Future-proofing Energy for Regional NSW

Unlocking Essential Energy's Sub-Transmission Thermal Capacity

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Essential Energy

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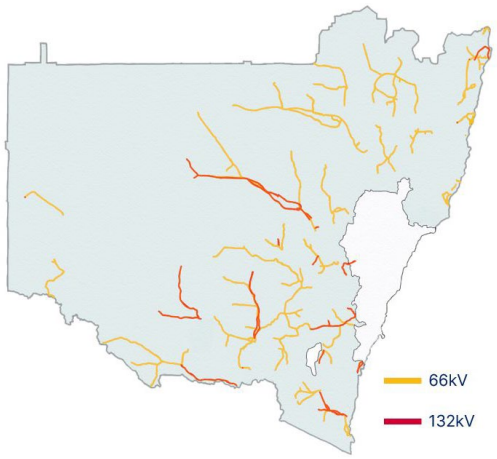
Distribution in the Energy Transition

Distribution Network Service Providers, like Essential Energy, have a key role to play as Australia's National Electricity Market transitions from fossil fuel to renewable energy generation. The phasing-down of traditional forms of base load energy generation from coal involves re-developing whole systems to operate on low carbon electricity, like wind and solar. It is a transformation similar to that which took place to electrify communities via reticulated electricity networks in the early to mid 20th century.

Utilising Essential Energy's existing distribution network infrastructure in the energy transition will provide economic opportunities for regional communities through locally generated and stored electricity and large-scale renewable connections. The opportunity for regional NSW lies in the large areas of available land and the untapped capacity on the network. Large and small-scale renewable generation coupled with large and small-scale energy storage connected to the existing infrastructure can support economic growth in regional, rural and remote communities. It can also help the transition happen swiftly and at a relatively low cost. As such it can complement the large transmission infrastructure projects like renewable energy zones. This was reinforced in the NSW Government's Electricity Supply and Reliability Check Up (Check Up).

Essential Energy's Capacity



Essential Energy's electricity distribution network covers 95 per cent of New South Wales and includes a substantive sub-transmission network comprising 2,100 kilometres of 132 kilovolt (KV) and 7,500 kilometres of 66 kilovolt (KV) powerlines. Both are lines capable of hosting utility-scale renewables.

There is currently 1.5 gigawatts (GW) of utility-scale wind and solar electricity generation connected to the Essential Energy network, with a further 2.5 gigawatts (GW) in the pipeline. The existing 1.5 gigawatts (GW) is comprised of approximately 0.8 gigawatts (GW) of solar generation, 0.5 gigawatts (GW) of wind generation, and 0.2 gigawatts (GW) of other renewable generation, with the largest single project being the 145 megawatts (MW) Flyers Creek wind farm, owned and operated by Iberdrola near Orange, that is currently in the commissioning stage.

Additionally, Essential Energy has approximately 30 active large-scale renewable generation connections progressing through the application phase to connect to the sub-transmission network.

Essential Energy has undertaken a hosting capacity assessment to determine the available thermal capacity on its sub-transmission lines to connect utility–scale renewable projects and support the NSW Electricity Infrastructure Roadmap targets. Over six months, the hosting capacity of 37 Bulk Supply Points across the Essential Energy network was assessed. A bulk supply point is where electricity flows between the transmission network and the distribution network.

Across the 37 bulk supply points:

- Taking into consideration the assets' thermal limits and the current and expected consumption, approximately 8.4 gigawatts (GW) of thermal capacity has been identified across the Essential Energy sub transmission network today.
- Considering an appropriate mix of solar and wind generation, battery energy storage systems (BESS) and other firming capacity this would equate to enabling connection of approximately 15 gigawatts (GW) of nameplate capacity generation.

Utilising this information and taking into account other operating factors, six Bulk Supply Points in regional NSW have been identifies as having the greatest potential to host utility scale generation, being a

nameplate generation capacity of approximately over 9 gigawatts (GW) of large-scale renewable energy generation. These are located near Dubbo, Albury, Marulan, Tamworth, Yass and Wagga. In some areas and depending on the generation mix, some transmission investment may be required.

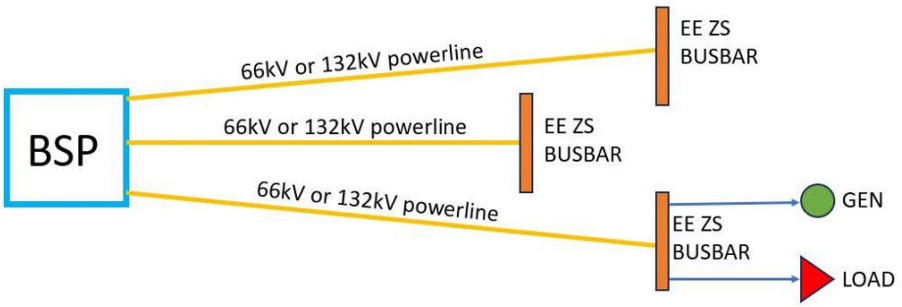
Hosting Capacity Assessment

As part of its commitment to supporting the energy transition and in line with the NSW Government endorsed recommendation of the Check Up, Essential Energy undertook an assessment of its sub-transmission network to understand the potential capacity for hosting large-scale renewable generation.

Stage 1 of the network analysis was to understand the thermal capacity to know how much current can flow through the 66kV and 132kV powerlines while ensuring the rating of the asset is not exceeded.

The NSW electricity network consists of 52 Bulk Supply Points, of which 37 supply Essential Energy's 66kV and 132kV powerlines - powerlines which could facilitate new energy generation connections with the appropriate augmentation. Each of the 66kV and 132kV assets has an upper and lower thermal capacity limit based on how much load is required to be supplied to the Essential Energy network.

The image is a simplified version which shows how the study area was configured. The image depicts load and generation on a single Essential Energy Zone Substation (EE ZS) busbar. The modelling assessment was undertaken for each of the 37 Bulk Supply Points.



The study was completed using the transmission planning and analysis software, known as PSS®E Power Simulator (PSSE). Each EE ZS busbar was configured with the network load, using two scenarios - minimum and maximum load, based on historical data. For each scenario, the EE ZS busbar was setup with a generation source. The generation source was incrementally increased across all EE ZS busbars until the first sub-transmission line limit was reached. The result was the first step to understanding what the thermal capacity range could be based on the minimum and maximum load scenario.

Stage 2 involved identifying the first thermal limitation whether that be an Essential Energy or a Transgrid asset. Where the limit was on an Essential Energy asset:

- a 66kV asset, the asset was augmented to a 92 Mega Volt Amp (MVA) rating and
- a 132kV asset, the asset was augmented to a 145 Mega Volt Amp (MVA) rating.

Where the Bulk Supply Point constraint was a Transgrid asset, this was used as the limit. Any augmentation was based on the thermal capacity of the Essential Energy asset only, with no proposed augmentation to the Transgrid asset.

Stage 3 of the assessment proposed the introduction of communications infrastructure and a remedial action scheme to utilise the full capacity of the existing Transgrid transformer assets at the Bulk Supply Point. The hosting capacity was then determined to be the limit of the augmented 66kV or 132kV Essential Energy asset.

The following network parameters were used:

- NSW network snapshot at 31st of May 2022 was utilised in PSSE.
- Proposed generating systems and loads within the NSW network were not considered.
- The assessment only considers the thermal constraints within the Essential Energy sub-transmission network. The intent is to extend this assessment by also considering voltage and stability constraints.
- Transgrid thermal constraints at Bulk Supply Points were considered.

The work undertaken to date was based only on steady state thermal capacity. Subsequent network analysis and planning has been completed to understand the potential nameplate capacity of generation that the Essential Energy network could be capable of hosting.

Energy Transition Ready

The Essential Energy distribution network allows for connections of renewable generation and battery storage anywhere across 95% of NSW with minimal disruption to communities and landholders through leveraging existing easements and rights of way.

The estimated average cost per megawatt for connection of generation onto the Essential Energy network is relatively cheaper than the average Renewable Energy Zones proposed under the NSW Energy Infrastructure Roadmap.

The utilisation of existing electricity distribution network infrastructure to connect renewable projects has significant advantages:

- Cost – the network augmentation cost that is required to connect renewables to Essential Energy's network is less than the costs associated with the proposed Renewable Energy Zones, subject to potential upgrades to the transmission network. This is due to the fact that Essential Energy can use existing assets and land access rights.

- Timing – significant opportunity to deliver meaningful contributions to NSW Roadmap targets by 2030, through timing advantages associated with avoiding greenfield development and utilising existing infrastructure; including providing greater investment certainty for generators
- Social licence – the avoidance of constructing significant new network infrastructure and the need to negotiate access to land limits the impacts on regional communities.

Consumer Energy Resources

Another important key supporting the energy transition for regional NSW is through Consumer Energy Resources (CER), like rooftop solar, residential batteries and electric vehicles. Renewables accounted for almost 40% of the total electricity delivered through the National Electricity Markey in 2023, momentarily reaching up to a 72.1% share on 24 October 2023. Rooftop solar alone contributed more electricity to the grid in the first quarter of 2024 (13%) than grid-scale solar, wind, hydro or gas.

In the Australian Energy Market Operator (AMEO) 2024 Integrated System Plan (ISP), rooftop solar is projected to increase from 21 gigawatts (GW) in 2024 to 36 gigawatts (GW) in 2030 and continue to increase to 86 gigawatts (GW) by 2050. In the Essential Energy network, there is 2 gigawatts (GW) of small-scale renewable generation coming from 32.3% of the 890,000 customers (35% of residential customers and 13% small business).

Australia has one of the fastest growing residential battery markets in the world. By 2030, residential storage installations are expected to reach 2.1 gigawatt-hours (GWh) per year, increasing to 3.9 gigawatt-hours GWh per year by 2035. Home batteries and electric vehicle batteries will play a major role in capturing the excess energy generated from rooftop solar, so that it can be used within the community when the sun is not shining.

If there is local generation of green energy that it reasonably priced and there is reliability and resilience in the network, then industry is more likely to be attracted to these locations, bringing economic benefits for regional, rural and remote communities.

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