COMM2501 Data Visualisation & Communication

Deliverable 3: Data Story Content

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Topic Statement

Australians who reside in rural Australia regarding access to clean energy. The national average of supplied renewable energy is approximately 40%, compared to the rural total clean energy consumption being 7% (Georgie Robertson, 2023). This exemplifies the significant changes that need to take place for rural communities to benefit from reduced energy costs, enhanced energy security, and low carbon footprint.

Rural communities heavily utilize diesel and fossil fuels due to their lack of connection to the main power grid. This is highlighted by a 2016 study in the NT that indicated that 23% of rural communities rely on diesel generators (Stellae Energy, 2020). These communities rely on diesel generators due to their low initial costs and their limited financial resources to transition to renewable energy.

This lack of accessibility to clean energy has been identified as SDG 7.1, 7.2, and 7.3. This challenge also related to Australian's health and climate change due to emissions. A method to address this challenge is for the Department of Industry, Science, Energy, and Resources to provide funding, policy support, and incentives.

Opposing Perspective

Summary

Renewable energy systems in rural Australia may seem like an attractive solution to environmental and economic problems; however, transitioning from diesel generators will cause reliability concerns. The opposition argues that renewable energy sources are inherently unreliable due to their dependence on weather conditions and natural cycles. This may be particularly problematic for remote communities as the unpredictability can cause inconsistent power supply. Remote communities already face challenges in accessing stable energy. For instance, solar power is only available during daylight hours and can be significantly diminished by cloudy or rainy weather. Similarly, wind speeds are not constant and can change considerably throughout the year.

Renewable sources are intermittent, meaning that energy production can fluctuate, creating periods of no to low power availability. Remote communities lack infrastructure for energy storage and grid support, as these limited resources can be problematic. There are potential solutions, such as batteries, for storing excess energy; however, they have a limited lifespan and add financial and logistical burdens. Furthermore, the technical expertise required to install and maintain renewable energy systems is often lacking in these areas, leading to increased dependency on external contractors and higher maintenance costs. Therefore, renewable energy systems currently are incapable of providing reliable and sustainable forms of energy production, despite their environmental benefits.

Stakeholders

Rural Communities

These communities are directly affected by energy reliability and costs. Reliable power is crucial for daily activities, healthcare, education, and overall quality of life.

Government and Policy Makers

Responsible for creating policies and regulations that support energy transitions and ensure sustainable development.

- **NSW Department of Planning and Environment**: The Minister for Energy in New South Wales.

Renewable Energy Companies

These companies provide technology and infrastructure for renewable energy projects.

Counter Argument

Intermittency of Renewable Energy

Solar panels only generate electricity during daylight hours and their efficiency can be significantly reduced by cloudy weather. Wind turbines require specific wind speeds to operate efficiently, which are not constant throughout the year. Capacity factors denote the extent of how intensely a fleet of generators is working. A capacity factor of 100% means that the generators are working constantly.

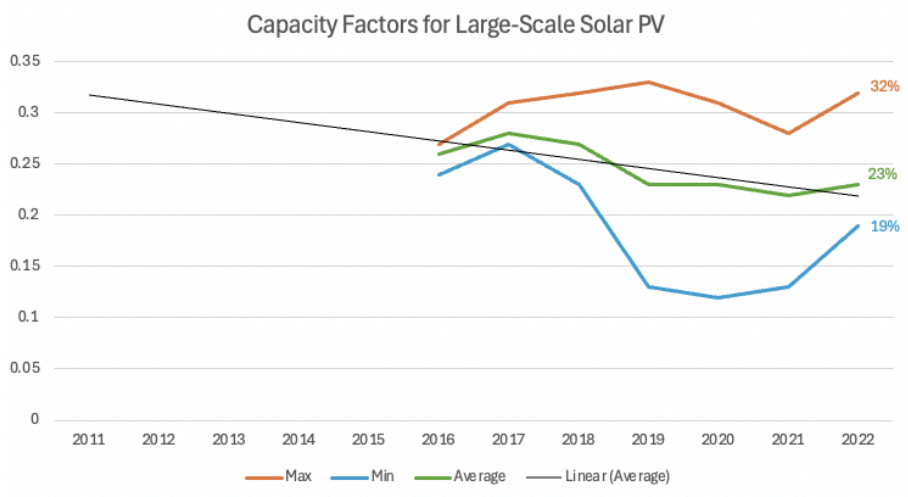

Figure 1.1: Capacity Factors for Large Scale Solar PV (Sourced from: GenCost 2022-23)

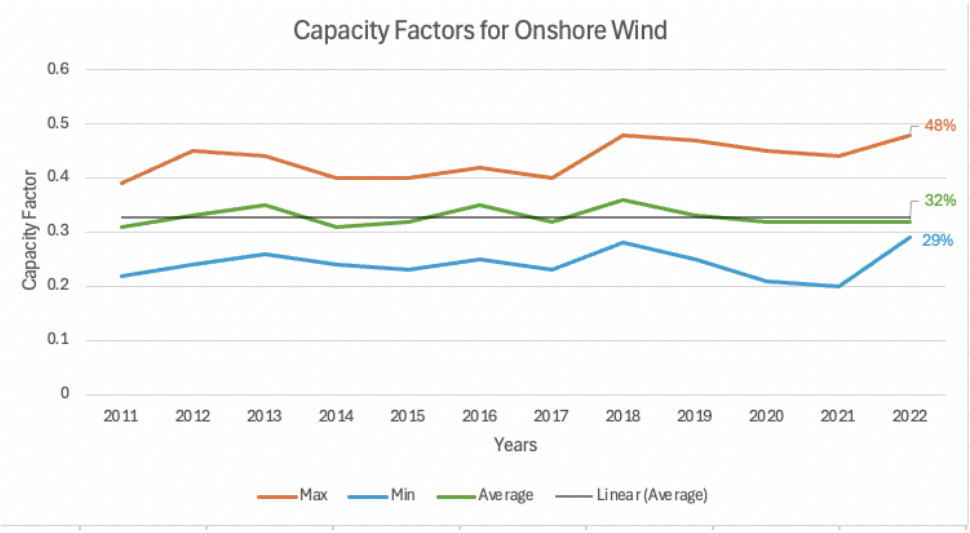

Figure 1.2: Capacity Factors for Onshore Wind (Sourced from: GenCost 2022-23)

According to GenCost 2023-24 LCOE, onshore wind and solar have average capacity factors that imply they aren't considered efficient. The trendline in Figure 1.1, portrays the stagnant nature and lack of efficiency improvement throughout the years.

Similarly, the average capacity factor of 23% has been decreasing throughout the years. Generators that have been working 23% of the time, mean that solar, hydro, and fossil fuel generators are utilized more often. The costs associated with implementing and running renewable energy generators significantly outweigh the environmental and logistical benefits.

Reliability of Diesel Generator

Diesel generators, despite their environmental downsides, provide a reliable and consistent power supply. They can operate in a wide range of conditions and are not dependent on weather, making them a dependable energy source for critical infrastructure in remote areas.

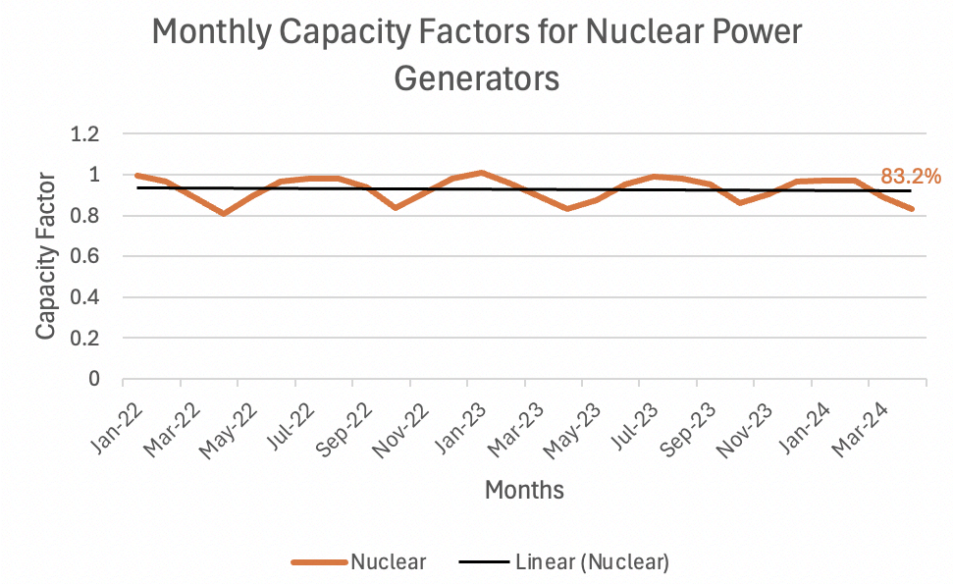

Figure 2.1: Monthly Capacity Factors for Nuclear Power Generators (Sourced from: U.S. Energy Information Administration)

As Figure 2.1 highlight, nuclear (83.2%) and natural gas (46.7%) generators have significantly higher capacity factors, meaning they produce energy at a more consistent rate. Remote healthcare facilities and emergency services rely on dependable power supply from diesel generators to ensure that essential services are not interrupted. Their trendlines denote their constant and reliable use throughout the years, unlike renewable generators.

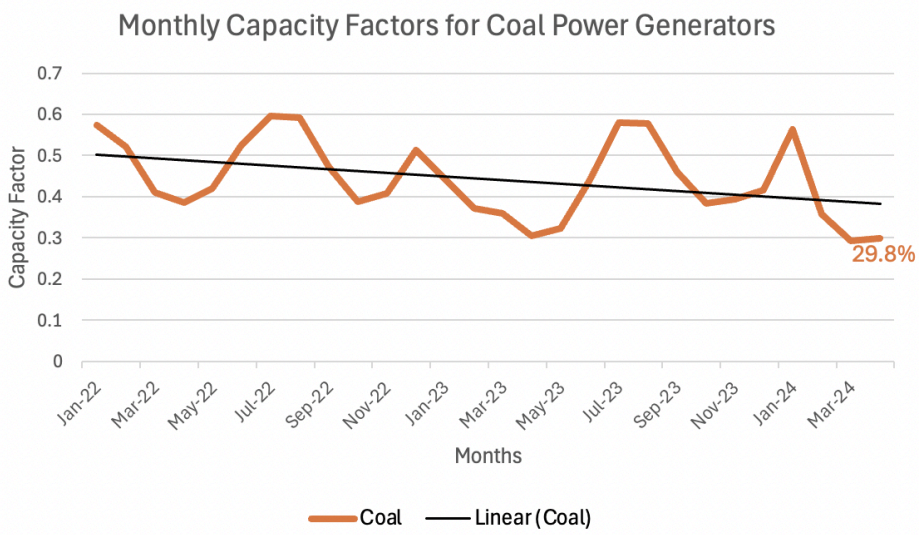

Figure 2.2: Monthly Capacity Factors for Coal Power Generators (Sourced from: U.S. Energy Information Administration)

Coal power generators (Figure 2.2) have a decreasing capacity factor trend due to *"Renewables are aggressively penetrating energy systems due to… plunging wholesale electricity prices" (Bruce Robertson, 2021)*.

Discussion

While the transition to renewable energy is crucial for environmental sustainability, the current limitations of renewable energy systems in terms of reliability, storage, infrastructure, and maintenance present significant challenges for remote communities in rural Australia. Diesel generators, despite their drawbacks, offer a reliable and well-understood solution that ensures consistent power supply, which is vital for the well-being and economic stability of these communities.

While renewable energy sources can be intermittent, incorporating hybrid energy systems that combine renewable and non-renewable sources can mitigate these reliability concerns. Studies have shown that hybrid renewable energy systems (HRES) can provide a more stable power supply by integrating energy storage solutions and backup generators. For instance, solar panels can be complemented with battery storage to provide power during nighttime or cloudy days, and wind turbines can be paired with diesel generators to ensure a continuous supply. Reflected by *"Through parallel integration, multiple energy sources can work together on the same platform… how that the combined natural gas supply system alone can reduce CO2 emissions by 8.5% and 29.6% per year" (Braslavsky et al., 2015).*

Research indicates that hybrid systems are increasingly viable and beneficial. For example, a study reviewing 38 articles on hybrid systems found that they are particularly effective in areas with unstable grid connections or no access to the grid at all. These systems leverage the strengths of multiple energy sources to provide a reliable and cost-effective power solution. tudies have shown that hybrid systems can increase capacity factors by 10-30 % compared to standalone installations.

References

Opposing View Perspective Source

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Counter Argument

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Hybrid Generators

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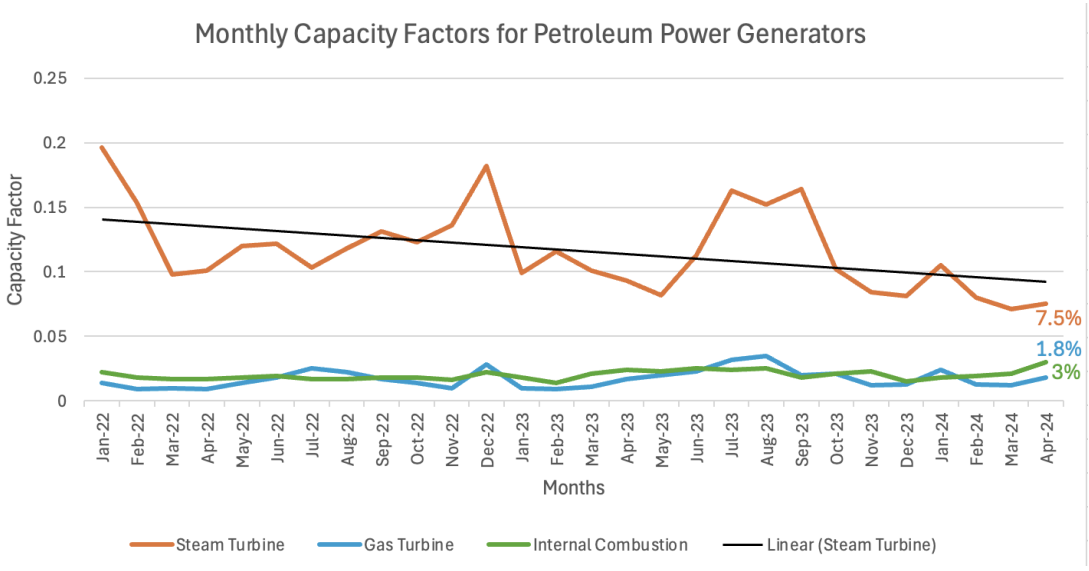
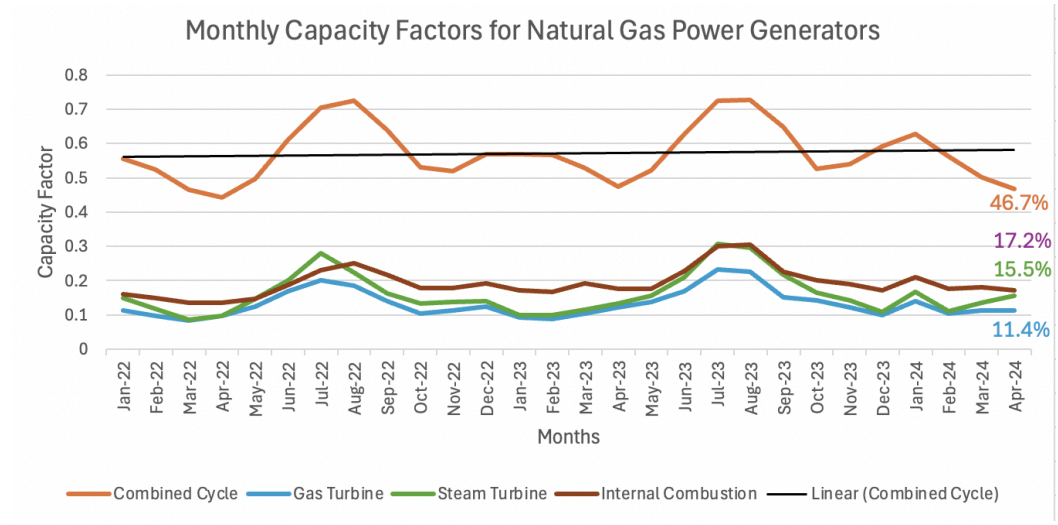
Appendix


Monthly Capacity Factors for Petroleum Power Generators
Capacity Factor
0.25
0.2
0.15
0.1
0.05
0
Jan-22
Feb-22
Mar-22
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Apr-23
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24
Months
7.5%
1.8%
3%
Steam Turbine
Gas Turbine
Internal Combustion
Linear (Steam Turbine)


Monthly Capacity Factors for Natural Gas Power Generators
Capacity Factor
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-22
Feb-22
Mar-22
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Apr-23
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24
Months
46.7%
17.2%
15.5%
11.4%
Combined Cycle
Gas Turbine
Steam Turbine
Internal Combustion
Linear (Combined Cycle)