Accelerating Energy Transition Series

ENGINEERS AUSTRALIA

Two perspectives on the critical role of ICT in the energy transition

What is the connection between data, AI and climate change?

Dr Ian Oppermann FIEAust | October 2024

The United Nations (UN) General Assembly recently adopted a resolution on artificial intelligence (AI), for the promotion of 'safe, secure and trustworthy' AI systems that will also benefit sustainable development for all. The resolution includes calls for:

- 4(a) Expanding participation of all countries, in particular developing countries, in digital transformation to harness the benefits and effectively participate in the development, deployment and use of safe, secure and trustworthy AI systems
- 4(d) Aiming to increase funding for Sustainable Development Goals (SDGs) related research and innovation related to digital technologies and safe, secure and trustworthy AI systems and build capacity in all regions and countries to contribute to and benefit from this research.

For some, this may seem an incongruous connection. What do data and AI have to do with the UN SDGs?

The UN SDGs are a set of 17 goals to which most countries (including Australia) have committed and which describe how we want the world to be by 2030. Among other things, they address poverty (Goal 1), gender equality (Goal 5), the availability of affordable and clean energy (Goal 7), and sustainable cities (Goal 11). They represent desired outcomes in the real world. They are both aspirational and inspirational. We know, however, that real-world outcomes are always driven or influenced by many factors, including social attitudes, the convictions of politicians, policy settings, and technology.

The SDGs are deeply interconnected, so a lack of progress on one goal hinders progress on others. There is also a need to place greater emphasis and focus on the complementarities and trade-offs between the different SDGs.

For example, action to develop affordable and clean energy (Goal 7) to tackle climate change (Goal 13) – such as significant construction of hydroelectric systems, wind or solar farms may have negative effects at a local level on biodiversity (Goals 14 and 15). Similarly, development of coal-fired power stations is a means of creating work and economic growth (Goal 8); however, it may lead to poorer health and wellbeing outcomes (Goal 3), as well as poorer environmental ones.

Acknowledging these trade-offs requires careful consideration when seeking to understand the link between the application of technologies and their impact on the SDGs, as well as in policymaking.

We know we have a long way to go to deliver on the UN SDGs. In September 2023, the UN Secretary-General, António Guterres, lamented that we are 'woefully off-track'. Despite this, we also know there is great willingness within many communities to meaningfully and positively impact the UN SDGs. This often leads to communities, politicians, or policymakers going it alone just to do 'something' that will make a difference.

While there are many 'no regrets' actions that communities or individuals can take to impact any one goal, we need to better understand the impact of the efforts we are all making.

We need a framework that highlights the mechanisms or pathways through which individual efforts impact the goals and what more we can do to drive them forward. Such a framework must also reflect the complex interconnection between the SDGs themselves and the complex interactions between technology, other factors and real-world outcomes.

Data is what helps create these frameworks. AI can then be used to make sense of them. Data can improve our understanding of what is actually going on in complex networks (be they energy or the environment), track longer-term trends, allow 'drill-down' analysis of points of friction, and even allow us to explore 'what if we did this' scenarios. On the operational side, data can be used to improve the effectiveness of these networks, allowing local or large-scale optimisation and even personalisation.

The ability to hit the affordable and clean energy goal (Goal 7) requires policy settings to align with technology capabilities and investment. Most importantly, however, it requires the ability to share and use individual household-level data at scale while simultaneously preserving individual privacy, and doing so in a secure way.

Think of an energy network with millions of individual contributors optimising generation and consumption at a household level, all rolling up to a more secure, resilient and affordable electricity grid. We are some way from that.

The mobile telecommunications world gives an example of how it can be done. Data is the valuable payload in the network, but is also used everywhere in the network to understand, analyse and optimise performance.

Mobile users can also simply change providers if they choose. Additionally, access to data from mobile networks has also driven consecutive generations of innovation. Imagine if we could do the same with energy networks?

Photons carrying information in the form of radio waves are different from the photons carrying energy in electrical networks, but the principles of 'understand', 'analyse' and 'optimise' are very similar. Electricity networks have a long way to go to approach the highly agile and consumer-centric networks of the mobile communications world, but the blueprint is there.

If we are to make meaningful progress on the UN SDGs, the complexity of these real-world outcomes needs a lot of will and a lot of alignment, but increasingly it will need a lot of data shared at scale, and a lot of AI to make use of that data. Without this effort, we continue to run the risk of not achieving any of our 2030 goals.

About the author

Dr Ian Oppermann is the former NSW Chief Data Scientist. He is a board member of the International Electrotechnical Commission (IEC), an industry professor at the University of Technology Sydney, a Fellow of Engineers Australia, and chair of the Pearcey Foundation's Australia 4.0 Working Group, exploring the transition to net zero for energy networks.

Accelerating the National Energy Transition – an ICT perspective

Wayne Fitzsimmons OAM and Tim Ryan | October 2024

The role of ICT in the transformation of our national electricity distribution grid is critical. Viewing this transformation through a digital and data lens highlights a number of critical issues that must be addressed if we are to have a distribution grid fit for purpose in the 21st century and ensure a net zero emissions level is achievable.

The diagram below highlights the complexity of the 'new' system, especially the number of new elements that will be required to achieve this new paradigm.

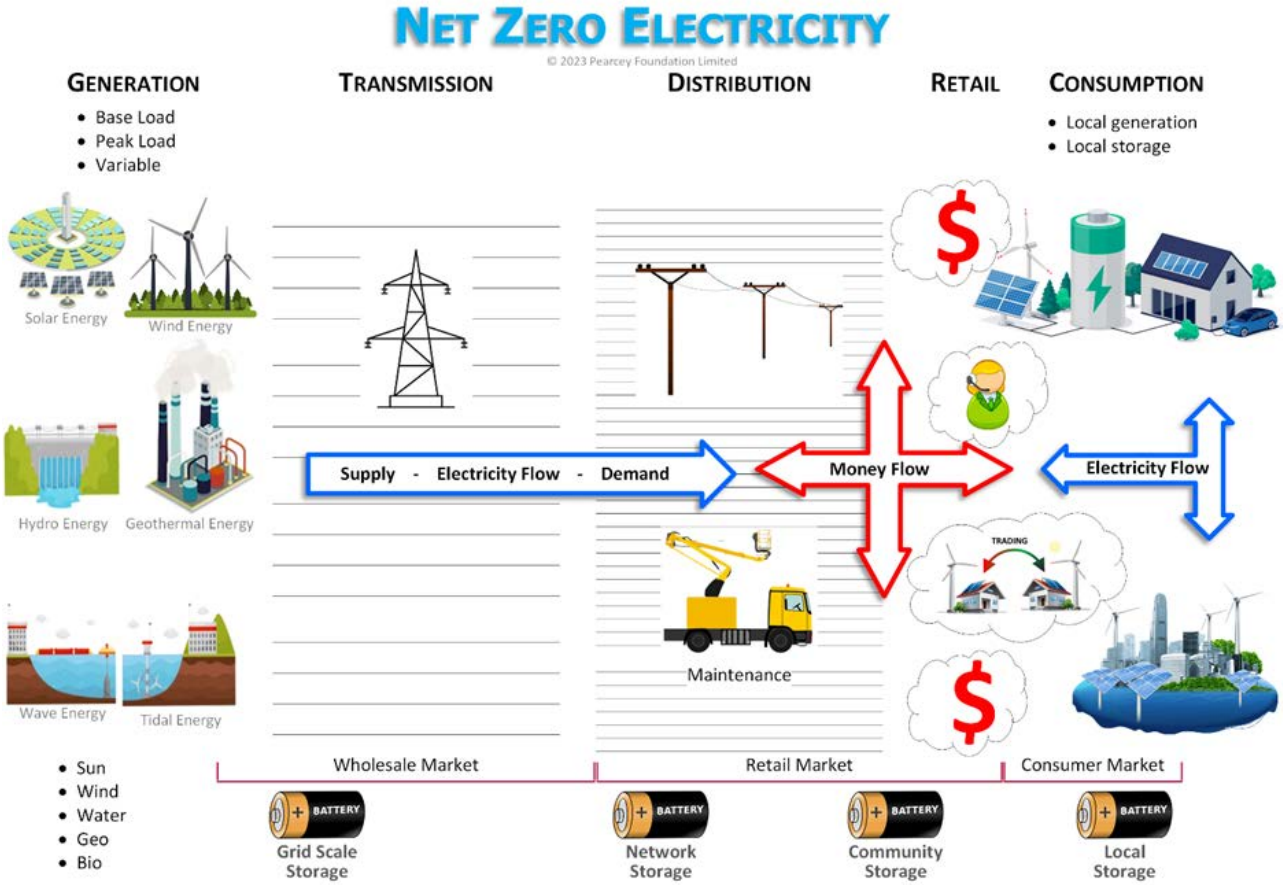

Figure 1: Electricity supply chain – net zero[1]

Whereas the current distribution contemplates tens to hundreds of generation points and millions of consumers, the new model contemplates millions of concurrent generators and storage devices as well as consumers. The mix of these three roles can change in milliseconds, both individually and in aggregate, similar to the internet and global communications networks.

This a traditional ICT/engineering perspective, but not one that is ordinarily discussed in the energy/climate debates. In 2023 there was a series of national discussions around this approach as a genuine attempt to

[1] As published in Pearcey Foundation White paper May 2023

engage the ICT sector in this transformation process, with the outcomes published in a communique[2] in April 2024.

These discussions highlighted the complexity of the future electricity grid and signalled an urgent requirement for more-sophisticated grid management. The need to coordinate and regulate the future grid in a multistakeholder environment also emerged as a major challenge.

The question of how to optimally use new digital technologies that will require access to data from existing and new sources gave rise to a number of urgent issues:

- How will household data be generated, who will own that data, who will/can use that data individually and in aggregate, and what data standards will be applied nationally or will be left to individual vendors to decide?
- Should existing electricity generation, transmission and distribution networks remain centralised, or is there a case for a decentralised systems approach similar to the internet?
- Can we contemplate a different approach to managing despatch of power concurrent with managing the demand for that power, or should they be asynchronous systems?
- Given the energy market operator is a federal agency while the distribution systems are operated under individual state regulatory environments, what new legislative paradigm is needed to preserve the agency of the consumer through the transition?

In thinking about these issues, the agency of the consumer in this transformation process takes on a new meaning that cannot be ignored. Who is intending to represent and defend consumers' interests and actual rights under this 'new' schema?

To progress these challenges will require a collaborative approach between industries that, up until now, have operated within their traditional silos. It will also demand the proactive involvement of the ICT industry to ensure this complex transition is successful.

About the author

Wayne Fitzsimmons is a communications engineer (University of Queensland 1964). He started his professional career at the Aeronautical Research Labs in Fishermans Bend, joined Fairchild Semiconductor (pioneers of silicon semiconductors and the raison d'être of the term Silicon Valley) and then in 1973 set up the Australian arm of mini-computer company Data General. Data General took him to the UK in 1980 and to Boston in the USA in 1983, holding senior executive roles with two NASDAQ-listed companies, Data General and Banyan Systems. Returning to Australia in 1994 as CEO and board member of publicly listed communications company Datacraft Ltd, he had a successful exit from his own IT start-up, OpenDirectory, in 1998. Wayne is currently chairman of the Pearcey Foundation, a national not-for-profit ICT industry group focused on promoting the ICT sector to the nation. He has been a board member of several successful early-stage Australian ICT companies – launching his latest Melbourne-based cloud software start-up, iPro, in early 2018. He was awarded an Order of Australia Medal in the 2018 Queens Birthdays Honours. His current focus is on the role of digital and data in the transformation of the national electricity distribution grid as we approach net zero emissions, including ensuring consumer agency is paramount in this transition process

[2] The Communique sets out the challenges in detail and can be found at Net Zero Australia - A40 Communiqué Download (pearcey.org.au)