South Australian Electricity & The Energy Trilemma

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Introduction

Modern prosperity depends on abundant and reliable energy. However, the fossil fuels that enabled economic growth now drive climate change, placing the electricity sector at the center of decarbonization efforts.

Problem Statement

Our project asks how South Australia's rapid transition from a fossil fuelled grid to one dominated by wind and solar has reshaped the balance between sustainability, affordability and security. SA now sources roughly three quarters of annual generation from Variable Renewable Energy (VRE), but limited storage and high firming costs mean gas and interstate interconnectors remain essential during renewable droughts.

The Energy Trilemma

This tension is captured by the energy trilemma: delivering power that is environmentally sustainable, affordable for users, and secure and reliable at all times. Using OpenElectricity data and Tableau visualizations, we explore how SA's transition influences each pillar across long run, seasonal and diurnal patterns.

Sustainability

Annual generation trends show a clear decline in fossil fuels as wind and solar rise. These shifts frame the dashboard's deeper analysis of renewable variability, price dynamics and residual demand.Monthly renewable share charts and seasonal boxplots demonstrate SA's strong but fluctuating VRE contribution, reflecting natural variability in wind and sunlight and the challenges of reaching higher renewable targets.

Affordability

Diurnal price profiles and daily volatility metrics reveal increasing market instability. Negative prices signal oversupply rather than free power; lost revenue must be recovered elsewhere, contributing to higher retail prices and wider cost of living pressures.

Security

Residual demand trends illustrate growing dependence on firming assets and sharper evening peaks. As renewables crowd out conventional generators, ensuring reliable supply becomes more challenging.

Conclusion

Every decision in life involves trade offs and energy systems aren't an exception to this rule. SA's transition reshapes all three pillars of the trilemma. It is important that households and businesses can see these dynamics for themselves. Our simple, transparent visualisations do not try to settle the debate on how to balance the trilemma. Instead they show, in data, how South Australia's transition towards prioritising and subsidising very high wind and solar shares has reshaped the market; and what consequences are for South Aussie households.

Our Question to You

If you had to choose, which pillar of the trilemma would you prioritise more: sustainability, affordability, or security? And what tradeoffs would you be willing to accept?

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