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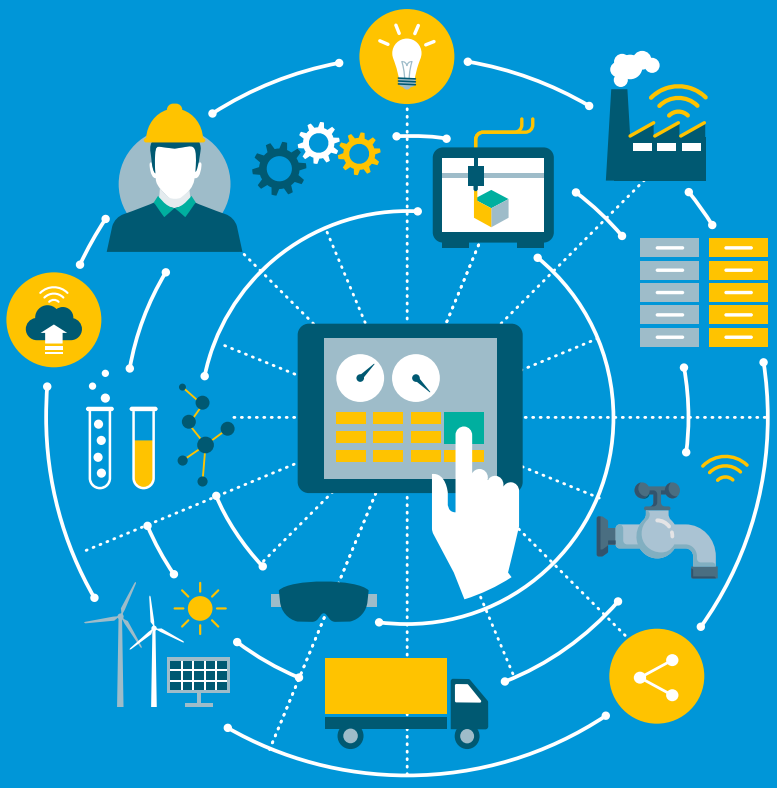
Planning for a connected future:

Considering the business case for IoT in utilities



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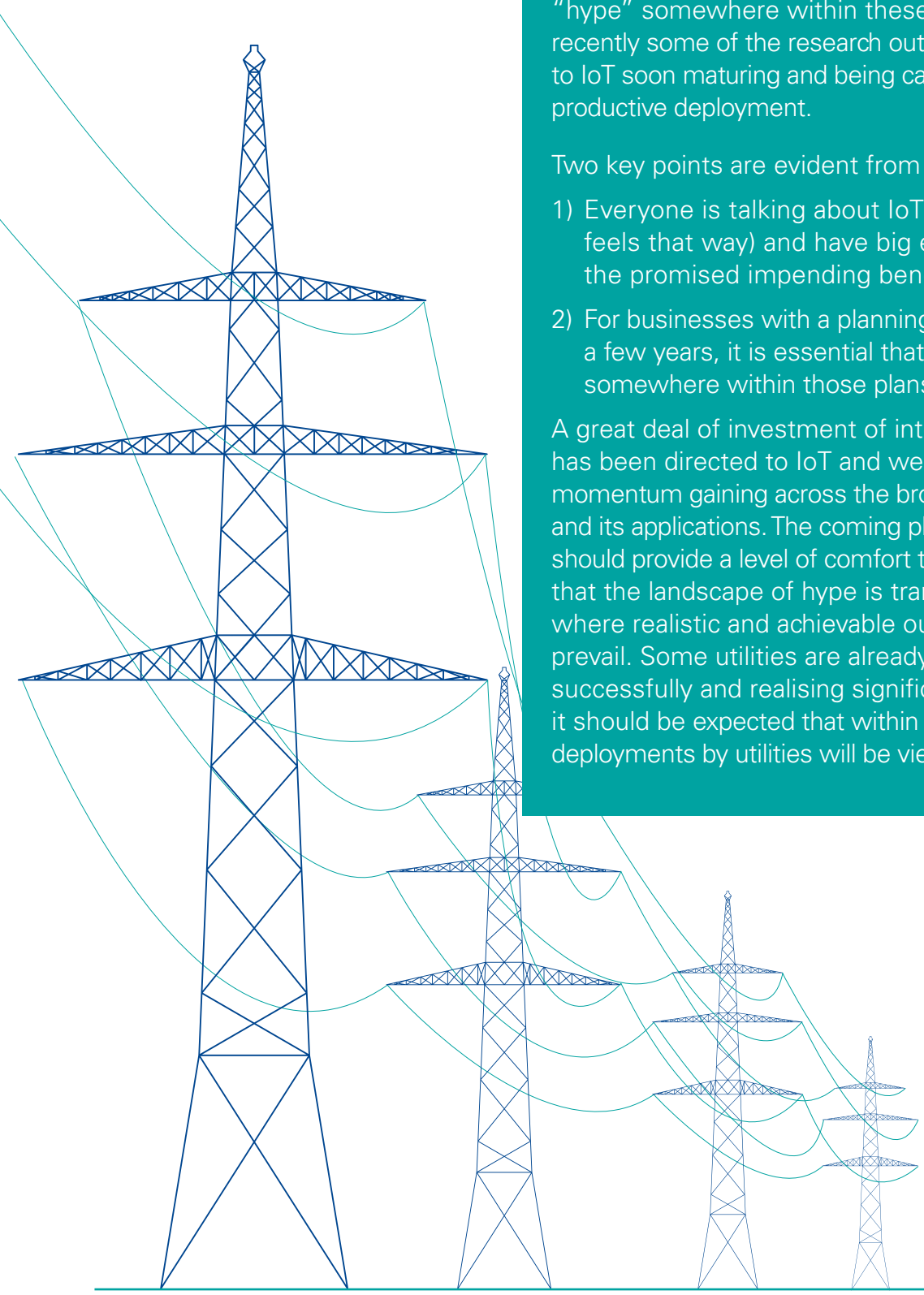
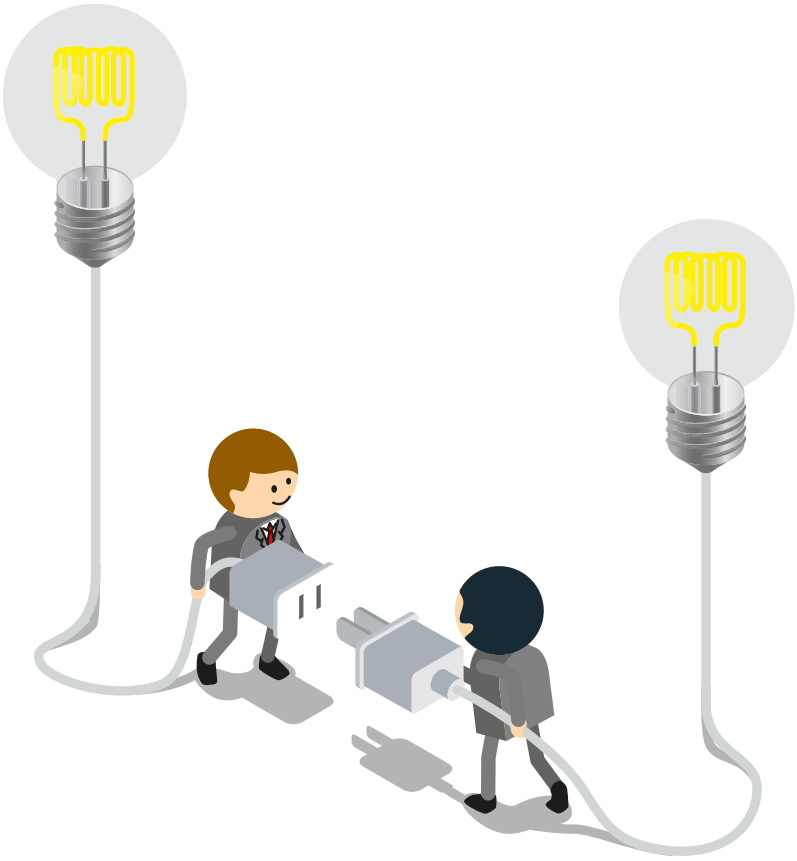
In recent years there has been a tremendous volume of analysis around the Internet of Things (IoT) with insights published by research organisations that range from the boutique through to the prestige. Frequently, the commentary around this analysis has included the term "hype" somewhere within these articles, although recently some of the research outcomes have pointed to IoT soon maturing and being capable of widespread productive deployment.

Two key points are evident from this:

1) Everyone is talking about IoT (or at least it feels that way) and have big expectations of the promised impending benefits.
2) For businesses with a planning horizon beyond a few years, it is essential that IoT feature somewhere within those plans.

A great deal of investment of intellect and effort has been directed to IoT and we continue to see momentum gaining across the broad IoT ecosystem and its applications. The coming phase of maturing should provide a level of comfort to business leaders that the landscape of hype is transitioning to one where realistic and achievable outcomes will soon prevail. Some utilities are already deploying IoT successfully and realising significant benefits, and it should be expected that within only a few years IoT deployments by utilities will be viewed as mainstream.





Within the present landscape of rapid advancement in IoT a shorter timeframe view can be beneficial

Planning for the future

The core function of any power and utility organisation is to safely and efficiently deliver energy and/or water to a customer at the maximum possible reliability, at the lowest possible cost, and in a manner that aligns with the particular values of that organisation. This is regardless of whether the organisation is operated as a government owned entity or whether it is a business that must deliver a financial return to shareholders. This requires good leadership and governance along with wise and informed decision making for investing in assets and embarking on modernisation programs. In the context of a technology driven digital transformation, the scope and scale of that transformation needs to be realised through clear benefits to the organisation that can be supported by a business case underpinned by rigorous modelling and evidence from proofs of concept where possible.

In the power and utilities sector, long-term planning horizons are the norm and, in many cases, are mandated by governments and regulators. Assets in power and water networks have, until today, invariably existed for long periods of time, and you only need consider a few examples to get a feel for the scale of lifetimes that are generally expected. Power transformer life expectancies can range from 20 to 55 years[1,2] based upon their function and where they exist within the distribution network. Water mains may have planned economic life expectancies of 80 years and dams 100 years[3].

IoT devices, however, are shorter-lived assets. With the exponential growth of IoT devices linked to improvements in battery performance, the indicative lifetime of an IoT device is dictated by the achievable lifetime of its battery, which currently is around 10 to 15 years. For planning purposes this lifetime may need to be derated to take into account some particularly harsh environments existing across a water, sewerage or power network, which may mean that battery outlasts the sensor and communications electronics. And within the present landscape of rapid advancement in IoT the shorter timeframe view can be beneficial in that future technology improvements can be considered if and when there is a requirement to refresh a deployment.

1 https://www.aer.gov.au/system/files/United%20Energy%20-%20Asset%20Management%20Plan%20-%20April%202015.pdf

2 https://www.aer.gov.au/system/files/SAPN%20-%2020.64%20PUBLIC%20-%20SAPN%20Asset%20Management%20Plan%203.2.01%20Substation%20Transformers%202014%20to%202025.pdf

3 http://www.water.nsw.gov.au/__data/assets/pdf_file/0004/549652/utilities_nsw_water_sewerage_strategic_planning_guidelines.pdf

The justification for a utility business to pursue an IoT strategy is strong, and examination of any of the soft or hard benefits would support the case that a detailed investigation is warranted

Benefits of an IoT strategy

The justification for a utility business to pursue an IoT strategy is strong, and examination of any of the soft or hard benefits would support the case that a detailed investigation is warranted. Some of these benefits include:

- deferring or avoiding capital expenditure
- risk mitigation
- reductions in operating expenditure
- gains in operational efficiency and excellence
- new products and services
- opportunities to empower customers, improve customer sentiment, and increase retention.

To illustrate the economic benefits, let's consider some scenarios where IoT could be deployed as a mechanism by which peak demand on the network is reduced. In a power network this could involve rolling out a Demand Response initiative. In wastewater this might look like a smart strategy for managing sewer discharges[4]. It has been a long held and reasonable view that we must build network capacity to accommodate peak loads, but the reality of doing so is that networks spend much of their time operating well below their peak design capacity. The net system load profile for NSW's electricity consumption shows that approximately two-thirds of the time the network operates at loads of 60 percent or less than peak loads[5]. So in this context, if you had the choice to invest $2 million in an IoT program that could avoid a $20 million investment in a 'traditional' network upgrade, then it would seem almost a given which option should be chosen. Clearly there is more to consider than the initial upfront investment, and with the economics we need to consider the entire Total Cost of Ownership (TCO). In taking into account the different life expectancies of the technologies, and factoring in

4 http://southeastwater.com.au/CurrentProjects/Projects/Pages/Aquarevo.aspx

5 http://www.aemc.gov.au/getattachment/5615bb69-f5b5-4afe-bc49-6c1a7ea89727/Net-system-load-profile-2012.aspx

ongoing maintenance, it would not be unreasonable to consider that the 5-year TCO may come in at $3 million for the IoT solution which compares favorably with $25 million in traditional network reinforcement. Even at the 10-year mark, you might assume that there has been a complete refresh of the IoT solution at some point in time, and so the TCO may come in at $6 million which is still a fraction of the $30 million 10-year TCO of the traditional approach. From an economics viewpoint it would certainly seem compelling to choose the IoT option, assuming that all other necessary considerations are met, such as system reliability.

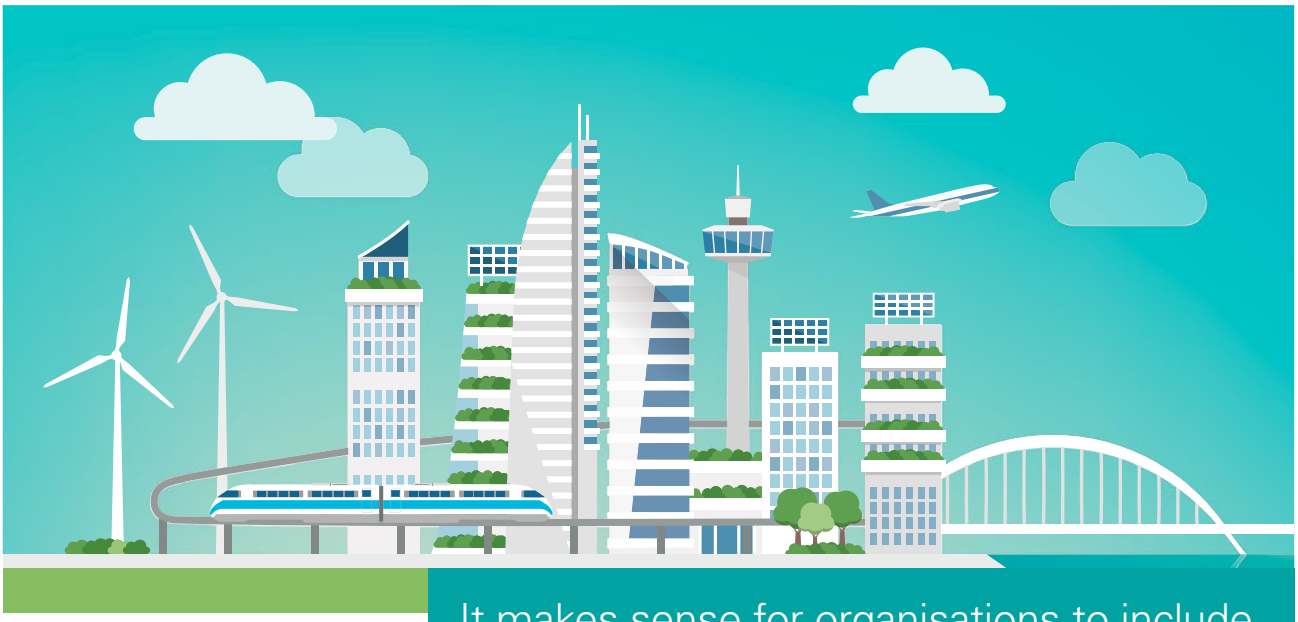
Building a business case around capital cost considerations is a reasonably black and white approach process that yields answers from that particular viewpoint. But what about looking for a moment at some of the other potential benefits that open up, as these too can be considerable levers in any overall decision.

IoT is opening up new approaches to traditional business areas, and this is particularly evident in risk mitigation. The very nature of a power and utility business means that risk management processes are built in to almost every aspect of the organisation's activities. IoT provides a lever by which risks and negative consequences can be reduced, either through enabling predictive decision making or by providing earlier and/or more granular insight into operations facilitating earlier and/or better decisions. For example, through deploying an IoT enabled monitoring and predictive analysis suite you may significantly reduce the likelihood of a major failure of an important network asset such as a zone transformer, avoiding significant financial and intangible consequences. The costs of implementing monitoring at this level need not be high – vibration and temperature can be sensed with low cost IoT devices – and in combination with a Machine Learning (ML) platform, the vibration and temperature could be checked in real-time against baseline healthy operations data enabling automatic warnings to be triggered should it become apparent that a fault condition is arising. This type of approach can be equally applied to other large assets across a variety of industries: large pumps and turbines; mechanical structures such as bridges; and HVAC chillers, fans and compressors.

A key driver for developing an effective IoT strategy is the need to reduce operating costs and better utilise available resources. For a power and utilities business, if we consider field work forces and their associated tools and equipment, their activities are predominantly directed towards responding to fault conditions and undertaking maintenance activities. If better visibility of the organisation's network operations were available to field works dispatchers, whether that be improved timeliness of information or improved granularity, it may be possible to better locate field work forces and more intelligently deploy teams to attend to faults. This could result in faster restoration times and reductions of the number of customers disrupted. Further field works optimisation may also be available through shifting some maintenance activities away from a cyclical model to a predictive maintenance approach supported by ML. When considering the field operational costs in full, what we are seeking is a net cost benefit where the gains through the approaches discussed outweigh any additional operational costs brought about by having an IoT deployment.

Data is the lifeblood of IoT, and the ways in which data is generated and operationalised are critical for optimal IoT deployment. Whilst data is primarily used to support operational decision making, there are other potential ways to capture significant value from data. For example, to enhance existing products or establish new products for existing customers, opening up the possibilities of new revenue opportunities and products that contribute towards improving customer retention and reducing churn. Consider the case of Smart Meters, in either the power or water sector. Several Australian states have employed Smart Meters for many years, and their reach is now expanding in response to regulatory changes, technology improvements and business case developments. For decades, Australian consumers have received only quarterly usage information for their power and water, but the data collected from smart metering can, in some cases include readings taken at 5-minute intervals. In the power sector Smart Meters already enable Time-of-use tariffs to be offered to customers, however, there are many other potential ways this data could be utilised to offer new products and services.

Beyond the existing customer base, there is also the opportunity to access an entirely new pool of customers. For example, if a power and utilities business has a geographically dispersed network of IoT devices that measure environmental variables, there would be a real possibility that other businesses may see value in having access to that data. In this case there is an opportunity to monetise this data, to the extent that the terms and conditions under which this data was collected allow and in a way that falls within relevant privacy legislation. This is precisely one of the use cases being considered by some owners and operators of street lighting, with the advent of intelligent street lighting options that incorporate LED lamps, an array of environmental and other sensors, along with connectivity, within a single pole assembly.



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Change and opportunity

Advances in IoT presents power and utility businesses with vast opportunities worthy of consideration. Furthermore, successful commercial IoT deployments that deliver true value to businesses are growing in number. With this in mind, it makes sense for organisations to include IoT within their technology mix, and in a manner that considers IoT to be an enabler of innovation across the entire organisation.

The changing landscape of the IoT ecosystem presents a key challenge for power and utility organisations. New and existing vendors are frequently bringing fresh IoT offerings to market, a number of which are accompanied by further advancements of technologies. There is little to suggest that this pace of change will slow down, and with recent history as our guide it may be reasonable to assume that the pace of change will only increase. This is a new paradigm for a power and utilities business that has only ever invested in operational technology infrastructure that is long-lived and built on well-established, stable technology.

With this in mind, it is essential that a robust business case be built in support of any IoT deployment. This business case should take into account a number of aspects that are relevant to IoT.

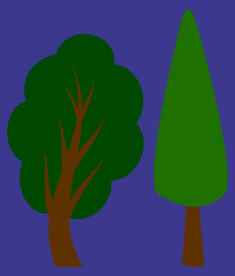
- Consider IoT devices and infrastructure to have a lifetime of between 5 and 15 years based upon their function and usage conditions. This may require a fast return on investment to be achieved for the shorter lived devices. In the context of the technological landscape, technologies available in 5 years' time will be exponentially further advanced than today. It is generally accepted that for most battery-powered IoT devices a target lifetime of 10 years will suffice, although in residential water metering deployments the target lifetime can extend out to 15 years.
- Benefits of an IoT deployment are often not singular. For example, an IoT deployment may both defer capital expenditure whilst at the same time reduce disruption to customers and/or increase customer satisfaction and retention. So in this example there is both a financial benefit and an advantage with a number of the intangible measures.
- In many situations it may not be appropriate nor feasible to consider IoT for blanket deployment across a utility's entire network. Instead it may be better to look at targeting deployment to select locations that can be prioritised based on need and likely benefits.

Key takeaways

Set IoT strategy from the top. Ensure that all necessary parts of the organisation participate to prevent IoT from remaining hidden within a silo, limiting its ability to deliver benefits.

Collaborate. Bring together internal cross-functional teams to pursue broad organisational benefits. Work with trusted partners to capitalise on their strengths.

Build capability. New skills will be necessary both in terms of new technologies and in terms of the data and information that will be generated through IoT.



Ecosystem. A successful IoT strategy requires a rich ecosystem of IoT innovators and technologies

Undertake proofs of concept. These should be the training ground for your teams to be brave and to innovate, and from which learnings will later contribute to developing the business case.

Develop your economic model and business case. This will be the opportunity to objectively justify where and how IoT should be used within the organisation, appropriately balancing costs and effort against the benefits.

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