LISTEN.
THINK.
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Energy Efficiency

Understanding & Benefiting from the Opportunity

Scott Wooldridge

July 2018

Rockwell Automation

Allen-Bradley · Rockwell Software

Defining Energy : W.A.G.E.S

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- Energy Components :
  - **W**ater / Wastewater
  - **A**ir
  - **G**as
  - **E**lectricity
  - **S**team
- Energy costs can be **20 percent of Cost of Goods Sold** for food & beverage plants
- Energy should be thought of as an INGREDIENT
  - Information can tell you how much of that ingredient is required for products you make (effectively becomes an input into a recipe)
  - Sustainability is a part of your BRAND

Electricity & gas cost impact

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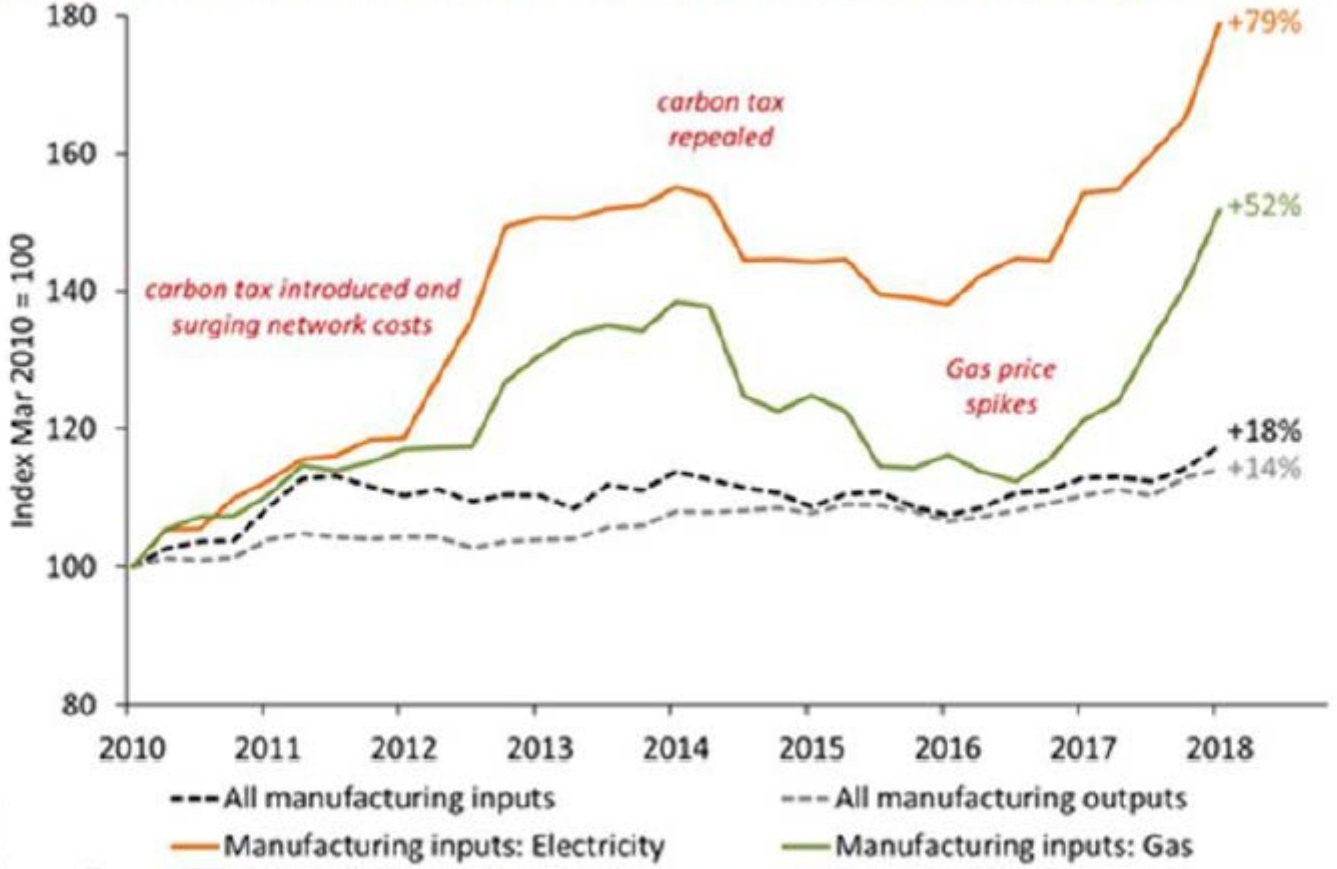
Chart 1: Manufacturing electricity and gas input prices indexes, cumulative change*, 2010 to 2018



* producer price indexes rebased to March Quarter 2000 = 100.

Source: ABS, *Producer Price Index*, Mar 2018.

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Volatile electricity prices

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What is causing this?

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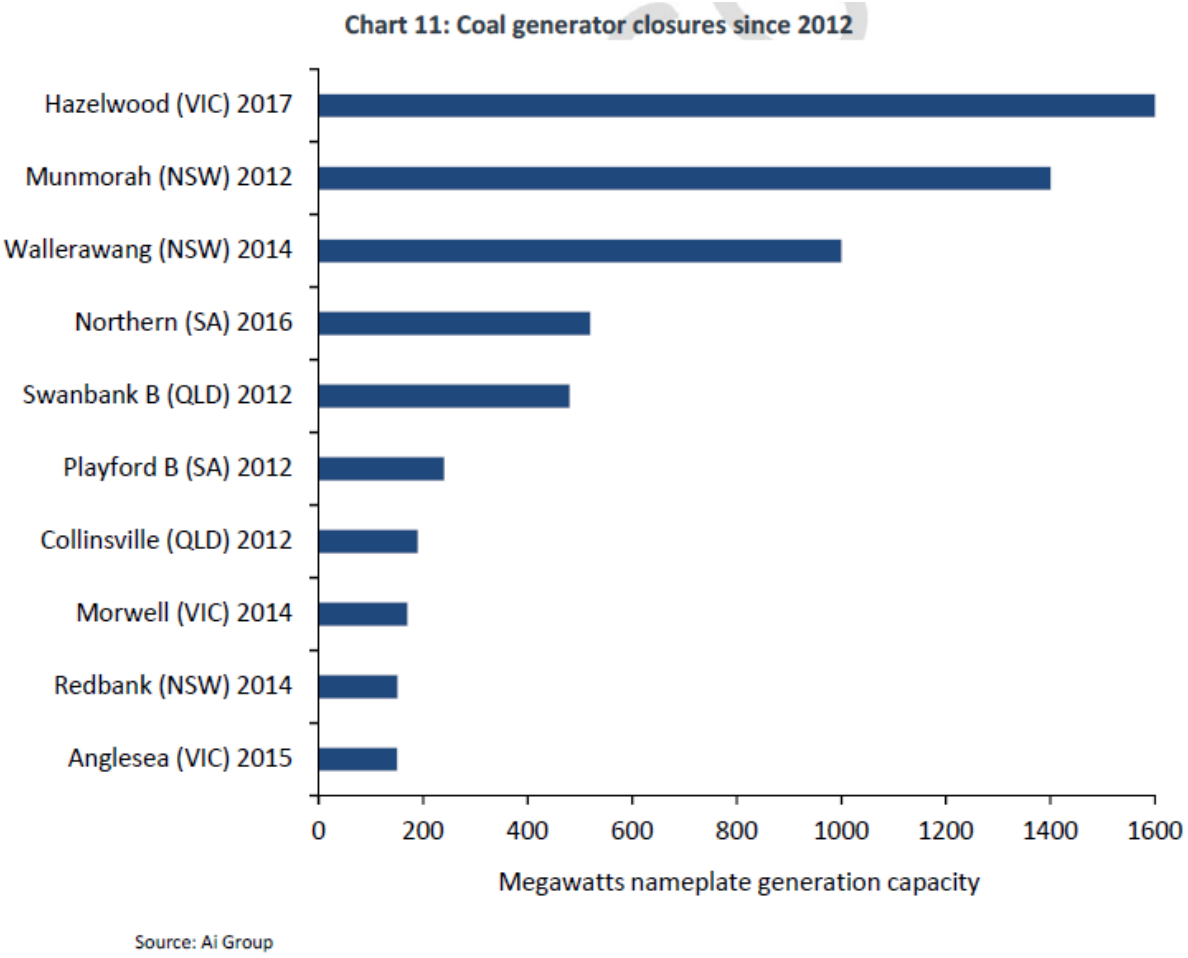

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Energy Generation capacity has reduced

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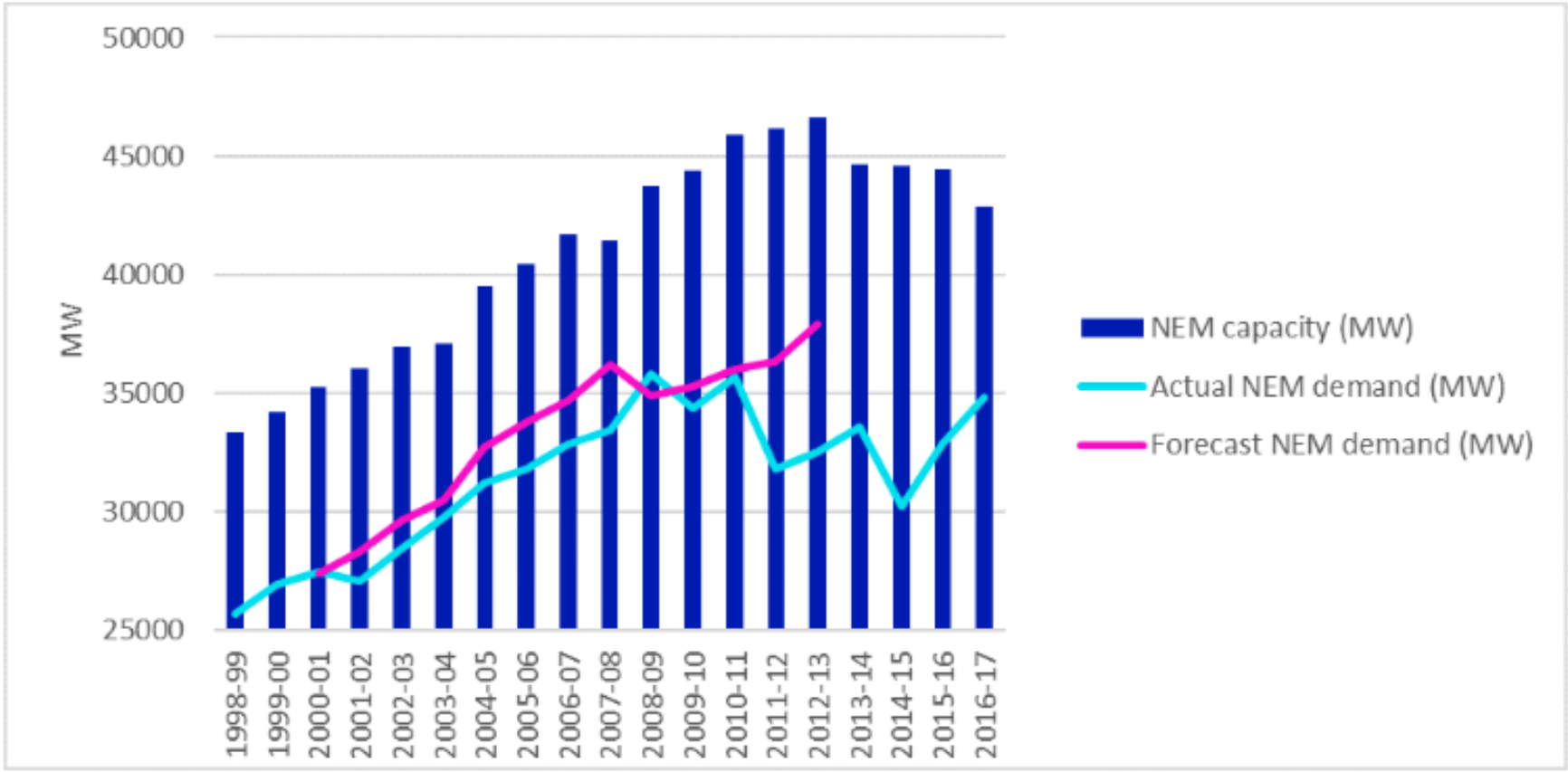
Actual NEM capacity and demand 1998-2017



Source: AER, AEMO

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Generation shortfalls in specific states

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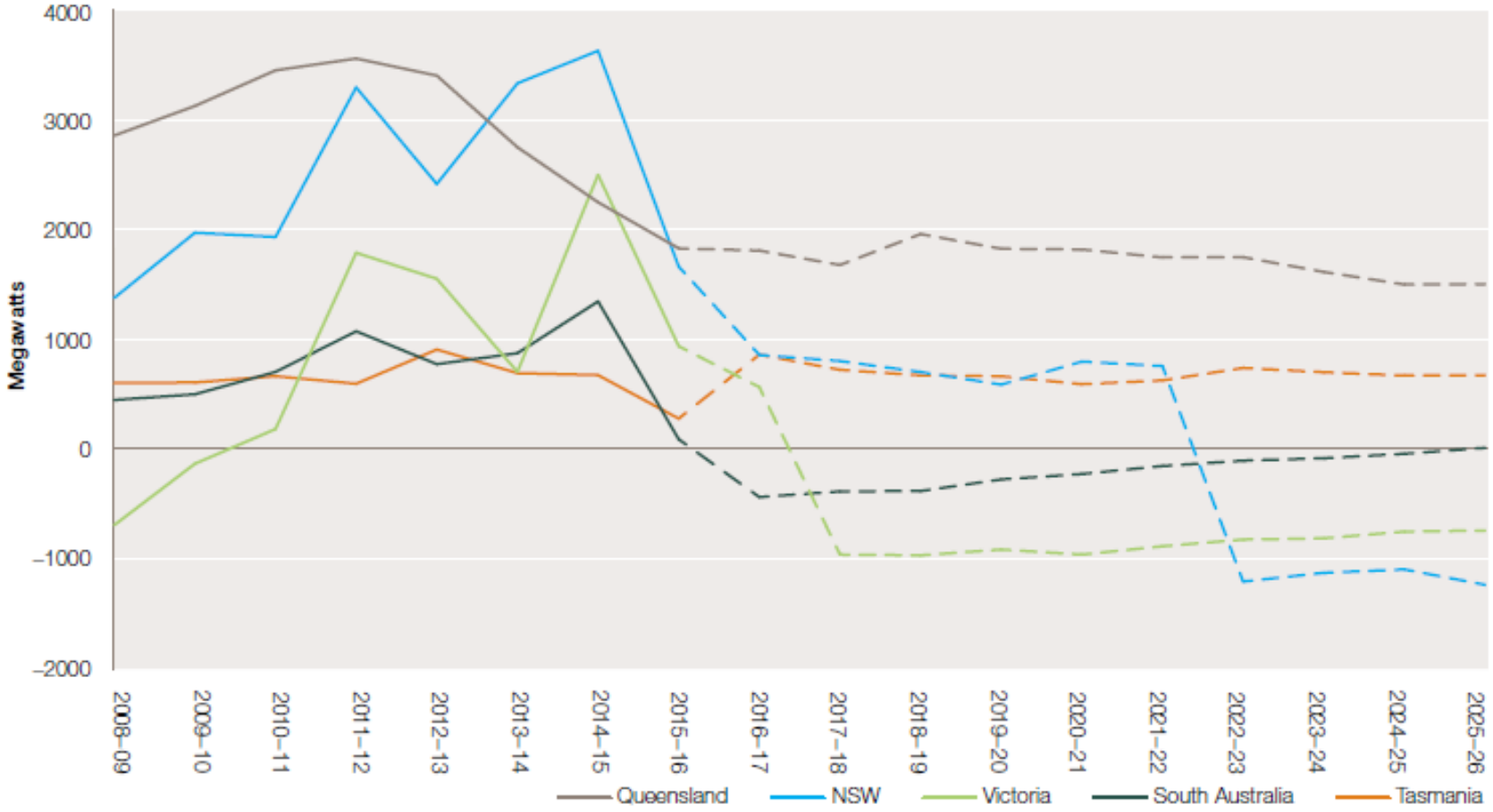
Figure 1.18

Surplus generation capacity, by region



Notes:

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Renewables are competitive

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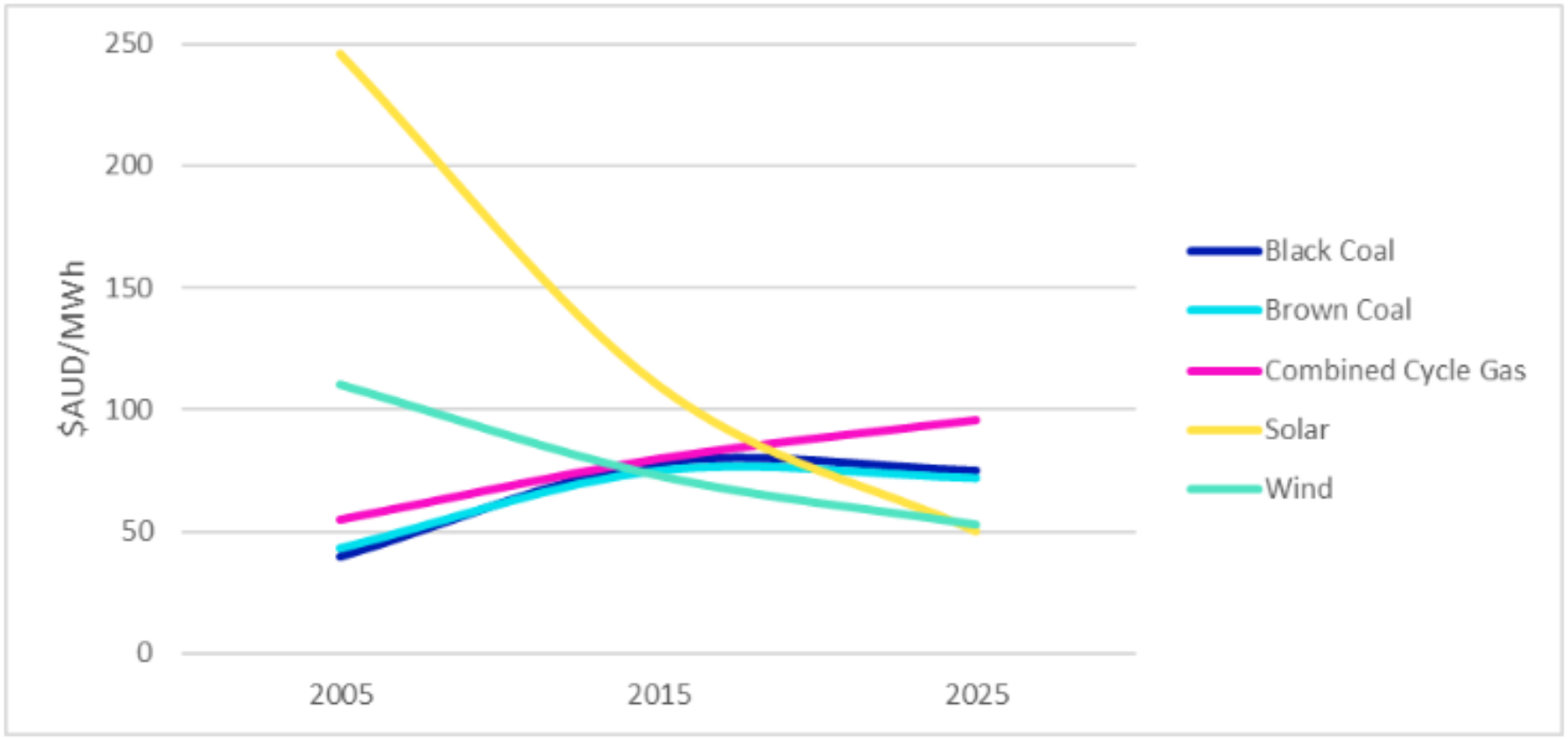
Levelised cost of energy (2005-2025)



Source: AiGroup, 2017

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Energy mix is changing however still coal dominant

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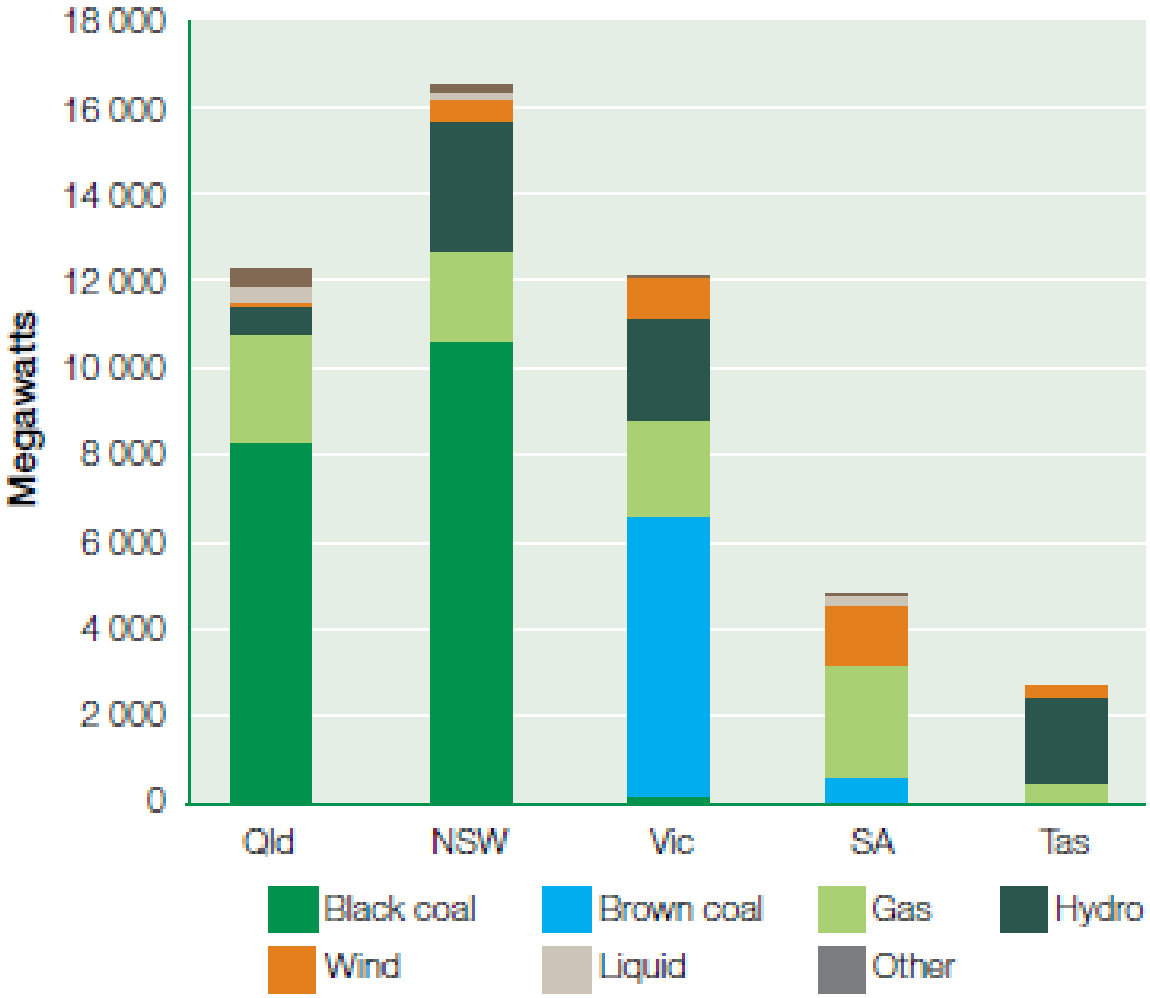

Sources (figures 1.5–1.6): AEMO; AER.

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Is our electricity expensive? 2017 peak price viewpoint

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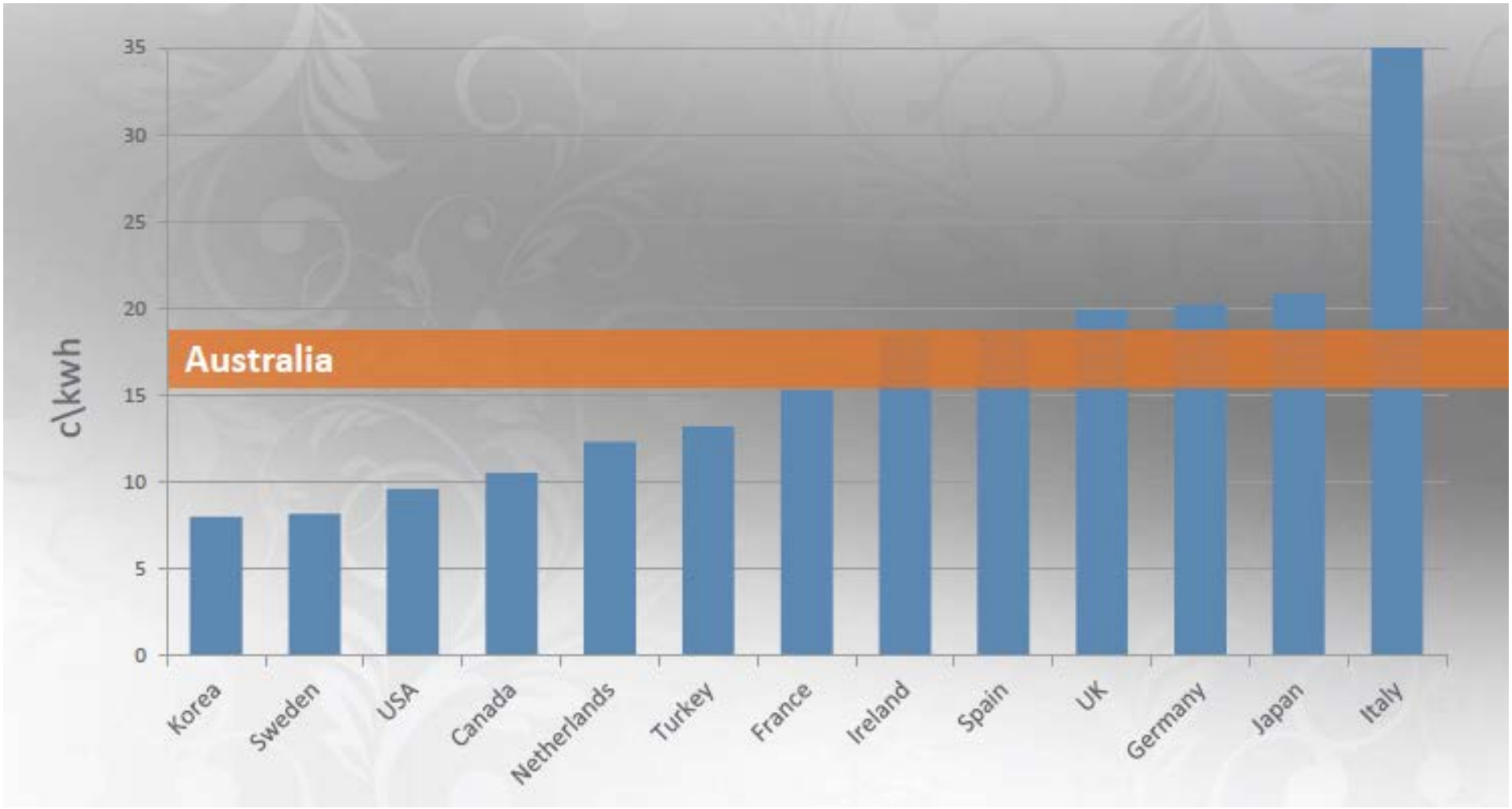

Reference: UK Department of Energy and Climate Change September 2016 comparative data set

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Remember the good old days? 1996 comparison...

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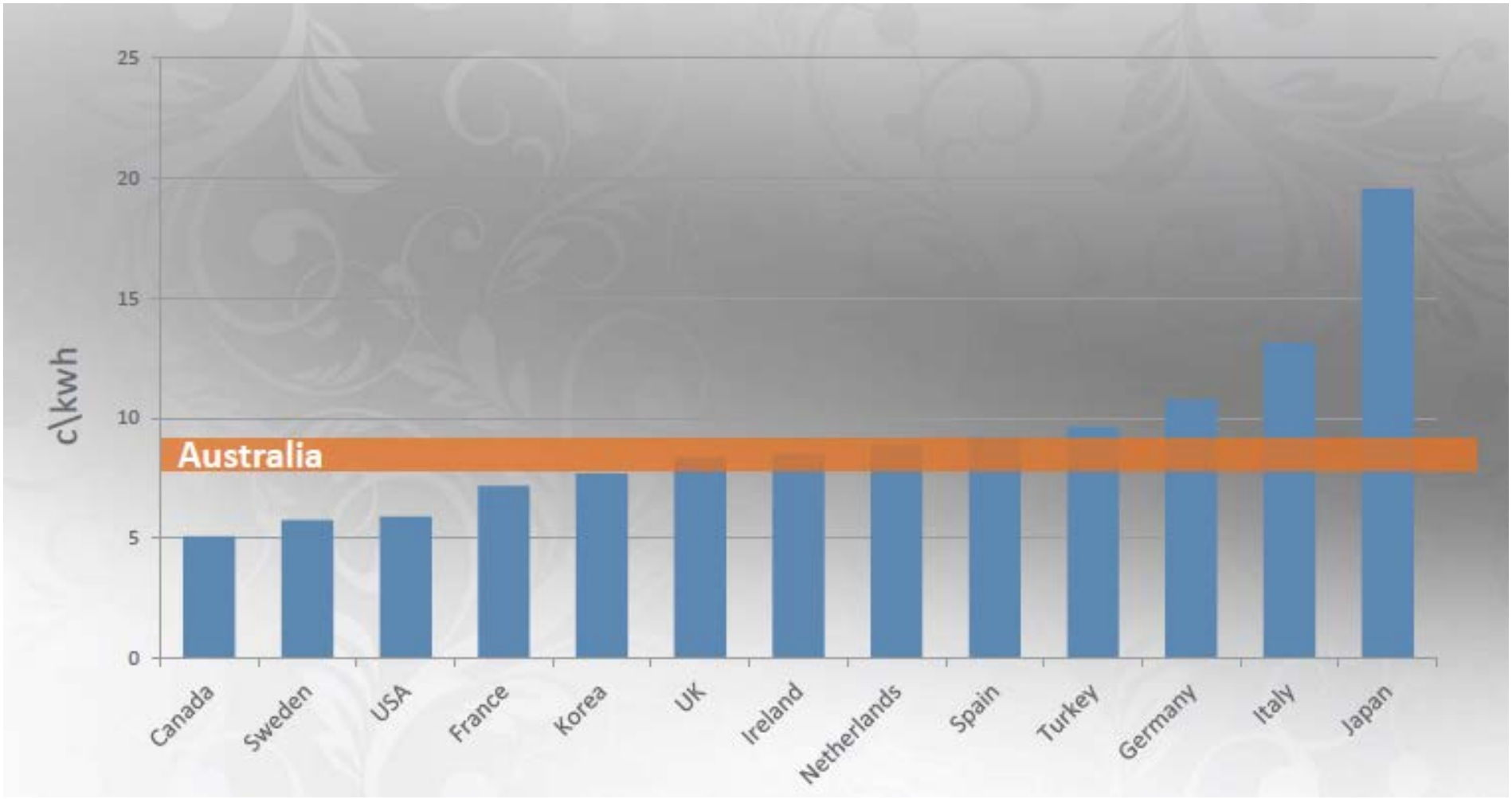

Reference: UK Department of Energy and Climate Change September 2016 comparative data set

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What can be done?

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Impactful results

BEGIN WITH A PLAN

Step 1: The plan

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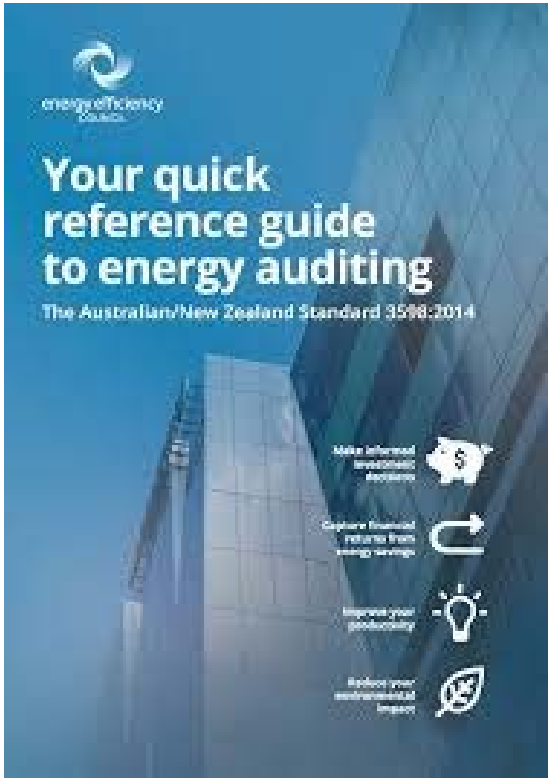
- Start with an Energy Audit

- 2014 Australian Standards
  - AS/NZS 3598.1:2014 Commercial buildings
  - AS/NZS 3598.2:2014 Industrial and related activities
  - AS/NZS 3598.3:2014 Transport and related activities

- 3 Levels of Audits
  - 1 Broad Brushed (Cheap….)
  - 2 Standard for site audits
  - 3 Precision subsystem audit



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State Funding Available! South Australian Example

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South Australian Energy Productivity Program

- Component One: Energy Productivity Audit Grants
  - Grants of 75% of the cost of a level 2 audit up to $15,000

- Component Two: Energy Productivity Implementation Grant

Stream One	Stream Two
Grants of up to $2.5m $1 SA Government Contribution $2 Business Contribution	**Grants of up to $75k** $1 SA Government Contribution $1 Business Contribution

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Why?

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- Different sites have different challenges, opportunities and payback models(without funding support)

	Payback Range	Industrial	Commercial
Lighting	3-5 years	Variable	Major
HVAC	3-5 years	Variable	Major
Refrigeration	3-6 years	Major	Major
VSD	2-4 years	Major	Major
Secondary	1-5 years	Major	Variable
Combustion	1-3 years	Major	Secondary
Fuel Switching (including solar)	4-7 years	Variable	Secondary
Control/Tuning	1-4 years	Major	Major
Powerfactor	2-5 years	Secondary	Secondary

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Step 2: If you can't measure it you can't improve it

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Step2: Building an Informative Platform

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- Here are some cost effective and starting points for building up intelligence on what your motor electricity costs are:
  - Power Monitors
    - PowerMonitor 5000 $2k+
  - Intelligent Motor Control Devices
    - E300 Intelligent Overload Relays $1k+
    - PowerFlex® Variable Speed Drives
  - Linking process control to Intelligent Electrical Devices
    - Prosoft 61850 gateway modules

Why?

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Lighting	3-5 years	Variable	Major
HVAC	3-5 years	Variable	Major
Refrigeration	3-6 years	Major	Major
VSD	2-4 years	Major	Major
Compressed Air	1-5 years	Major	Variable
Combustion	1-3 years	Major	Secondary
Fuel Switching (including solar)	4-7 years	Variable	Secondary
Control/Tuning	1-4 years	Major	Major
Powerfactor	2-5 years	Secondary	Secondary

Refrigeration quick wins

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- Monitor overall refrigeration circuit effectiveness
  - Temperature differential across heat exchanger, is this at specification? Typical issues
    - Low quantity of refrigerant, low pressure leaks
    - Wrong flow rates inlet to outlet
  - Are the pipework and storage tanks insulated
- Offsetting cooling cycles
  - Cooling/over chilling in off peak periods
  - Increasing cooling unit dead bands during non vintage periods

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Refrigeration phase down

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• 1995	• 2010-2020	• 2018-2036
• CFCs phased out due to severe ozone damage	• HCFCs phasing out due to moderate ozone damage	• HFCs being phased down due to global warming potential
R11, R12, R… R112, R113	R22, R1… …1, R402, R4… …1…	R134a, R… R410…..

What's left??

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New Refrigerants, New Opportunities

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- For commercial scale applications:
  - CO_2 (R744)
    - Wide range of applications, typically with significant efficiency benefit
    - Heat pumps
    - Commercial/industrial refrigeration
    - Often 20% improvement on HFC equivalents
  - HFO refrigerants R1234 and variants
    - Being used in car air-conditioners
    - New series of chillers being produced showing >10% efficiency improvements relative to current best practice
    - Quite early days for product in this area

Think carefully before investing in new HFC plant:

Will you have to retire it before its time?
Is there a superior low GWP alternative?

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Powerfactor <0.96 – an opportunity

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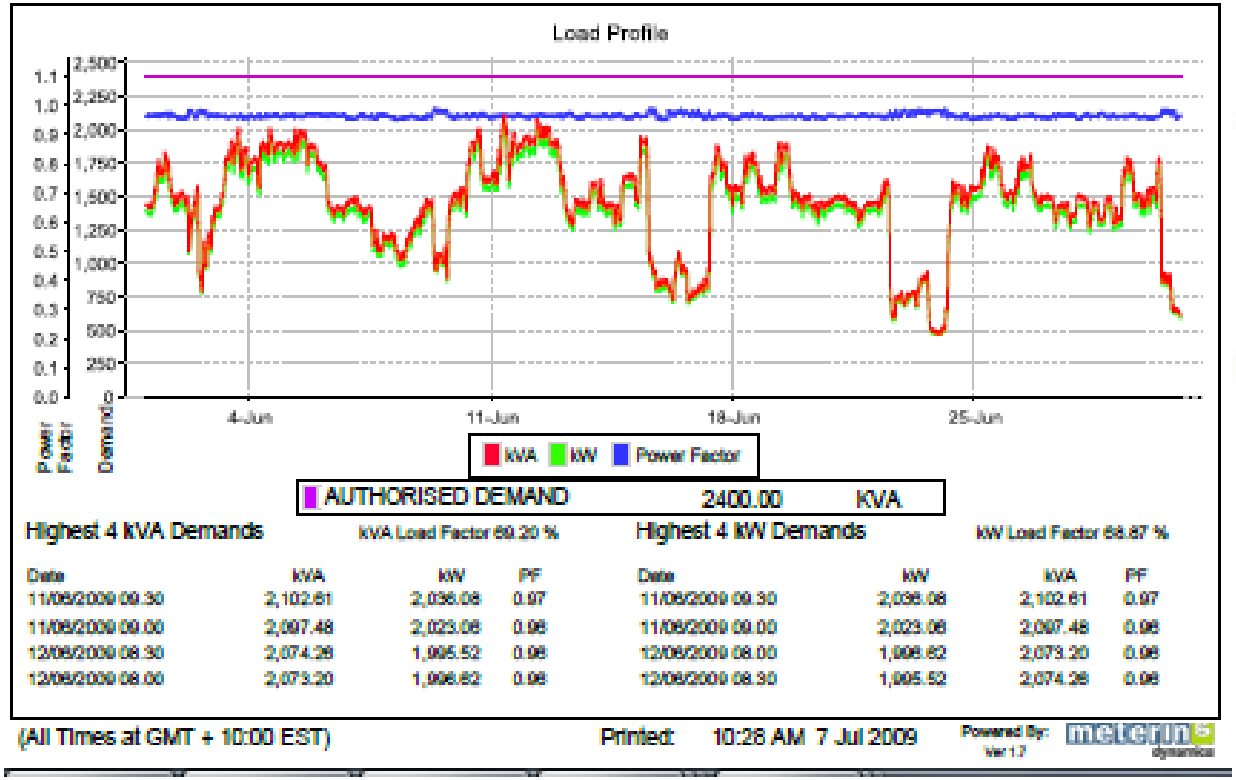

- As part of your energy contracts you are paying for a billing meter
- The metering provider has available reporting and analytics that you are paying for!

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Final Words
Remember step 1 – the plan

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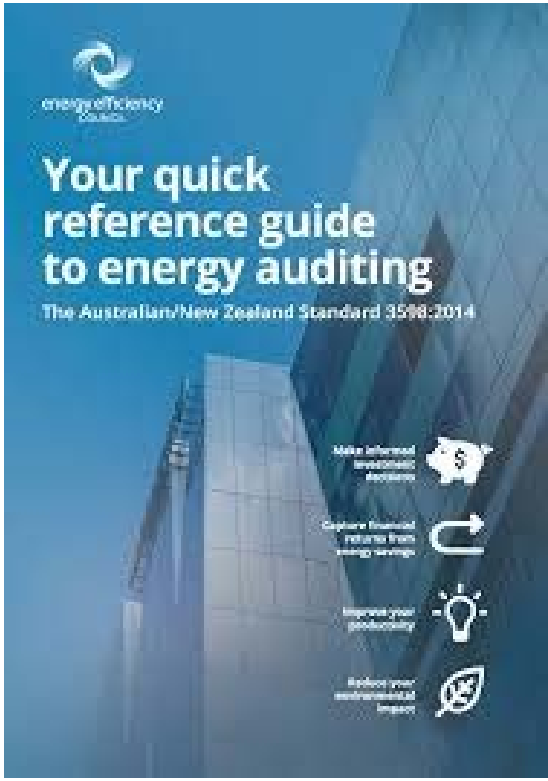

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Q&A

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