31 August 2016

Victorian Renewable Energy Auction Scheme Consultation
Department of Environment, Land, Water and Planning
Victorian Government

By Email: renewable.energy@delwp.vic.gov.au

Dear Sir/Madam

Victorian Renewable Energy Auction Scheme – AEMO submission

Thank you for the opportunity to submit to this consultation paper. AEMO has a number of functions relevant to this consultation:

- National Electricity Market (NEM) and Western Electricity Market (WEM) Operator and Systems Operator.
- National Electricity Transmission Planner.
- Victorian Transmission Network Service Provider (TNSP).
- Victorian Declared Gas Transmission Network Operator.

Please find attached our submission.

AEMO supports the work of the CoAG Energy Council in considering how to better integrate environmental and energy policy. We consider that major policy initiatives are best taken in a national framework, and that reducing carbon emissions in a technology and geographically neutral manner is likely to lead to the lowest cost of abatement.

In seeking to minimise the total cost of the Victorian Renewable Energy Auction scheme on customers, we consider that:

- The impacts on the Victorian electricity network need to be assessed and considered within the proposed mechanism; and
- The design of the Contract for Differences (CFD) should not undermine important NEM investment and operational incentives.

AEMO recommends that security and economic issues related to the Victorian grid are used as an evaluation criterion within the auction and that AEMO's declared network functions be leveraged to assist this evaluation. This should not only minimise overall costs but also allow the targets to be met in the designated time.

An optimally designed CFD would align the holders' financial incentives with security needs and investment with dynamic efficiency objectives. It would also allocate financial risks upon those best placed to respond to them, resulting in lower costs over the long-term.

Should you have any questions in relation to this submission, please contact XX on XX.

Yours sincerely

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NEW SOUTH WALES QUEENSLAND SOUTH AUSTRALIA VICTORIA AUSTRALIAN CAPITAL TERRITORY TASMANIA WESTERN AUSTRALIA

1. Policy context

The CoAG Energy Council are undertaking a major line of work to better integrate environmental and energy policy across all levels of government and institutions. AEMO supports this work, and recommends that initiatives be undertaken within that CoAG framework, which should achieve governments' environmental objectives at lowest total cost.

1.1. Least cost solar energy

AEMO observes the technology costs of renewable energy are undergoing rapid change. Solar capital costs that were historically significantly more expensive than wind, have in the last 12 months had rapid falls, particularly at large scale, and AEMO expects this trend to continue.

Southern Australia has the nation's best wind resources, whilst Northern and Western Australia have the best solar. Through AEMO's National Transmission Planning function, we observe the beginning of a trend of least cost renewable energy moving away from Southern wind toward Northern solar. Further, advances in tracking solar, and in time solar with storage, can realise benefits from a stronger correlation of output to customer demand.

Notwithstanding these developments, Victorian solar is likely to remain more expensive than Victorian wind for the duration of the proposed auctions. Thus, if the policy is restricted to developing solar energy within Victoria, it will be unable to benefit from these major technological advancements.

1.2. Forecasting industry transition

The deployment of 5,400MW of new large-scale generation over approximately seven years will represent the most rapid rate of investment the Victorian power system has experienced. It is important to consider the practical challenges that such a transition implies; issues that are not identified by conventional market modelling tools.

In order to solve efficiently, these tools typically simplify future years into a small number of large time periods, typically representing hundreds of real hours, and dispatch generation around those blocks. The models find a lowest cost/most profitable generation structure from these blocks, effectively average outcomes across a wide spread of similar real hours.

AEMO uses similar models in its own planning function, and finds that these models' simplifications are acceptable when assessing the energy market through periods of relatively gradual change, and where intermittent generation plays a small part.

Looking ahead to 2025, combined with existing generation and expected small-scale growth, we forecast the Victorian and South Australian regions to have installed at total of approximately 8,000MW of wind and 5,000MW of large and small-scale solar. These regions have correlated solar patterns, wind and customer demands implying frequent swings in supply and demand that will need to be mostly resolved within these regions given the limited capacity of the existing interconnectors to NSW and Tasmania.

Conventional market modelling is unable to contemplate the day to day operating challenges created by these swings. Constraints related to minimum generator output levels, startup delays and startup costs are necessarily ignored. This is acceptable where the intermittent share is small, or where the non-intermittent plant is highly flexible (e.g. hydro, gas or battery), but not where it is inflexible, such as Victoria's brown coal fleet.

Conventional modelling is likely to predict that despite the additional renewable energy, the majority of the brown coal fleet will remain profitable in 2025 and continue to provide reliable

capacity. This is due to its very low marginal costs which allow it to earn some profit from periods when intermittent generation is low. However when viewed across a sequential hourly time-series of daily supply/demand swings, the required operating regimes for that plant may prove physically unrealistic. To participate in the Victorian market, it is likely the plants will have to operate at minimum stable output (approximately 60% of full output) through periods of negative prices, undergo regular startup/shutdown cycles, or both.

It is likely that in such an operating regime these plants will prove less profitable than the modelling anticipates. Should this cause the plants to close, the resulting raised and volatile prices would encourage replacement with more flexible alternatives over time. However the costs of these alternatives, and the impacts upon customers of the necessary transitional prices, will not have been forecast by the original modelling.

1.3. Policy design

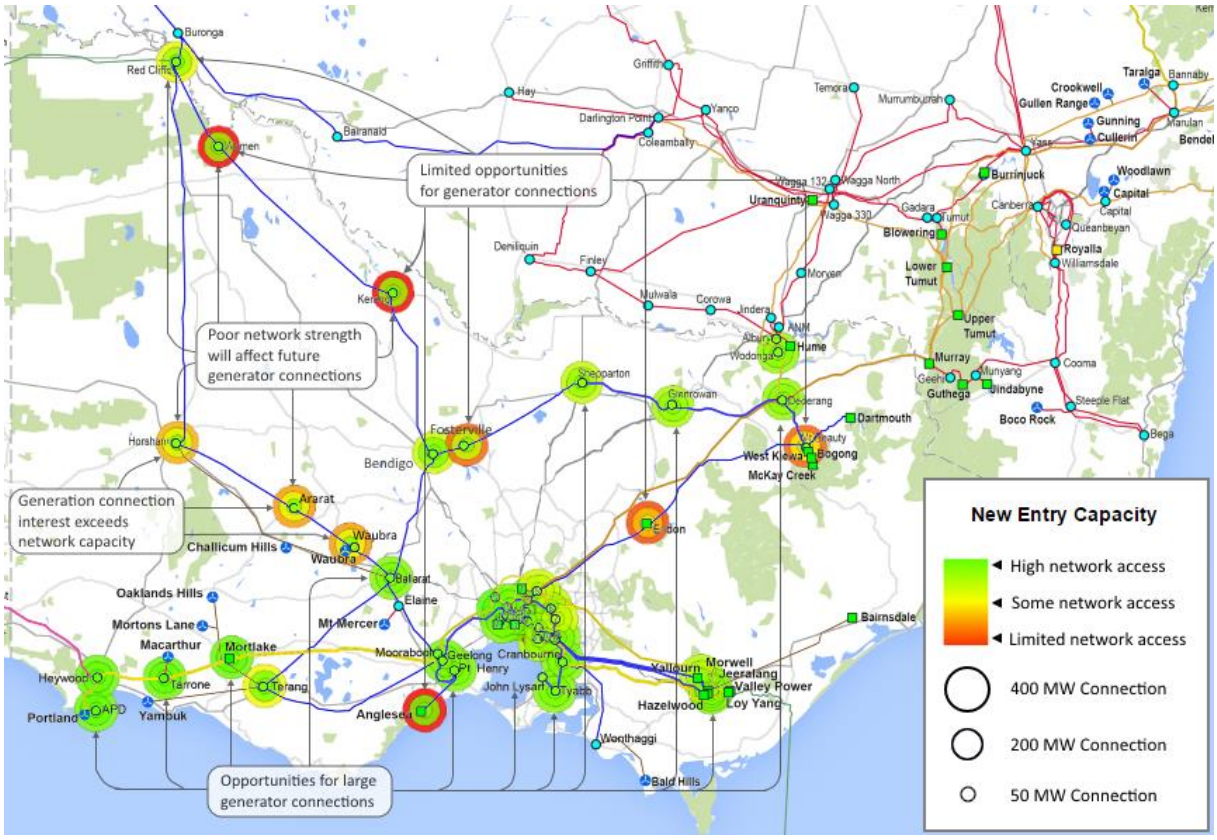
The concerns above could be moderated by a least-cost, geographically neutral approach such as those being considered by the COAG Energy Council. AEMO also notes the ACT and California sub-national jurisdictions each have ambitious renewable energy targets that do not oblige the generation to be physically located within their own jurisdictions. At the same time transparent accounting ensures integrity in delivery of their environmental objectives. These approaches lower total cost to their customers and eases the transition in the jurisdiction's own energy market.

2. Victorian Network Issues and Auction Design

2.1. The Victorian Network

As discussed in our 2016 Victorian Annual Planning Report (VAPR)[1], parts of the Victorian grid face challenges accepting the current rates of connection interest, almost exclusively in the West of the state, and principally from wind generation.

[1] http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Victorian-transmission-network-service-provider-role/Victorian-Annual-Planning-Report



For historical reasons the Victorian network is built around two backbones:

- Parallel 500kV and 220kV lines from the Latrobe Valley to Greater Melbourne and Geelong, then extending along 500kV lines to the smelter at Portland and the South Australian interconnector at Heywood.
- A 330kV path from the North of Melbourne to NSW via the Snowy scheme and Wodonga.

Outside Melbourne, Gippsland, Geelong and the Portland smelter, all Victorian load is serviced by the 220kV “Victorian state grid”. This is a thin and sparse network, built to supply a relatively small demand across a very wide area, in turn servicing an even sparser 66kV distribution network.

This network traverses areas of high wind resource, particularly between Ballarat and Horsham, and the triangle between Terang, Ballarat and Moorabool. It also extends into the sunniest parts of the state, particularly between Kerang and Red Cliffs (Mildura). This network was not designed to accommodate generation, and, without major reinforcement, cannot connect and/or evacuate the energies from all the interested developers along its length.

Fortuitously, the stronger 500kV lines from Moorabool to Portland also traverse high wind resources. However higher connection costs discourage connection to this higher voltage, although this can be defrayed by sharing costs with other users. AEMO applied its policy for shared Victorian transmission connections to the physical design of the Tarrone and

Mortlake 500kV terminal stations[2]. These were initially funded by their first connecting generators, but the design enables the stations to ultimately be shared with future generators, with funding contributions from all connecting parties.

On the other hand, AEMO observes negligible interest in connecting renewable generation to the well serviced Latrobe Valley or the 330kV network in the North East. Whilst the renewable resources in these locations are weaker, if the economics of the grid is fully taken into account, it is likely these locations could be competitive.

2.2. Congestion

In the VAPR and a 2015 Q & A document[3], AEMO warned of the potential for congestion in parts of the state grid, particularly between Ballarat and Horsham, which would result in a need to constrain renewable generators, including existing generators. The NEM's undefined shared network access framework is known to create locational inefficiencies and generator risks[4]. Congestion is shared between all parties in a congested area according to the economic dispatch process; there is no obligation for an entrant to upgrade the shared network or to compensate incumbent generators for congestion.

The result of the NEM's arrangements is that a congested location can still appear individually attractive to a developer, even if, as a result of its investment, no additional renewable energy as a whole is transported to customers.

2.3. Network Strength

As discussed in the VAPR, the sparseness of parts of the North-Western state grid and its remoteness from large synchronous machines means that it is incapable of securely connecting a large volume of asynchronous wind or solar generation without additional equipment. AEMO may need to reject connection applications in the future unless such equipment is included within the project and funded by the proponent. An example of this exists at the Musselroe Windfarm in Tasmania, whose connection included small synchronous condensers and other grid strengthening equipment.

2.4. Reinforcing the shared grid

Where the above issues result in significant congestion or higher project cost, AEMO can investigate a shared network augmentation via a Regulatory Investment Test for Transmission (RIT-T). The augmentation could take the form of, for example, a line duplication to remove congestion, or, a large synchronous condenser to improve network strength over a broad area. Some features of a RIT-T are:

- AEMO must identify "market benefits" that exceed the cost of the augmentation. In AEMO's experience, reducing congestion tends to have a relatively small economic value compared to the cost of line duplication, notwithstanding the acute commercial impacts it may be having on affected generators.

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[2] See http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Network-connections/~/link.aspx?_id=8F98AAFA209C481E96617AFFCC30C88B&_z=z

[3] https://www.aemo.com.au/media/Q%20and%20A%20WESTERN%20VICTORIA%20AEMO%20template.pdf

[4] For detailed discussion on these issues, see AEMC Transmission Frameworks Review, http://www.aemc.gov.au/Markets-Reviews-Advice/Transmission-Frameworks-Review and Optional Firm Access http://www.aemc.gov.au/Markets-Reviews-Advice/Optional-Firm-Access,-Design-and-Testing

- If passed, the RIT-T will be funded by Victorian transmission customers, regardless of the perceived causers of the original issue.

Note also that a process to investigate, plan, approve and construct new lines can extend beyond four years, and may face environmental disputation.

2.5. Evaluating grid interactions in the auction

The above discussion implies a potential for Victorian renewable energy to develop sub-optimally with adverse impacts on generators and consumers. The best way to avoid these outcomes is for their risks to be part of the investment decision. If generators can be encouraged to locate at locations with higher network capacity and strength then total costs and generator risks are lowered and it is more likely the target can be met. As the National Electricity Rules alone do not fully address these issues, the government's auction mechanism provides an opportunity to partly overcome them.

The government's proposed evaluation principle of "Electricity transmission network interactions" seems an appropriate mechanism to do this. AEMO agrees with how this is presented in the consultation paper, and adds:

- The network interactions should be extended to electricity distribution, as renewable energy projects often connect into distribution voltages, and these generators will impact both the distribution and transmission networks.
- AEMO concurs with weighting projects that assist with grid stability and result in lower overall consumer funded augmentation costs. AEMO suggests that the economic cost of congestion should also be explicitly included – which would include congestion affecting the new generator and other generators.

AEMO recognises that it is well placed to provide technical and economic advice on these matters, and this could potentially be provided to the government within AEMO's declared network functions for the Victorian electricity grid. It would be inappropriate for AEMO to assess any of the other principles, for example "value for money", and as such, the government would remain clearly the determiner of the successful bidder.

Estimating grid issues and future economic costs can be technical and complex. To assist provision of any advice, AEMO suggests:

- Auction participation be limited to advanced proposals (see section 3.1 below), for which at least preliminary grid connection investigations would have already occurred.
- AEMO's advice be requested only in relation to a short-list of the most prospective projects, determined on the basis of the other criteria
- The government explain to AEMO whether the short-listed projects are mutually exclusive or additional with respect to auction outcomes.
- An ability for relevant distributors and/or transmission asset owners to collaborate with AEMO in providing the advice.
- AEMO be provided adequate time to perform an engineering assessment and, if necessary, economic studies. AEMO suggests allowing at least four weeks. Alternately, the consultation paper's suggestion of an expression of interest stage suggestion may create a time window for this.

- AEMO's advice be provided to the government in confidence, as it is likely to contain, or be drawn from, AEMO's confidential information.

If such an advisory role is to be used, AEMO suggests making this clear to auction participants, including the limitations of AEMO's engagement. AEMO understands that bidders will desire that the grid evaluation be performed in a transparent and predictable way. AEMO is sympathetic, but also notes some practical limitations:

- The grid interactions are complex and difficult to anticipate at this time. It is unlikely that a formulaic method for their calculation can be prepared.
- As the assessment must contemplate the grid's operation into the future, there will unavoidably be some reliance on expert judgement.
- Any assessment will involve the use of participant data that has been provided to it in confidence, which inherently constrains transparency.

3. Auction participation suggestions

3.1. Advanced proposals

One of the challenges experienced in other competitive grants processes is the vast number of theoretical projects at different stages of development and prospect. In determining bid eligibility, the government will have to strike a balance between competitive participation and auction manageability.

A recent similar government tendering exercise required bidders obtain "Intending Participant" registration status with AEMO. This status was not designed for this purpose and was not necessarily a good indicator of development progress. In the lead up to the tender, AEMO and these bidders invested considerable urgent efforts in processing numerous registration applications, despite only a minority ultimately progressing to full registration.

In order to evaluate the grid interactions, the project will need to have previously performed reasonably detailed planning for its connection. We considered suggesting a bidder be required to have completed a National Electricity Rules connection enquiry or application, but consider this may result in unintentional outcomes similar to the Intending Participant status described above.

AEMO suggests instead the government prepares its own checklist criteria, following a model similar to that AEMO employs for its planning documents when assessing whether a generator is a "Committed Proposal" or an "Advanced Proposal"[5]. In particular the "Advanced Proposal" status which requires three or four (but not all five) of AEMO's criteria to be met. AEMO uses a direct surveying technique to determine these statuses, details of which can be provided to the government on request.

AEMO suggests this eligibility criteria could be developed alongside the criteria the government will have to develop to exclude projects that are too progressed to be considered additional.

[5] See linked spreadsheets, (tab "Background information") on this page http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/~/link.aspx?_id=8AA86A5C53DA447CBB2B20EE791B2D66&_z=z

3.2. Scheduling and Semi-Scheduling

Generators that will export over 30MW at the connection point are generally required to be registered in the NEM as “Scheduled Generators”, or “Semi-scheduled Generators” if intermittent. This is necessary in order for AEMO to accurately dispatch the generators, manage the network and provide accurate forecasts. Generators below the threshold usually elect to register as “Non-Scheduled”, which is advantageous to them.

It seems likely that the majority of projects awarded contracts will be above this threshold, however some may be below. AEMO is observing that Non-Scheduled generators can potentially create challenges:

- Where a number of smaller projects with correlated outputs cluster together with a large combined impact on a specific part of the transmission network.
- In heavily congested areas of the grid where the ability to monitor and constrain the output of smaller generators is required.
- Where a Non-Scheduled generator locates in a congested location, the impact of the congestion is entirely borne by other Scheduled and Semi-scheduled generators, exacerbating the issues described in section 2.2.

AEMO recommends auction eligibility should include a blanket requirement that all generators of over 5 MW capacity[6] at one connection point must register with AEMO as Scheduled or Semi-Scheduled generators.

If the government chooses to accept bids from aggregated proposals, e.g. clusters of commercial-scale rooftop solar, then in some parts of the grid there may be a need for tailored arrangements such as real-time monitoring fed to AEMO and the network owner.

4. Contracts for Differences Design

An important design feature of the NEM is the way it provides virtuous and self-correcting incentives to generators to deliver in accordance with customer needs. This in turn provides an industry of lower cost and stronger reliability and security. The extreme rarity of the need for AEMO to intervene in the market demonstrates how successful the NEM’s pricing process is in signally the customers’ needs to generators. The government should be careful to avoid undermining these important signals, considering the scale and geographic concentration of the policy.

To assist explaining this issue, consider the following categories of market signal:

1. Long-term supply-demand signals, i.e. whether new supply invests or disinvests to meet the growth or decline in customer demand.
2. Locational signals, i.e. whether generation is invested in a place where it is most useful, considering the limitations and losses of the network and the location of customer demand and other generators.
3. Short-term dispatch signals, i.e. whether the generator produces output correlated with the needs of the customer.

AEMO understands the government is seeking to lower risk to renewable generators. The above three risks express the natural characteristics of the power system, and should the

[6] 5MW is the point at which AEMO provides a standing exemption from all technical registration requirements.

scheme immunise generators from these risks, the risk will not be eliminated but instead passed onto consumers in the form of higher future CFD payments. Where possible, the scheme should leave these signals with the generator, as they are the only party with some capability to respond and minimise them.

Certificate based renewable subsidy schemes, such as the Commonwealth's Renewable Energy Target Large Generator Certificates (LGCs), tend to keep these signals largely intact by paying LGC generators the NEM's spot price. For example, AEMO observes:

- A slowing in the rate of investment in South Australian wind generators, as the high penetration of wind in that region creates an increasing discount in realised spot energy price. In 2015 South Australian wind-weighted spot prices were only 77% of time-weighted prices, versus 97% in New South Wales. This is an expected and beneficial outcome of this market signal.
- A preference to locate new renewable generators in those parts of a region with superior loss factors.
- A preference to invest in technology that is better correlated to price and therefore customer demand. This preference is likely to have affected, at the margin, decisions to invest in Queensland large-scale solar and biomass plants versus southern wind generation. It is also affecting decisions to invest in tracking solar (which generates later into the afternoon peak) as opposed to non-tracking, and, in time, to encourage renewables to integrate with storage.
- The self-curtailment of LGC generators when there is excess supply and spot prices become negative.
- The scheduling of renewable energy maintenance away from the times of demand peak and therefore highest spot price.

4.1. AEMO's preferred design

As a general principle, AEMO encourages retention of spot market incentives upon generators, and therefore prefers certificate based schemes over CFD mechanisms. At the stakeholder forums, the government presented alternatives where a fixed "top-up" payment was made to the generator, either on a MW or MWh basis, meaning the generator retained exposure to the spot price. AEMO would similarly prefer this approach, which would be more compatible with the NEM and vest government and customers with a predictable cashflow.

The apparent attraction of the CFD scheme over these alternatives is that by immunising the generator from NEM signals it lowers risk to them enabling them to bid a lower price at auction. AEMO submits that this is a false economy: these risks will instead be borne by customers through CFD payments, and the risks that are transferred downstream from those generators are risks that are best left upstream with the generators.

If the government nevertheless chooses to retain a CFD approach, then AEMO recommends variations from the ACT scheme:

- Payouts under the CFD must be floored at zero spot price. As Victoria's wind generation penetration grows under the policy, there will be extended periods where zero marginal cost supply exceeds demand. If participating generators are immunised from negative price, then:
    - The market will not be able to resolve these surpluses, so that:

        - Prices will frequently fall to the market price floor of minus $1,000/MWh and causing extreme risks to other generators who are exposed to it.
        - AEMO may need to intervene in the market to restore security.
    - The government will have to make large CFD payments to cover participating generators' payments to AEMO when they generate into minus $1,000/MWh prices.
- CFD payments should be settled at the regional reference price, thereby retaining loss factor locational incentives with the generator.
- CFD payments should preferably be settled over a longer period than half an hour in order to retain an incentive to produce at the times when prices are highest, and the suggestion of a monthly average is supported. This issue has influenced the choice of a seasonally averaged "baseload reference price" in the United Kingdom's CfD design.

  "…the intent is to ensure that the CfD Market Reference Price does not interfere with other important signals that impact behaviour and pricing within the GB energy market, and to allow the Market Reference Price to reflect local conditions…"[7]

Consistent with the ACT design, AEMO recommends the CFD should not remove from generators:

- Costs of connection.
- Congestion risk, i.e. CFD payouts should be always be linked to realised output, thus retaining some locational incentive.
- Ancillary services "causer-pays" payments, which reward output predictability.
- Ability to sell ancillary services and retain revenue from it.

5. Developments in Connections Rules

There are a number of initiatives underway that could affect the cost and timing of the connection of new generators. While the reforms will improve on the current framework, they are still being developed and the detailed arrangements are uncertain.

Under the Victorian connections model, AEMO is the service provider to the connecting generator. It enters into a Use of System Agreement (UoSA) with the connecting party and secures incremental shared network services (i.e. any new shared network augmentation needed to support the new connection) through network service agreements (NSA) with the incumbent TNSP (I-TNSP) and contestable TNSP (C-TNSP). Concurrently AEMO also enters into a project construction deed to ensure that the TNSPs build the shared network augmentation according to the functional specifications set by AEMO.

Under the current Victorian model, primary functional requirements (PFRs) and protection and control requirements (PCRs) are used to define the technical specifications of a

7 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/404558/cfd_policy_drafting_up

connection. AEMO is also responsible for enforcing compliance on an ongoing basis. Perceived shortcomings in the Victorian connections process, as well as potentially a significant increase in new connections, has prompted AEMO to investigate options to scale back its involvement in negotiations and contracting to determine how the process can be more efficient and cost effective for applicants but not compromise system security.

To this end, we are considering whether there is scope for AEMO's technical requirements (and outage incentives) to be a regulatory requirement rather than a contractual obligation.

In addition, the AEMC is considering a rule change to introduce contestability to the other regions of the NEM. AEMO welcomes reforms that allow contestable providers to build, own, operate and maintain the contestable shared network. We are participating in the AEMC's consultation process with the goal of developing a stronger foundation for a contestable connections market.

If the Renewable Energy Auctions result in AEMO considering multiple connection proposals side-by-side, then it may be more efficient to build shared connection assets at a hub rather than a separate terminal station for each new generator. The AEMC's Rule change is exploring how to build connection assets that allow for the efficient long term development of the network, without imposing inappropriate additional costs on first movers. At present, AEMO as the Victorian Network Planner has regard to future requirements when a new connection is proposed. This may include recommending the acquisition of an option to procure additional land space for potential expansions of assets.

6. Calculation of the target

AEMO understands that tracking against the 25% and 40% targets, which will be used for determining auction sizes, are assessed from Victorian "as-generated" energy values. This has similarities to AEMO's regional consumption metrics[8], however AEMO nets off regional imports and exports.

AEMO notes that imports and exports to a region are an outcome of the competitive NEM process, and can be volatile from year to year due to market conditions and the relative costs of Victorian versus other generators, which will in turn be affected by environmental policies. AEMO suggests it may be more appropriate, and predictable, to calculate the targets using percentages of generation net of inter-regional flows.

[8] See http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/~/-/media/31828D130AF64F8084BF893CFFD3B301.ashx