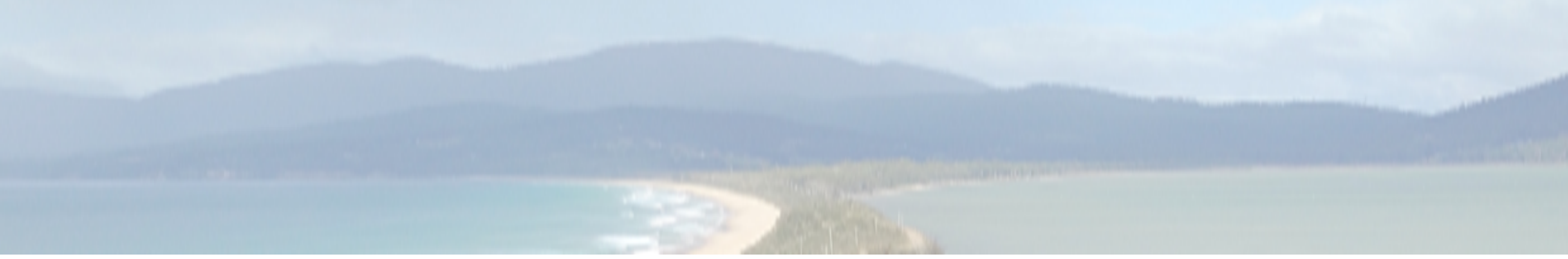


Figure 10 Open Energy Single Integrated Platform model from [3]

Other emerging architectures are discussed further below.



VPPs

Virtual Power Plants are operational today from companies such as Reposit, Tesla, Sonnen and SolarEdge. VPPs are typically operated in conjunction with a retailer-partner which offers discount- or credit- style energy plans to consumers in return for wholesale energy and FCAS services from DER. Reposit's GridCredits®, available from a number of retailers, is an example.

Most VPP providers recognise that they cannot indefinitely continue to dispatch DER without managing network constraints. They are therefore active participants in exploring each of the models discussed below. It is unlikely therefore that stand-alone VPPs will be a long term alternative to the NAC. VPPs and their retailer partners will however be important users and beneficiaries of the NAC.

Distributed Energy Resource Management Systems (DERMS)

DERMS are typically extensions to Advanced Distribution Management Systems (ADMS) but are also offered by third parties. ADMS is used by control rooms to manage network status and operations. As the ADMS is the hub of network operations, many networks are attracted to modules being offered by their ADMS providers (most Australian networks use systems provided by Schneider/Telvent or GE).

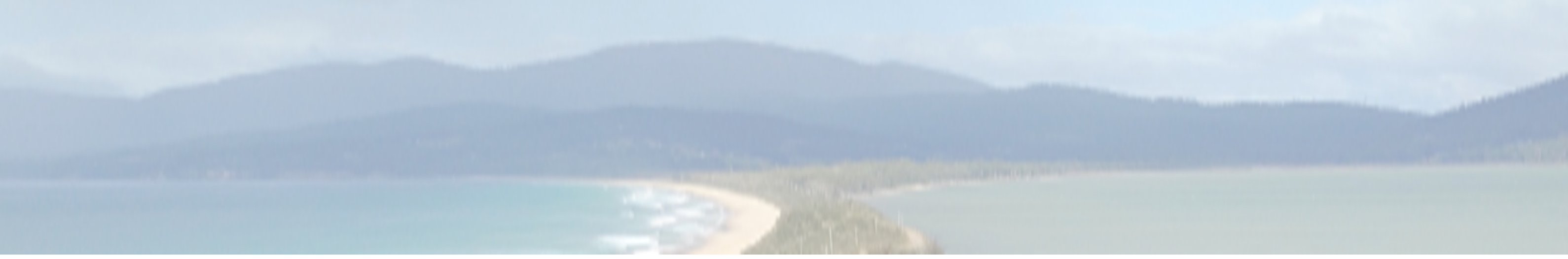
The scope of DERMS modules are not yet fully clear. Horizon Power (WA, microgrid network operator) has recently invested a DERMS by PXiCE. This flavour of DERMS assists in microgrid stability by rapidly controlling DER set points in response to microgrid frequency. A number of other systems, such Embala's DERMS, offer frequency control solutions to larger grids.

DERMS are credible because networks are strongly partnered with their ADMS provider and resistant to the implementation of additional software. The NAC can minimise this threat by ensuring it is compatible with ADMS outputs.

One significant problem for international DERMS modules in Australia will be the almost unique market structure. Very few markets have deregulated to the same extent. Here in Australia, networks (aside from Horizon) are forbidden from trading energy (and FCAS). It appears that DERMS assumes in many cases that the utility may participate in these markets and that this revenue will offset costs. In contrast, here in Australia, DERMS are likely to be a significant cost overhead for networks with no offsetting revenue. A free NAC is therefore likely to be attractive.

Dynamic Hosting Capacity Engines.

The most active alternative to the NAC at the time of writing are constraint engines, often call Dynamic Hosting Capacity Engines (DHCE) . These calculate a constraint (sometimes known



as an envelope) and publish it to VPPs. More advanced versions will also accept dispatch intentions from VPPs.

DHCEs are attracting funding from ARENA and other sources. Much of this paper deals with the reasons why the NAC is a superior solution to DHCE, both technically and economically.

Success or failure for the NAC against DHCE may partly be in the competition of ideas. The NAC and its reasons for existence have been poorly understood by the market; the NAC has been perceived as an overly complex solution, when in fact it is far better matched to a challenging problem than the alternatives (see above discussion on the nature of the problem being solved). The DHCE has gained momentum in a period where the debate has lacked technical and economic depth.

Not only is the NAC a superior solution, it may also have a stronger revenue model. Revenue models for DHCEs are not clear but are likely to be largely based on fees charged to networks. If the NAC can be offered for free to networks, then it may be a more attractive solution for them.

Market Places

The best known ‘marketplace’ is DeX, owned by Australian technology company Greensync. It has been funded by ARENA and has an impressive list of partners. In theory it is very similar to the model for NAC proposed here-in, although the inner workings and interfaces are likely to significantly differ.

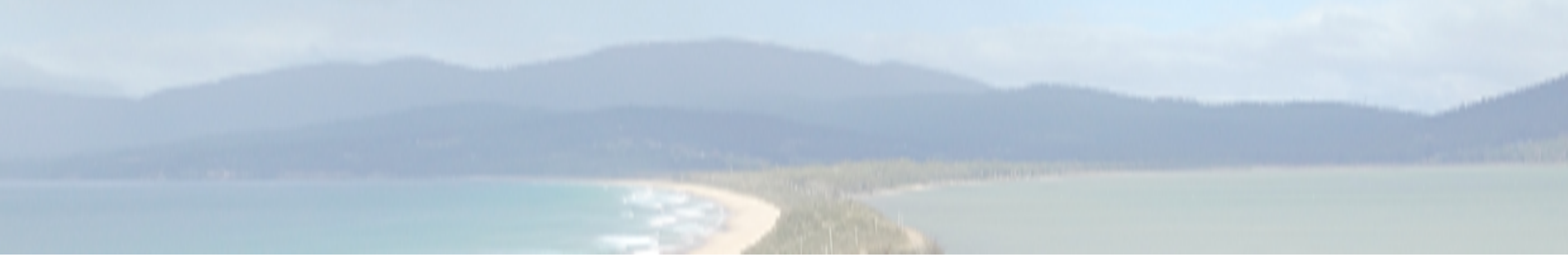
These differences will emerge from differences in approach. DeX is an interfaces-first strategy with a very large pool of ‘partners’. It is likely to attempt to work its way inward until striking the difficult OPF issue. NAC has followed precisely the opposite approach technology first approach, tackling the central problem of designing an algorithm which solves for least cost DER dispatch whilst respecting network limits.

Demonstrations of technology capability is likely to decide the superior implementation of the two marketplaces. At some point they may unify.

Next Steps for the NAC

The next challenge for those developing NAC is to demonstrate operation at a larger scale, as well as build new modules, such as a NEMDE-compatible bidding engine. Several funding opportunities are under investigation. A site for such a trial has not been finalised. Canberra is an attractive option, which has:

- the most detailed network models courtesy of Evoenergy,
- up to 1000 households with active DER thanks to the ACT Government NextGen subsidy, and
- a long history of electricity leadership.



Alternatively, TasNetworks, a strong partner for NAC may be willing to offer a site.

If the NAC technology can demonstrate superiority over alternatives, it has an excellent chance of playing a vital role in the future of our electricity system; helping to deliver a lower cost, lower emission, and more inclusive service to our economy.

References

[1] Paul Scott, Dan Gordon, and Sylvie Thiébaux. Network-Aware Coordination, Final Report, CONSORT Bruny Island Battery Trial Project. April 2019

[2] CSIRO and Energy Networks Australia. Electricity Network Transformation Roadmap: Final Report 2017-2027, April 2017.

[3] AEMO and Energy Networks Australia. Open Energy Networks -- Consultation paper, December 2018.