



Analytics from the trenches

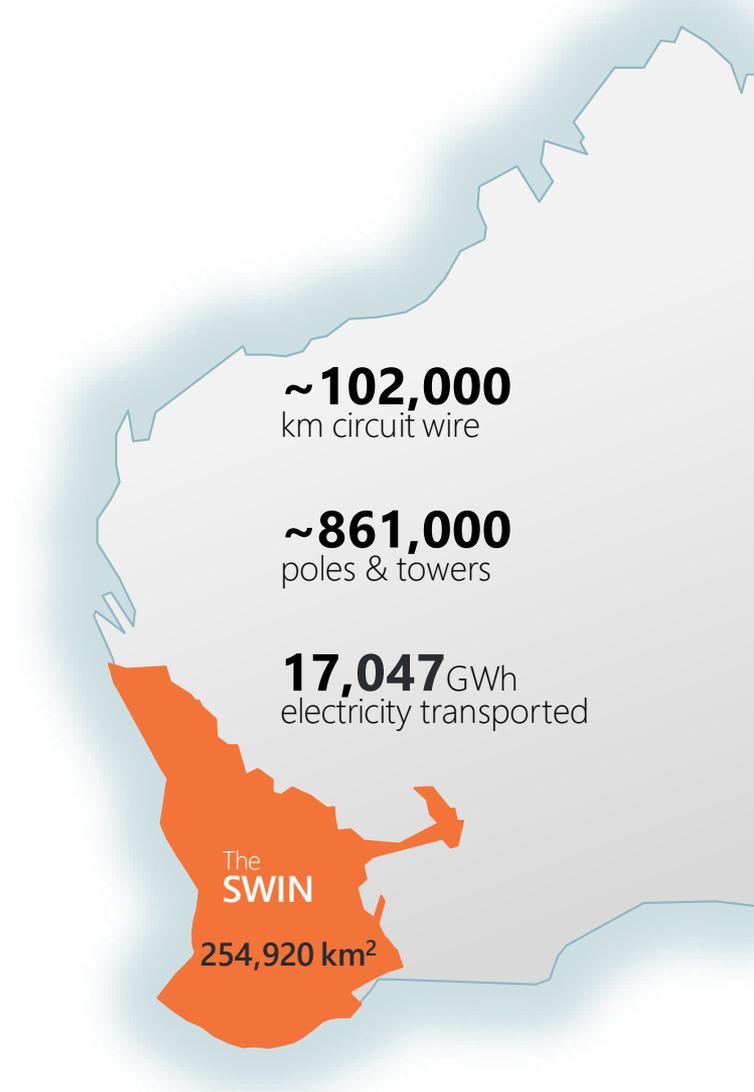
Towards an analytics strategy for digital utilities



About Western Power

- Build, maintain & operate transmission and distribution assets: South West Interconnected Network (SWIN)
- 1.1+ million customers
- ~264,000 street lights
- ~224,000 solar PV installations*
- ~220 battery systems*

* As at 1/10/17

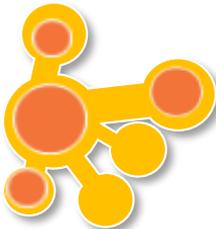


What we do



Network evolution is reliant on community behaviour, technology advancement rates, regulation and policy

Integrated Network



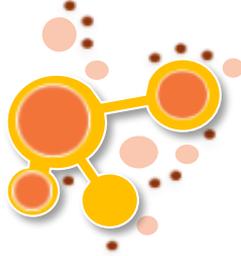
Current SWIS model

Fringe Disconnection



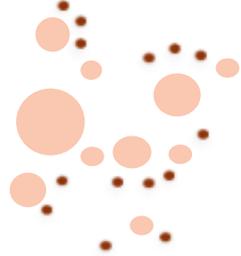
Future model with small number of islanded systems

Modular Network



Future model with variable network types

Fully Decentralised



Extreme model without centralised network

KEY	 BRANCH NETWORK	 MESH NETWORK	 MICROGRID	 STAND-ALONE POWER SYSTEM (SPS)

A strategy is...

- A plan to achieve one or more goals under conditions of uncertainty.
- Strategy is solving a design problem with trade-offs
- Key elements are:
 - Diagnosis
 - Guiding policy/principles
 - Action plan



Elements of an analytics strategy

- Understand the business strategy and strategic focal areas
- Develop analytics vision and set target maturity levels for core processes
- Develop business ideas for analytics supporting the vision
- Prioritize and develop a strategic roadmap
- Develop a blueprint of the resulting target architecture
- Decide on organization and capability development



Analytics guiding principles

1. Define business problem (economics)
2. Collect data & analyse
3. Tell the story with data to provide actionable insights
4. Take action

Implementing data science is the goal

Analytics must identify & address the core business problem



The problem

Diagnosis



Natural monopoly

What does it mean?

Introducing competition in a natural monopoly industry results in the cost to consumers going up.

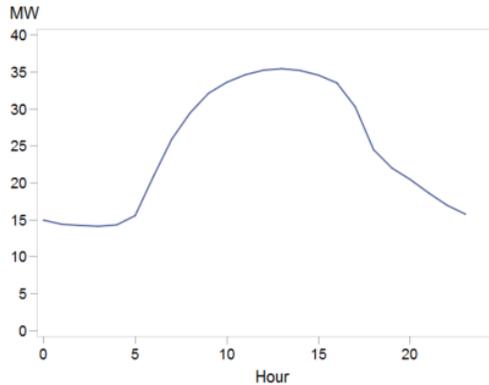
Pretty much describes the Australian electricity industry since 1995 doesn't it!

Cost increases of 2x, 3x, 4x,...

Intraday profile by zone substation

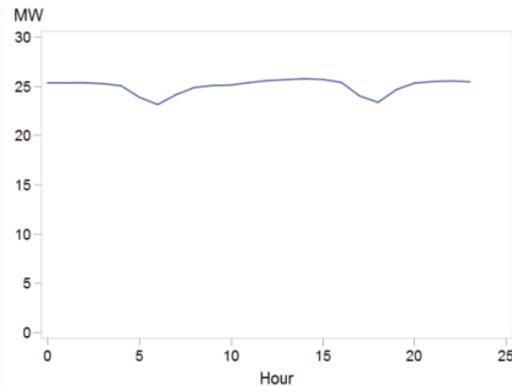
Average intra-day demand profile

Customer type=COMMERCIAL



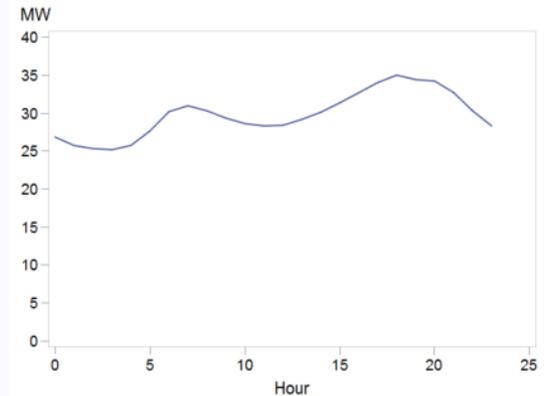
Average intra-day demand profile

Customer type=INDUSTRIAL



Average intra-day demand profile

Customer type=RESIDENTIAL

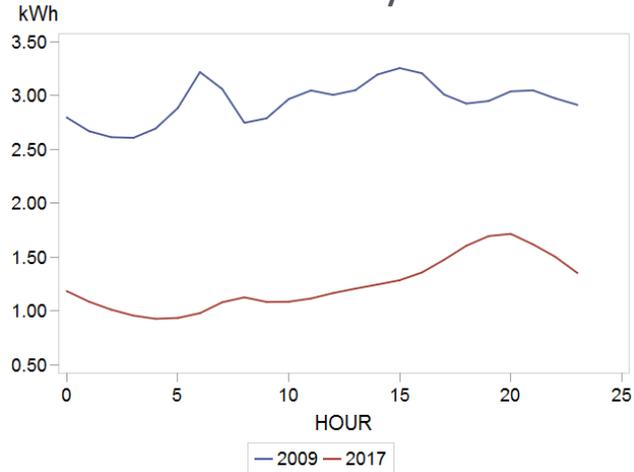


Each zone substation supplies a mixture of each customer type. The zone substations shown above have been chosen as they are predominately supply by customer type indicated.

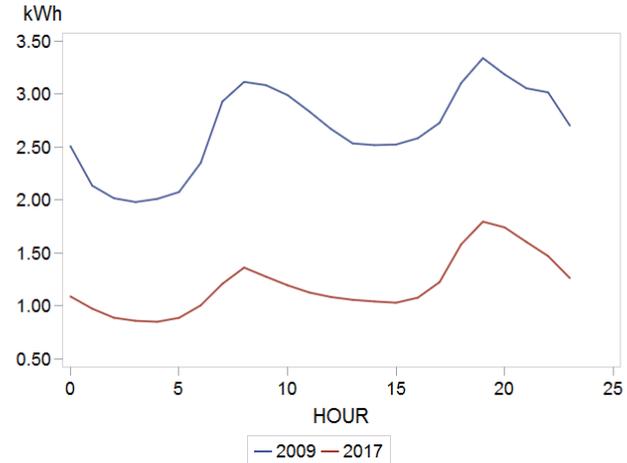


Average residential meter data

February



June

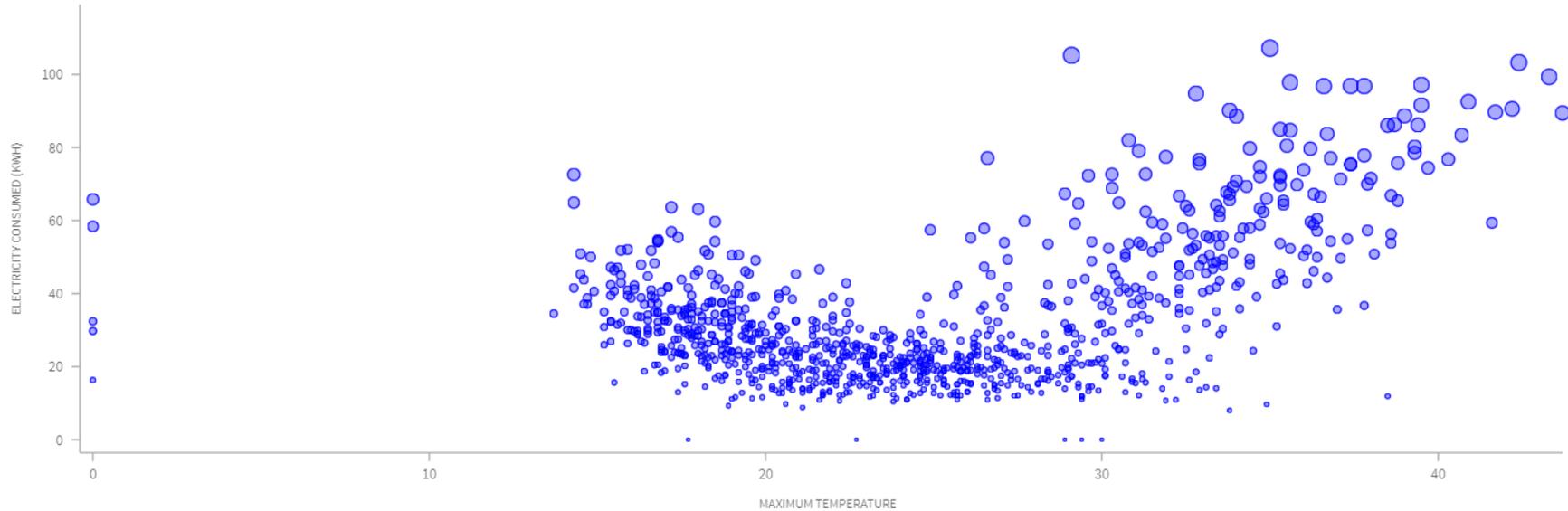


With solar PV in 2018



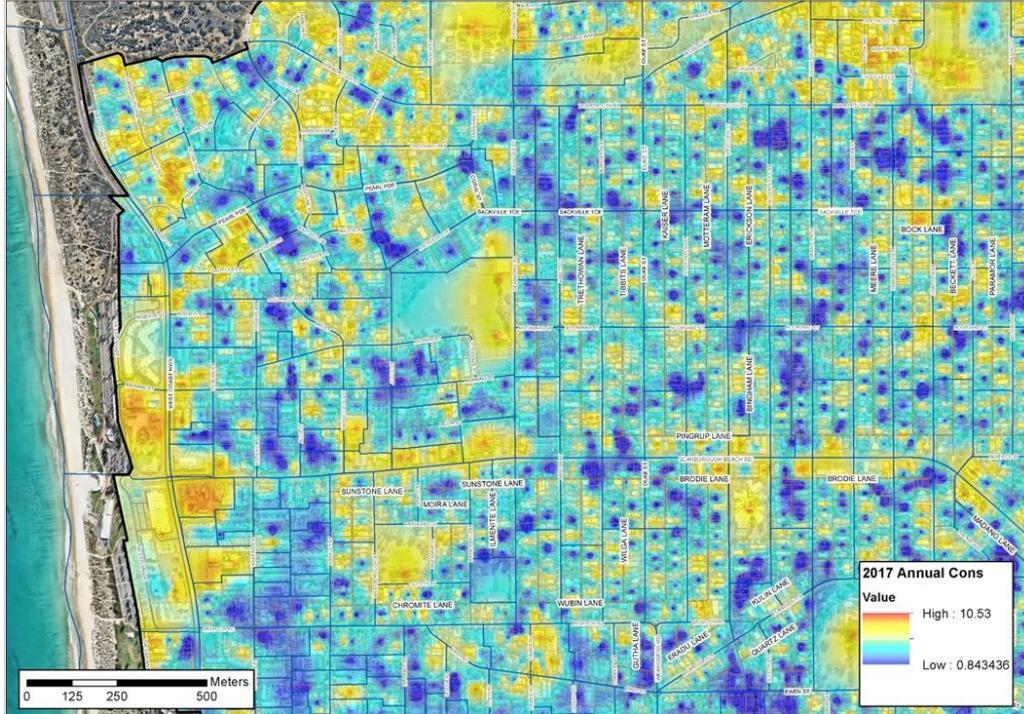
Weather analytics

Temperature versus electricity



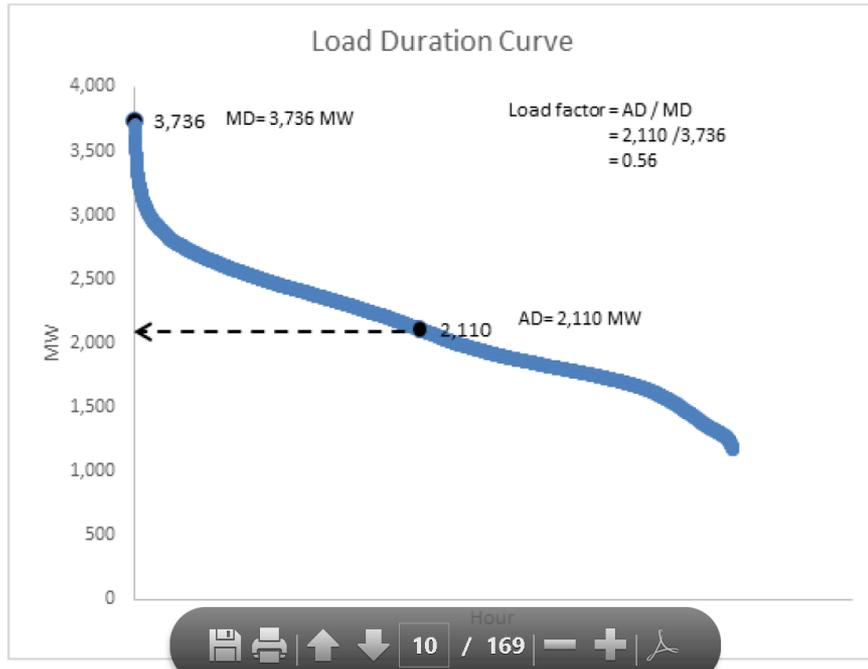
Spatial analytics

Demonstration - current load density

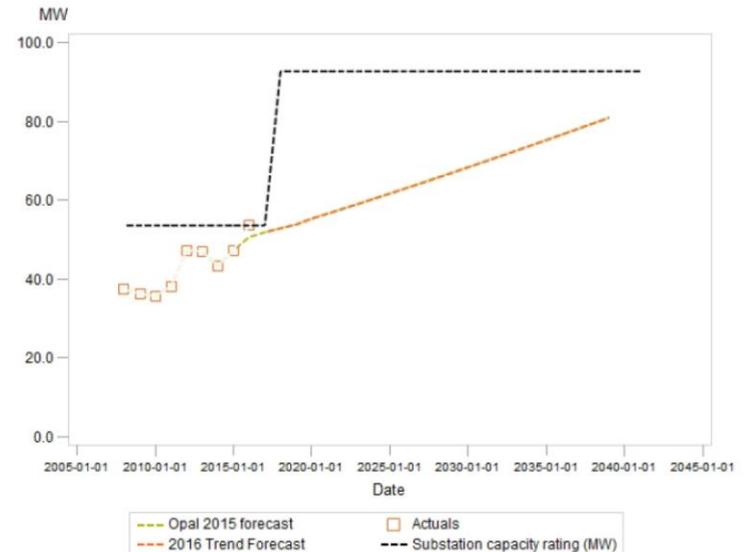


Low utilisation is an issue

Adding network capacity is lumpy



- A lot of network capacity built for just a few hours per year



What will our customers do next?

- Customer analytics
- Customer intention analysis

Understanding our customers is at the core of forecasting network



Distribution of one customer type



Strategic implications

- Behind this simple story lies a deeper truth.
- Network utilisation is low; a large portion of network capacity is devoted to supplying electricity for just a small part of the year.
- Given that network cost is largely fixed combined with postage stamp pricing, there is a tendency for heavy seasonal electricity consumers to underpay for the system.
- There are two choices here. Either:
 - Heavy seasonal consumers reduce their demand
 - Over-payers adopt photovoltaics, thus offsetting their rising electricity bill
- One further observation is that there are substantial supply-side lags
 - Lumpy capex means that surplus capacity takes a reasonably long time to use up
 - It takes a long time to add new capacity and it comes in expensive lumps
 - This implies that network prices trend with a long lag – ‘cos it’s tied to supply-side costs!



Data patterns

Tomorrow

- It is all very well knowing today's story, but what people pay us to do is figure out what tomorrow's patterns will look like and why.
- This is where understanding the DGP becomes powerful.
- The story so far suggests:
 - There is a growing affluence that allows consumers to install more energy-using appliances.
 - Consumers respond to adverse financial shocks.
 - Supply side trends can take a long time to change.

Taking action

The most challenging part



Focus on the fundamental

With a detailed enough understanding of the problem, we can think about solution attributes that are likely to be effective.

With consumers responding to or expecting future adverse financial shocks, we need to find ways to:

- Reduce the magnitude, if not completely eliminate, the upward trend in electricity prices.
- Enhance the value proposition of the network.

Remember I stated that traditional network capacity is lumpy and imposes a fixed cost that is sunk and irreversible.

- What if there is a smart way to avoid or defer that new capacity augmentation?
- What if customers could capture new value in the form of direct participation in the electricity market?



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Data patterns

Electricity storage: A thought experiment

Given my account of the DGP, what do you suppose is likely to happen with respect to *en masse* adoption of electricity storage by SWIS connected consumers?

- Will we see *en masse* adoption?
- If so, when?
- What would be the impact on the network?

Assuming no change to pricing policy & long supply side lags, there is an incentive to keep adding photovoltaics without storage.

Caveat: keep an eye on affluence. There are several ways this can manifest:

- Higher real income, lower real prices or both.
- Lower real prices of storage changes the relative price between network supplied electricity & self-supply. This makes self-supply more attractive.

Final thoughts

Our digital future

A **general purpose technology** or GPT is a term coined to describe a new method of producing and inventing that is important enough to have a protracted aggregate impact.

Electricity and information **technology** (IT) are probably the two most important GPTs so far.

Boyan Jovanovic and Peter L. Rousseau, [General Purpose Technologies](#)

Digitalisation as a process helps to systematically remove human-imposed constraints on productivity growth.

A fully digitalised network provides new capabilities:

- Millisecond AI switching facilitates rapid coordination of demand response along its four dimensions: [Shape, Shift, Shimmy & Shed](#)
- This suggests a fundamentally different type of capital expenditure that efficiently minimises the extent of the fixed cost problem for electricity grids everywhere.