What is energy security, and how has it changed?

September 13 2018, by Samantha Hepburn

Australia needs to think about the energy grid of the future. Credit: DAVID MARIUZ/AAP

The idea of energy security has been at the centre of much policy debate recently. The federal government defines energy security as the adequate

supply of energy across the electricity, gas and liquid fuel sectors.

But this notion has become outdated, following the spate of electricity blackouts that have occurred in the past few years. The concept of energy security is now increasingly synonymous with resilience: responding to problems quickly and avoiding power outages.

To be secure, the national energy market must ensure a sufficient supply of electricity at an affordable price *and* be able to respond to major disruptions. Being "energy secure" in this context now means having a backup plan. Unfortunately, Australia doesn't.

All about oil

Historically, energy security was purely about oil supply. It evolved as a policy response to the 1973 Arab oil embargo. At the time, the aim was to coordinate among the industrialised countries if supply was disrupted, to avoid future supply problems and to deter exporters from using resources as a strategic weapon. Four key developments emerged from the embargo:

- the International Energy Agency (IEA), whose members are the industrialised countries;
- strategic stockpiles of oil, including the US Strategic Petroleum Reserve;
- continued monitoring and analysis of energy markets and policies; and
- energy conservation and coordinated emergency sharing of supplies in the event of a disruption.

Australia is not 'secure'

When Australia joined the IEA in 1979, it was a net exporter of oil and was therefore exempt from the requirement to stockpile liquid fuel. Since this time, however, Australia's oil production has peaked and is now in decline.

Reasons for this are various but include the reduction in oil refining capacity and significant increases in reliance on imported oil products.

In 2012 Australia became non-complaint with the IEA requirement that all members maintain oil stocks equivalent to at least 90 days of the previous year's daily net oil imports.

In contrast with many other IEA members, Australia does not have a public (or government-owned) stockpile of oil and has instead relied on commercially held stocks. Currently, Australia has an aggregated fuel reserve of roughly 48 days, including about 22 days' supply of crude oil, 59 days of LPG, 20 days of petrol, 19 days of aviation fuel, and 21 days of diesel.

This lack makes Australia very vulnerable in a crisis – 98% of our transportation relies on liquid fuel, as do all of our major defence platforms. An extended disruption means our economy, policy force and army could cease to function.

While the federal government intends to return to compliance by 2026, our ongoing failure to understand and respond to a changing environment has resulted in us becoming, at least in the context of liquid fuel, energy "insecure".

Are we ready for a new approach?

The modern energy landscape is complex, and energy security is a much broader and more dynamic concept than it was thirty years ago. Public

expectations have also evolved. Australia must address a multitude of new challenges that include: climate change, integrating renewable energy, rising peak demand, rising domestic gas prices and a raft of new geopolitical rivalries.

In many parts of the world, mechanical and analogue systems traditionally powered by oil-products, have been replaced with automated and networked systems that run on electricity. As a result, the number of digitally connected devices has grown from 400 million in 2001 to in excess of 25 billion in 2018.

These changes make electricity and natural gas, in addition to oil, key supports of many facets of society. They ensure that the modern world is completely dependent on energy generation. Within this context, resilience is a critically important requirement.

Future energy systems, responsive to this enlarged concept of energy security will therefore look very differently. Large fossil fuel and synchronous generators will be replaced by a clean electricity system composed of small-scale, clean asynchronous generators. It will mix large renewable projects (which will mean extending the physical transmission network) with distributed energy generation (for example, from rooftop solar), and the network will require new systems to ensure coordination and stability.

Renewable energy is an important component of energy security but it works differently to fossil fuels. For example, inertia functions differently. Inertia is the capacity of a power system to respond to unexpected shocks, and its ability to react and stabilise the system's balance.

Inertia slows down the rate at which frequency changes after a disruption in the grid, such as the failure of a power plant or a transmission line.

Inertia has traditionally been provided by fossil fuel generators. However, within a mixed energy framework, renewables will provide synthetic inertia. For example, modern wind turbines can use the kinetic energy stored in the generator and blades to be responsive during grid stress. This can provide an efficient injection of power into the grid where it is required, and the delivery can be flexibly controlled to suit regional grid conditions. New storage technologies will, however, need to be incorporated into networks early so their application in practice can be understood.

These are all responses to a new understanding of energy security. Today, what is essential to the definition of energy security is not just an adequate supply of energy at an appropriate price but an adequate supply of sustainable, resilient energy at an appropriate price, which is responsive to the demands of a decarbonising economy.

In light of this, energy security is perhaps even more crucial in our modern world than it was back in 1973. Understanding the evolving meaning of energy security means we are better equipped to comprehend the different ways in which our global interconnection can make us vulnerable.

We need to minimise risk and reduce exposure. We need to imagine what a secure energy framework of the future looks like. We need energy policy that is more responsive to the social, economic and environmental demands of modern Australia.

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