IPEEC Energy Management Network Tokyo January 2013

Energy and Demand Reduction in Australian Manufacturing Industry – Amcor's Experiences

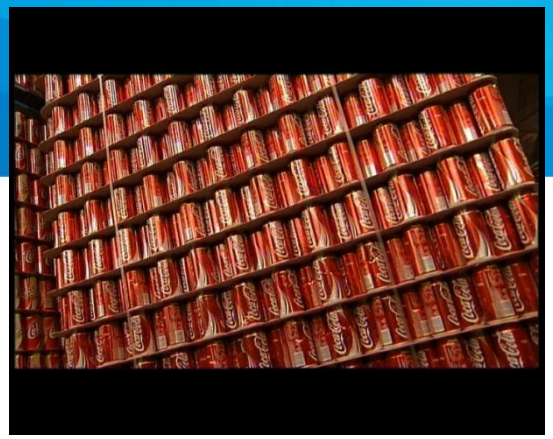
By

Peter Dobney, Group Manager Resources and Energy
Amcor

amcor

Sustainability Plus

Amcor Products



Over 60 manufacturing plants in Australia
Over 200 sites across 43 countries.

amcor

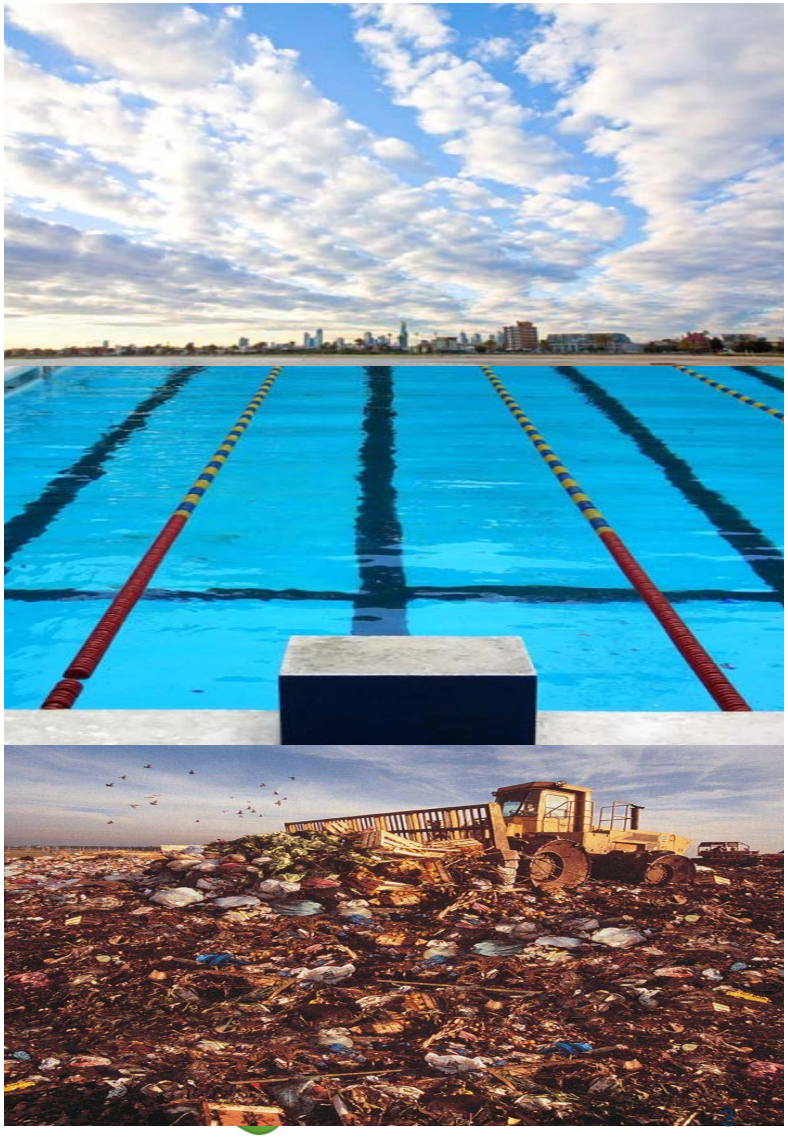
Amcor's Australian Operations' Environmental Footprint

Each year Amcor:

Releases 1.0 Million tonnes of CO_2 through energy use

Uses 1.7 Billion litres of potable water

Disposes of 56,800 tonnes of waste to landfill

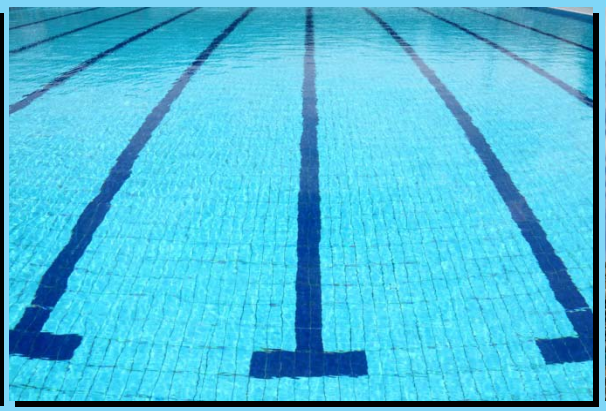


Amcor's Resource Efficiency Targets 2011 - 2016

Reduce CO_2 emissions by 10% (100,000 tonnes CO_2)

Reduce water use by 10% (150 ML)

Reduce waste to land fill by 50% (35,000 tonnes)



amcor

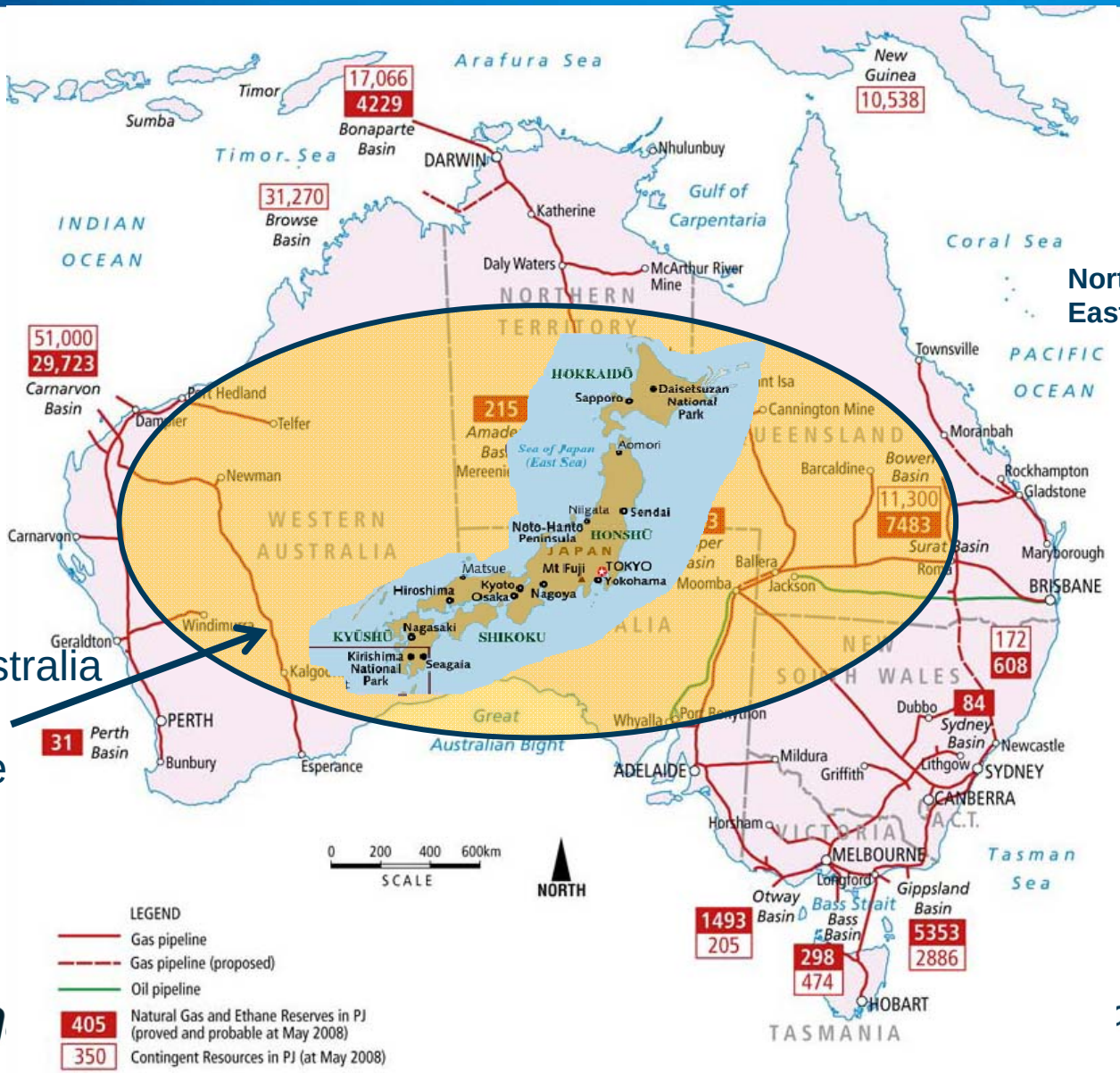
Sustainability Plus

Demand Management

- Background on Australian Energy (Electricity) Markets

- Amcor's participation in Demand Side Response (DSR) programs

Australia is a very large country Population = 22.5M. Compared to Japan Population = 128M



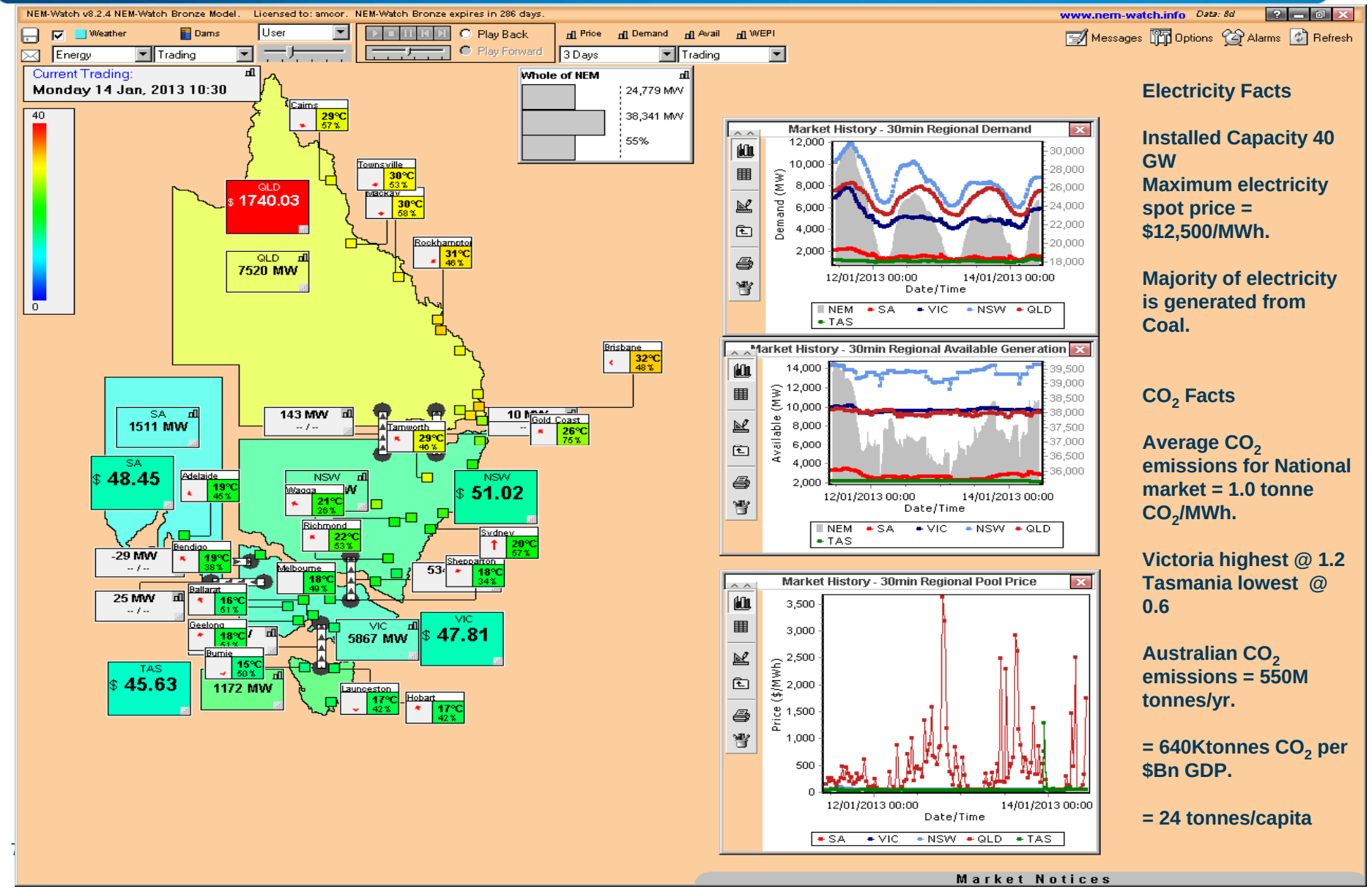
Central Australia
Very Hot
Few people

North to South 3,500 Km
East to West 4,000 Km

Population largely Based along the eastern seaboard

ainability Plus

Eastern Australia has a connected electricity grid
Spot market prices can vary by region from $0 to $12,500/MWh



Electricity Facts

Installed Capacity 40 GW
Maximum electricity spot price = $12,500/MWh.

Majority of electricity is generated from Coal.

CO_2 Facts

Average CO_2 emissions for National market = 1.0 tonne CO_2/MWh.

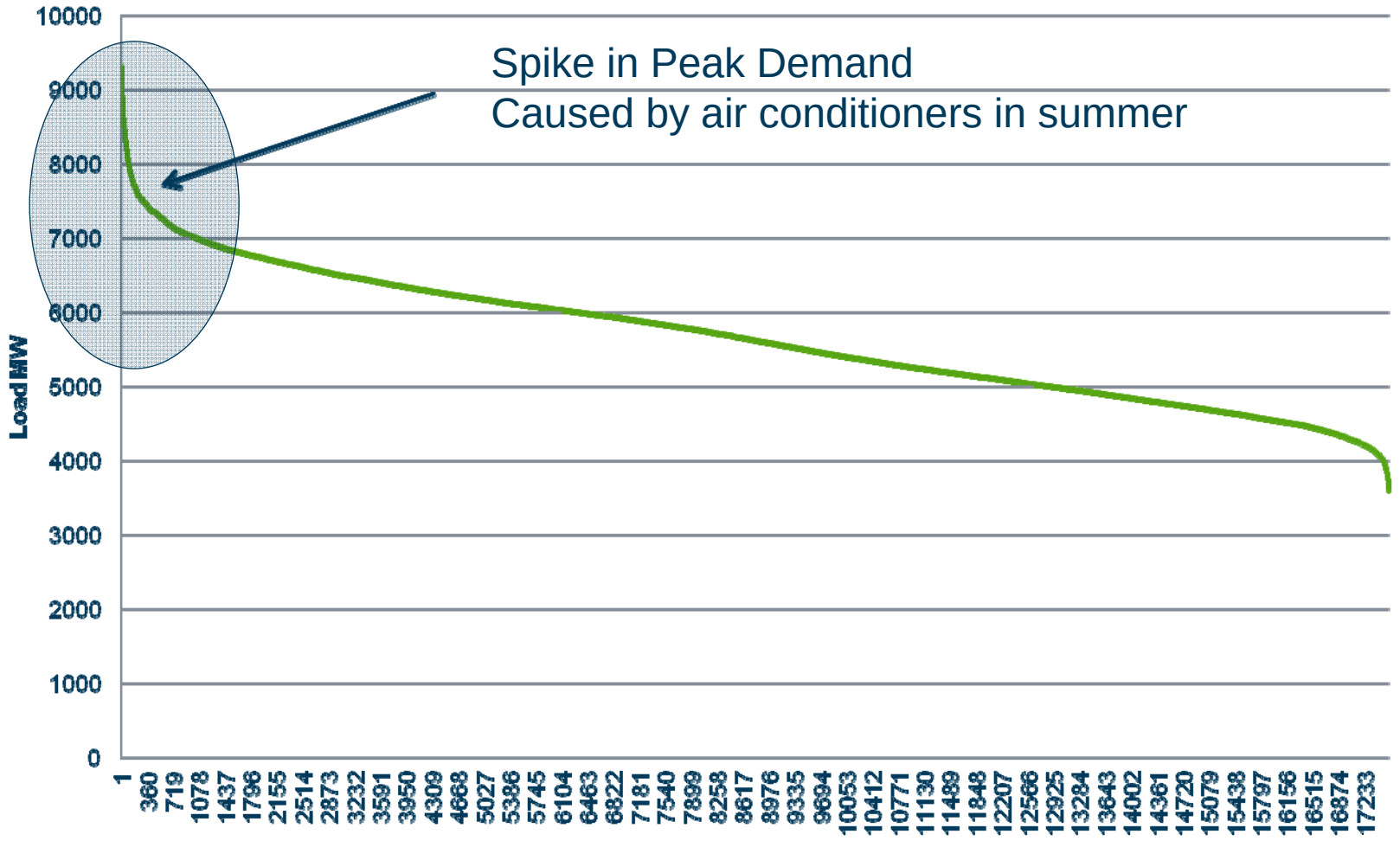
Victoria highest @ 1.2
Tasmania lowest @ 0.6

Australian CO_2 emissions = 550M tonnes/yr.

= 640Ktonnes CO_2 per $Bn GDP.

= 24 tonnes/capita

Typical Regional Electricity Hourly Demand for 2012



amcor

Sustainability Plus

Amcor's participation in State and National DSR programs

Amcor uses DSR aggregator = ENERNOC ™ to assist with DSR

- South Australia

  Regional Electricity Spot Price

- Queensland

  Network Reserve Capacity payment

- Western Australia

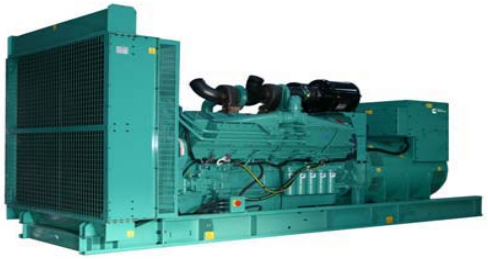
  Capacity Market Payment

Amcor Glass – South Australia - 3 x Diesel generators

Amcor Standby Generators Details

- 3 x 1500 Kva
- Load approx = 3 x1 MW
- Diesel fuel usage at load = 270 l/hr each
- Fuel cost say $1.50/litre
- Marginal fuel cost = $400/MWh

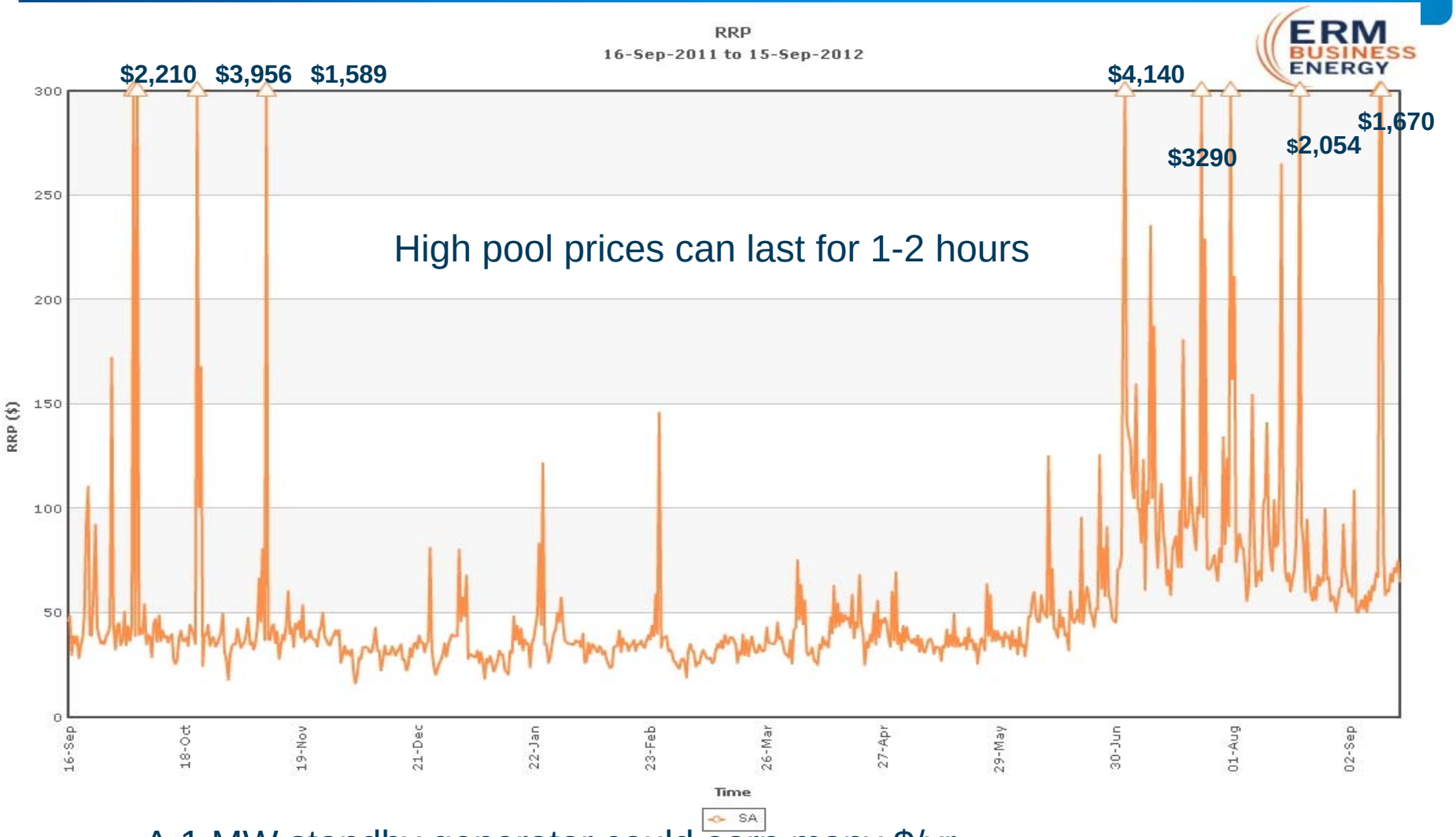
- **Metering and Dispatch:**
- Each generator has a meter and is registered so that it can be dispatched into the pool and receive spot price.
- Generators are started remotely by Enernoc on high spot prices.
- Benefits shared with Enernoc.
- Generators can also be used when required by Transmission company to help with system maintenance/constraints.



amcor

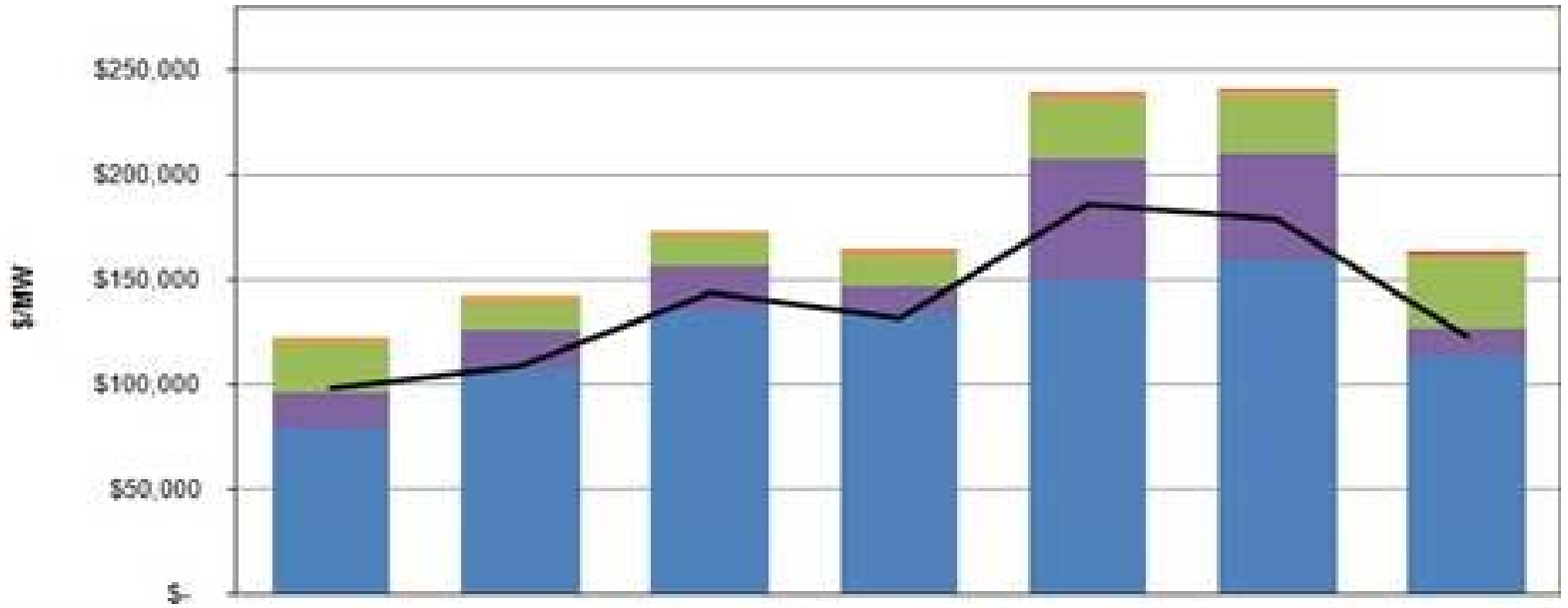
Sustainability Plus

South Australia Electricity Spot Market prices 2011-12



A 1 MW standby generator could earn many $/yr

Value of DSR in Western Australia's Reserve Capacity Market $/MW pa



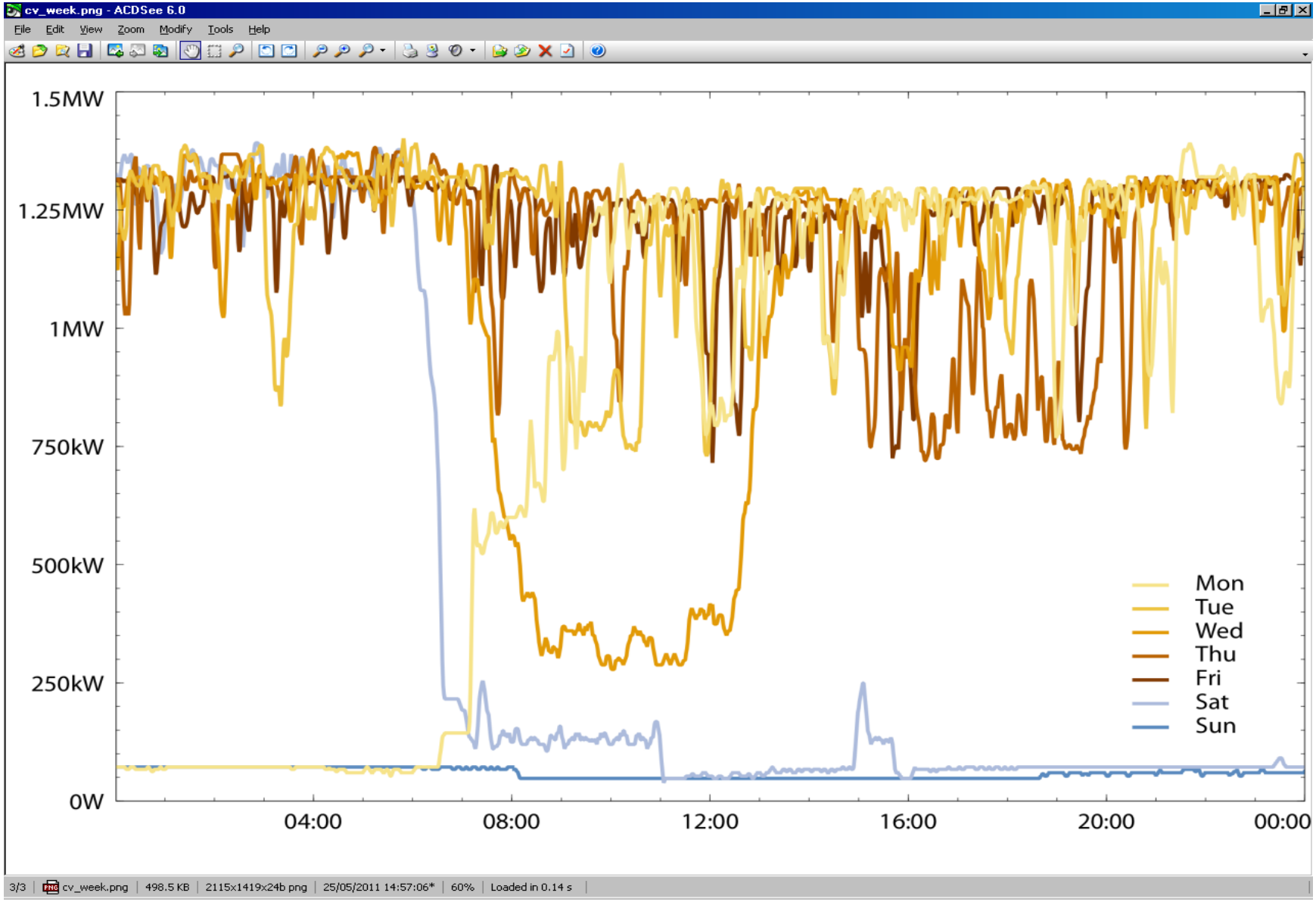
Capacity Year	08/09	09/10	10/11	11/12	12/13	13/14	14/15
Power Station Cost	$ 79,110	$ 107,404	$ 135,701	$ 134,091	$ 149,306	$ 158,710	$ 113,956
Transmission Costs	$ 16,558	$ 18,017	$ 20,672	$ 13,151	$ 58,493	$ 51,621	$ 12,328
Fixed O& M	$ 23,900	$ 13,383	$ 14,392	$ 13,431	$ 27,335	$ 26,649	$ 33,384
Fuel Costs	$ 2,907	$ 3,456	$ 2,631	$ 3,151	$ 2,615	$ 2,825	$ 2,239
Land Costs	$ -	$ -	$ -	$ 293	$ 769	$ 818	$ 1,972
MRCP (nearest $100)	$ 122,500	$ 142,200	$ 173,400	$ 164,100	$ 238,500	$ 240,600	$ 163,900
Excess Capacity	6.43%	11.44%	2.19%	5.83%	8.99%	14.59%	13.79%
Reserve Capacity Price (per yr)	$ 97,837	$ 108,459	$ 144,235	$ 131,805	$ 186,001	$ 178,477	$ 122,427

Independent Market Operator (IMO) sets an annual value of capacity in the WA market

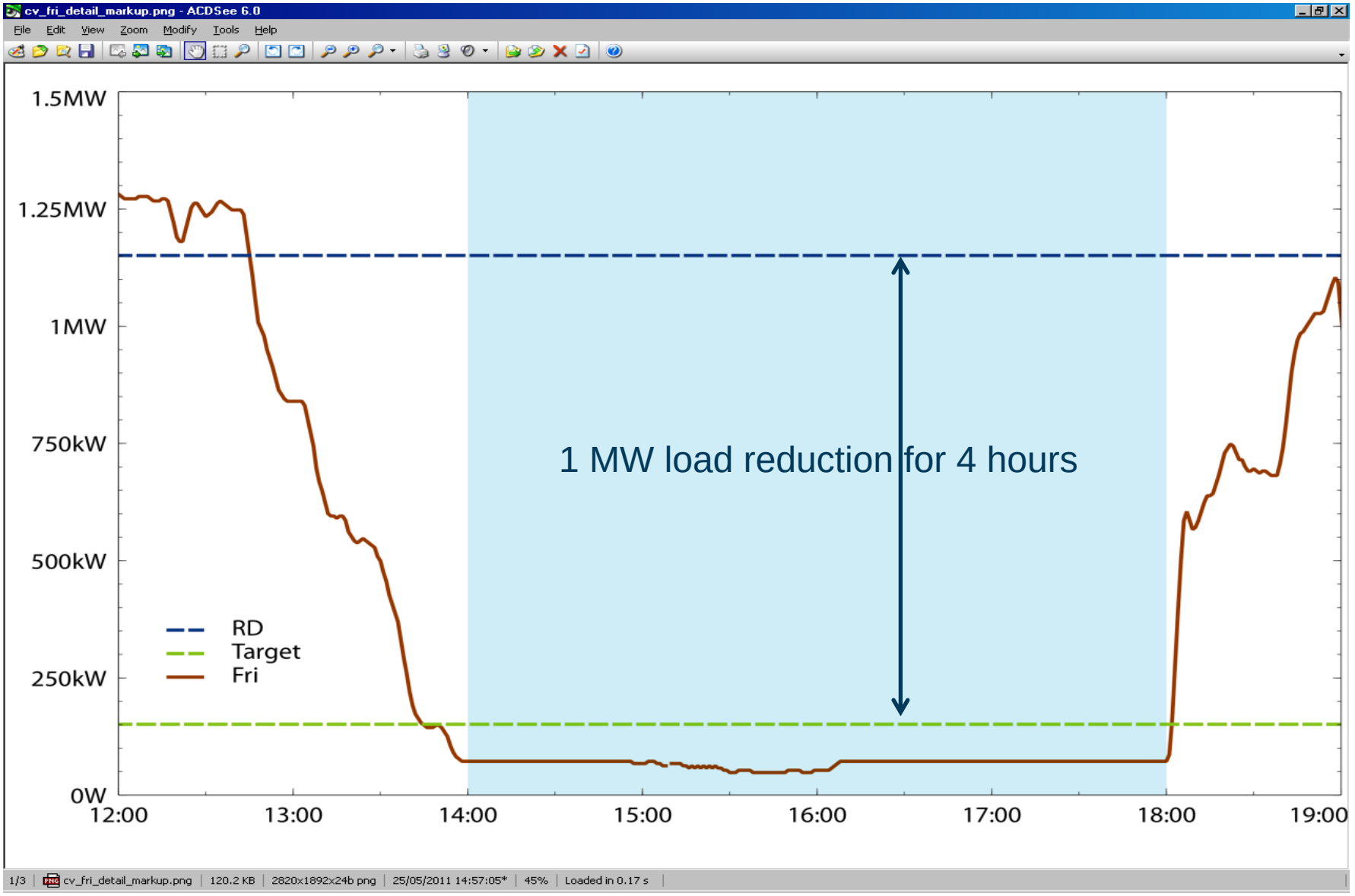
amcor

Sustainability Plus

Amcor - Western Australia Plant Daily Load Profile



Amcor Western Australia Aluminium Can Plant DSR Trial results



Conclusions – Demand Side Response

- The Value of DSR is significant both for the market and for the Owner.
  - National Electricity Market = $50K/MW pa.
  - Western Australian market = $186K/MW pa
- DSR is easy to implement though it may take some time to put in place.
- It is often easier to have an aggregator do the work of managing your DSR for you.
- Loads shedding is quite straightforward so long as your plant has some flexibility.
- Standby generators can be put to use to deliver benefits

Energy Management – Using Benchmarking

- Why Amcor Benchmarks energy use
- Level 1 benchmarking
- Level 2 benchmarking
- Quantifying energy saving opportunities by benchmarking

Why Amcor Benchmarks?

- To improve:
  - Production efficiency
  - Energy efficiency
  - Water efficiency

- Reduce greenhouse gas emissions
- Reduce waste to landfill
- Meet State and Federal Government legislation
- Improve profitability
- Create competition between manufacturing plants

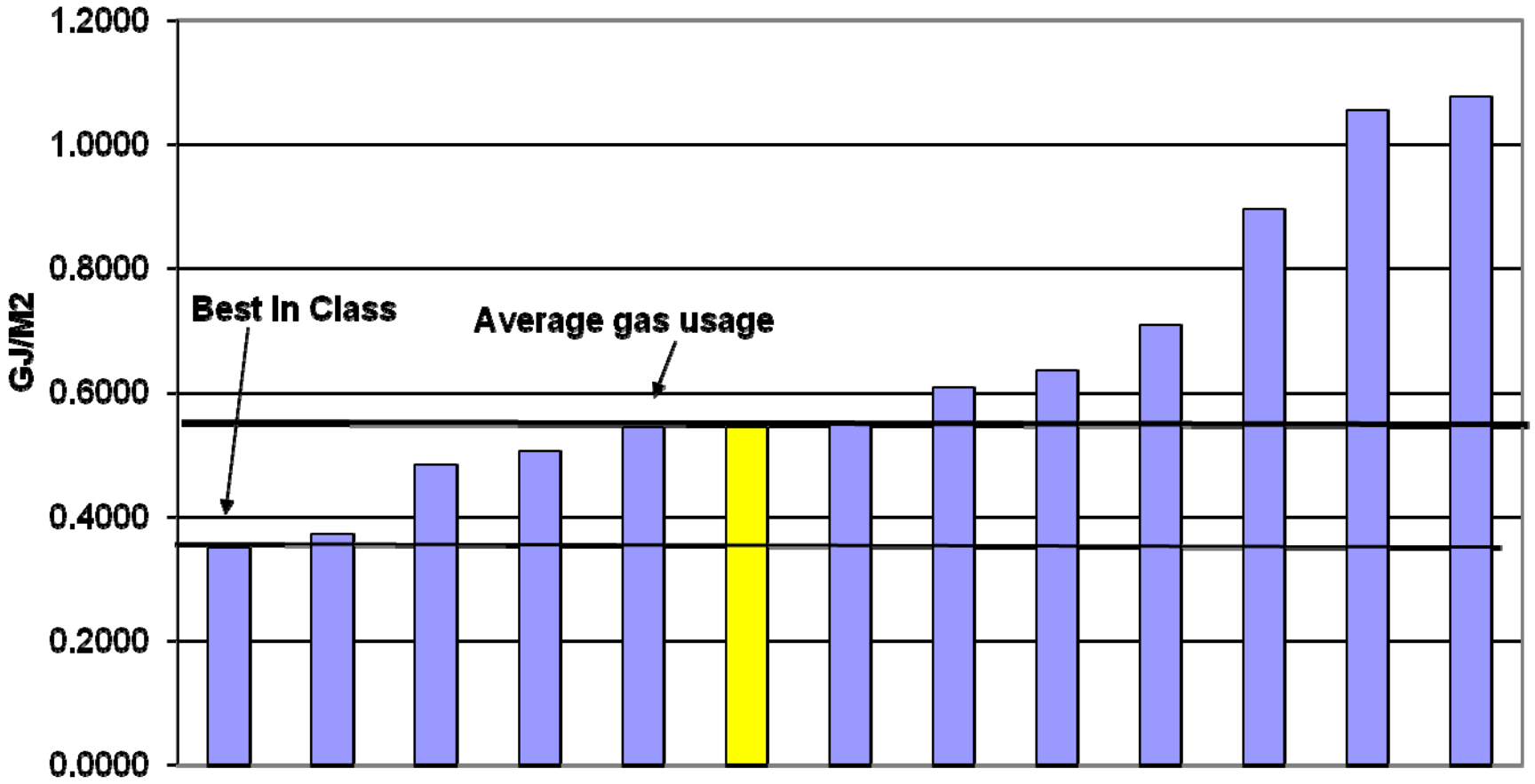
How Amcor Benchmarks

- **Level 1 - High Level**
- Identify appropriate business metric
- Collect monthly consumption and production data
- Analyse and benchmark data by
  - Total annual consumption
  - Annual consumption per unit of production
  - X-Y Scatter Plots of consumption vs production

- Used to
- Report to Business Management and to Government
- Estimate potential benefits from achieving best practice
- Prioritise sites for further investigation
- Identify and learn from best performing sites

amcor
Sustainability Plus

Benchmarking – High Level Gas Savings Estimation for similar manufacturing plants

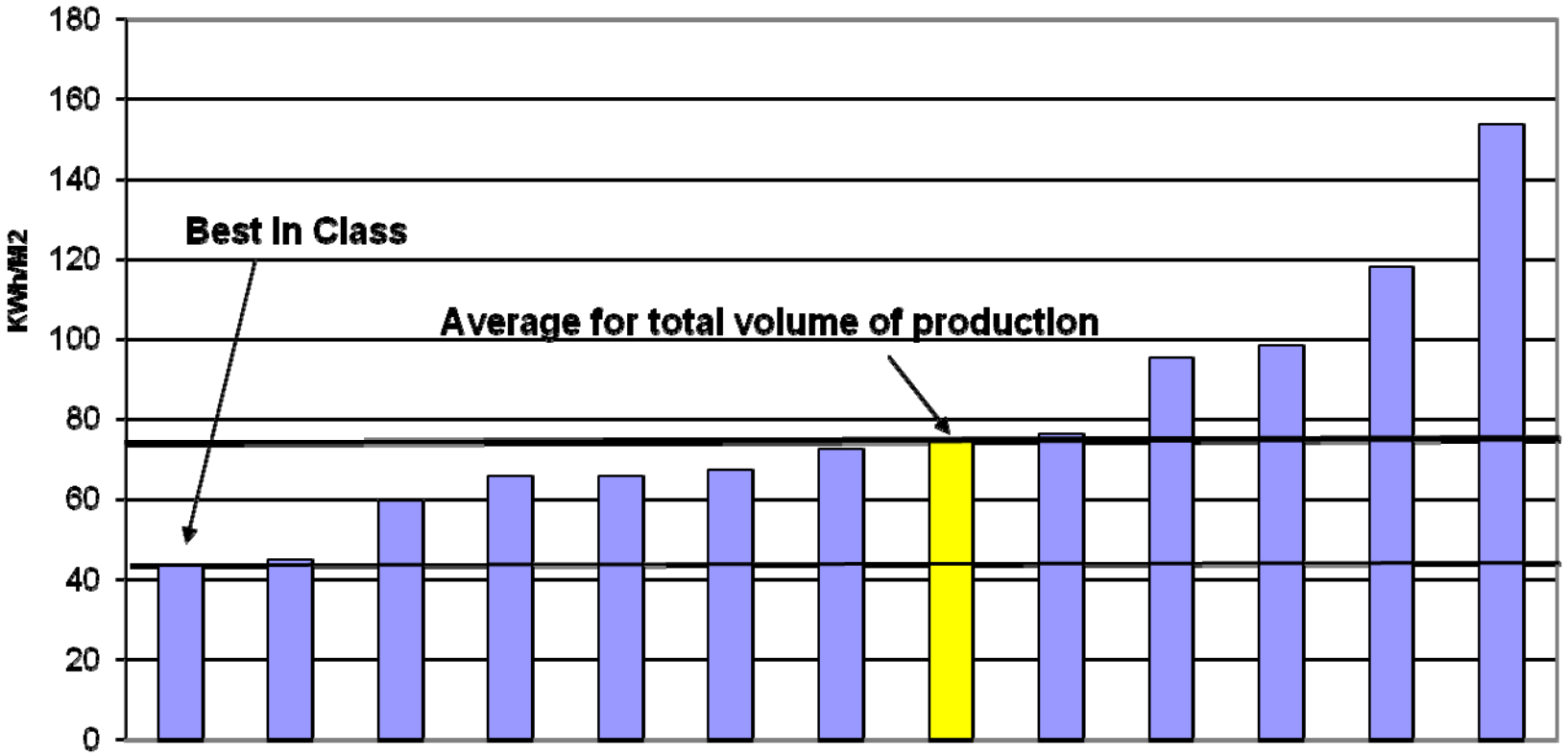


- **Indicative Savings Based on:**
- **Average = $350K/yr**
- **Best in class = $1.25M/yr**

amcor

Sustainability Plus

Benchmarking – High Level Electricity Savings Estimation for similar manufacturing plants



- **Indicative Savings Based on:**
- **Average = $1.5M/yr**
- **Best in class = $2.7M/yr**

amcor

Sustainability Plus

How Amcor Benchmarks

- **Level 2 Operation Level**

Use Electricity load profiles to investigate:

- Maximum Demand (and MD reduction opportunities)
- Load shifting opportunities
- Out of hours use

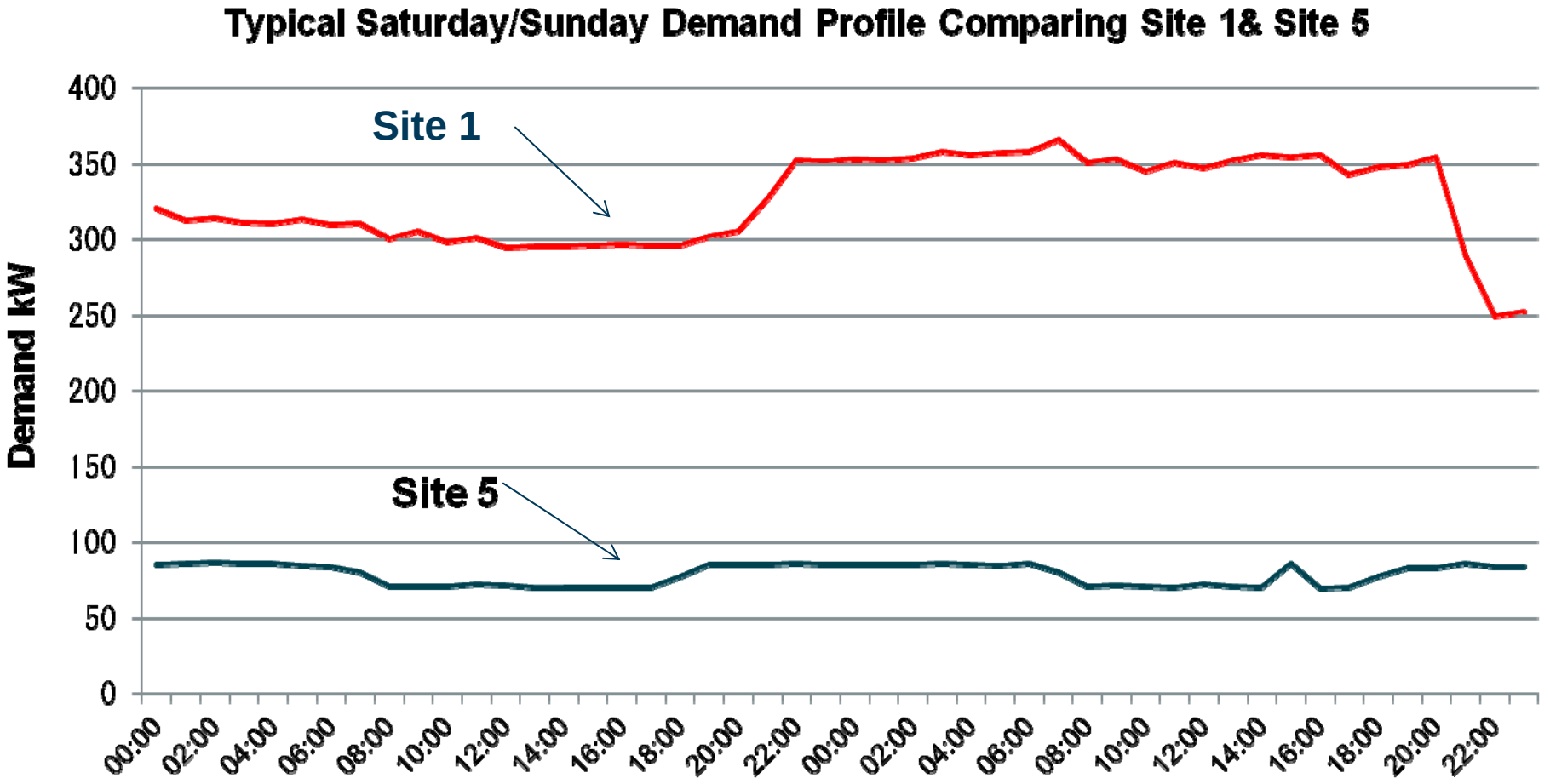
Develop Energy Balance to benchmark similar activities:

- Lighting
- Compressed Air
- Boilers and Steam
- Process Plant
- Heating and Air Conditioning

amcor

Sustainability Plus

Use of Electricity Load Profiles to review after hours performance



Site 1 is using 3.5 times more electricity than site 5 during shutdown.

amcor

Sustainability Plus

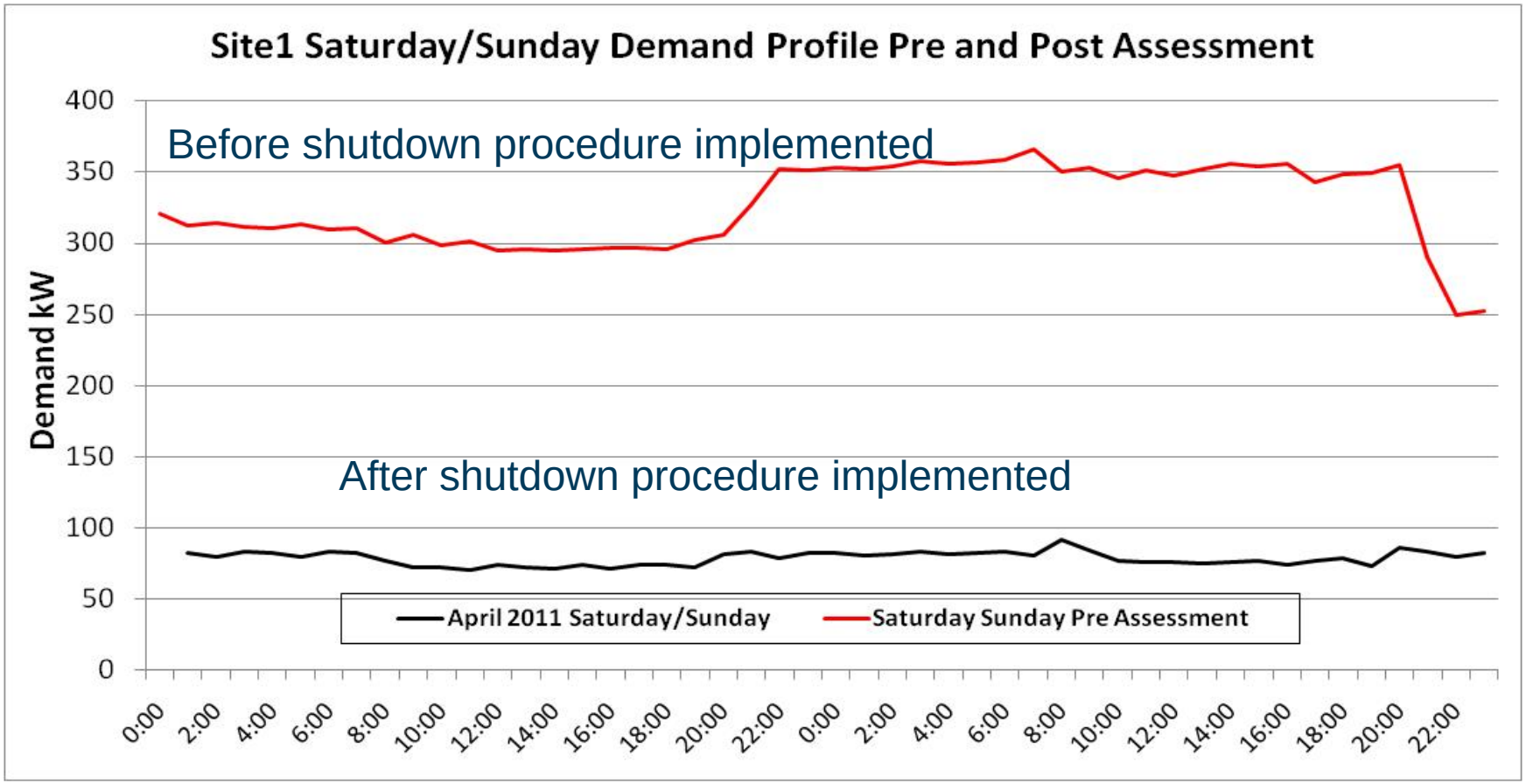
Improvements at Site 1

Able to justify $475,000 expenditure on:

- Boiler burner management with Oxygen Trim Control
- Boiler auto start
- Economiser
- Insulation Improvements
- New space heating with controls (Australians regard a 10^{C} day in Winter as very cold)
- New lighting and controls (site lighting was below Australian Standards
- Air leak survey
- Equipment controls

Expected Savings = $220,000/years and 3,160t/yr of CO_2

Results at Site 1 are starting to show value of the Energy Audit Investigation

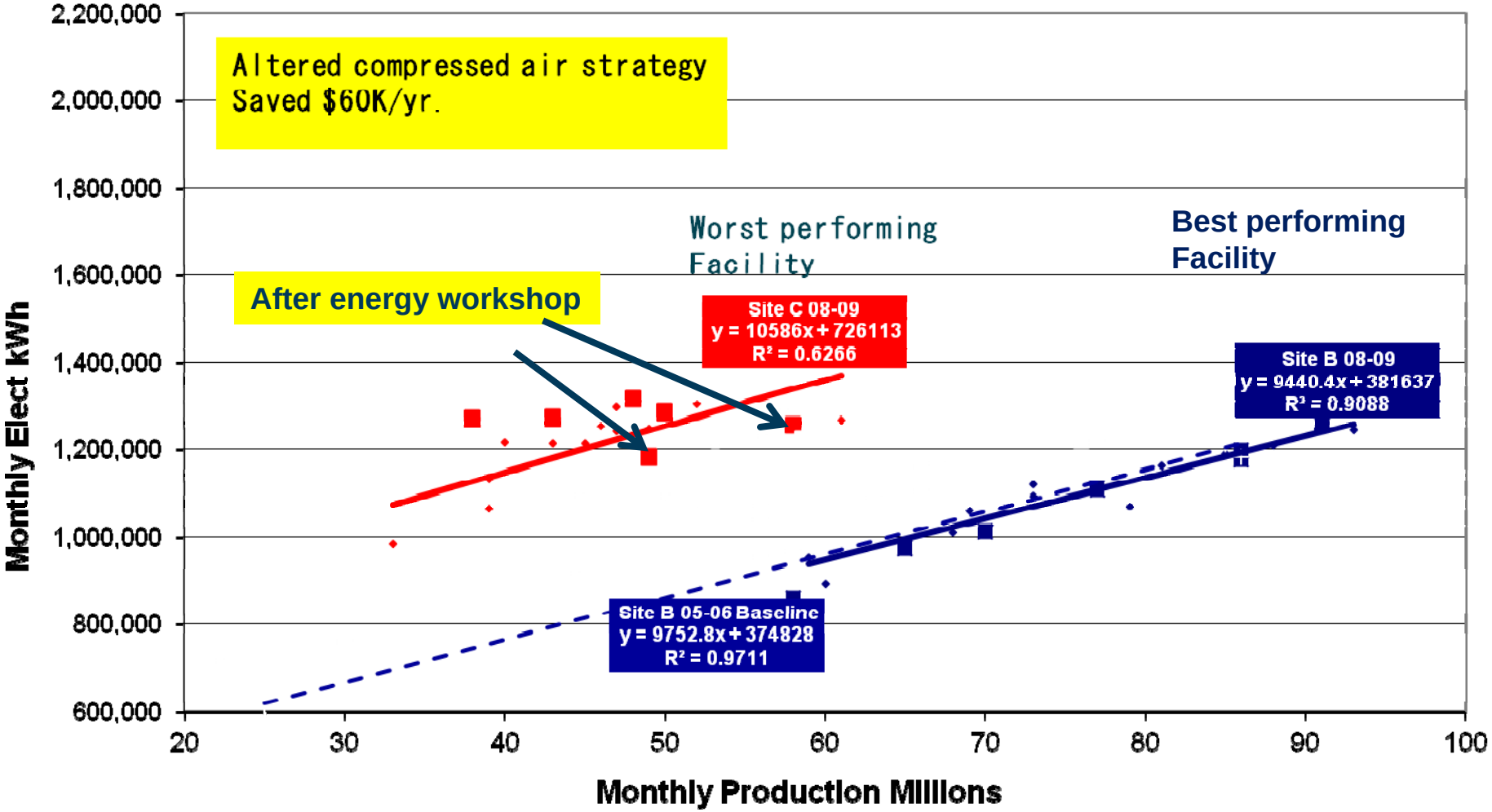


Site 1 Electricity use in April 2011 was 16% lower compared to April 2010. Production was only down 4%

amcor

Sustainability Plus

Multiple Site Benchmarking – Regression Analysis Example 2



amcor

Sustainability Plus

Level 2
Electricity Use Benchmarking – Similar Activities/Facilities

	Total Power MWh/yr		Use MWh/M Cans		Costs	
System	Site C	Site B	Site C	Site B	Site C $/yr	Site B $/yr
HP Compressed Air	2,813		5.20		278,458	
LP Compressed Air	1,420		2.63		140,611	
Vacuum	1,433		2.65		141,871	
Cooling Towers	484		0.89		47,916	
Lights	1,087		2.01		107,633	
Air Conditioning	200		0.37		19,804	
Totals	7,437		13.75		$ 736,292	
Difference	2,877					

How Amcor Benchmarks cont…….

- **External Benchmarks**

- Used with care as Australian Sites are different due to:

- Climatic conditions.
- Large distances between Capital Cities.
- Generally smaller then comparable US and European Plants/markets.
- High capital costs due to high labour prices.
- Lower energy prices.

Global Benchmarking
Aluminium Can Manufacturing – Amcor Leader

Company	Region	Water KL/Million Cans	Electricity MWH/Million Cans
Ball U.S.	US	70	20.80
AMCOR Dandenong	Australia		
FAMOSA Toluca	Mexico	108	19.70
FAMOSA Ensenada	Mexico	103	19.0
Latapack BrazilPB	Brazil	81	22.20
Superenvases Envalic	Venezuela	179	34.00
Thai Beverage Company	Thailand	133	17.60
Ball Asia Pacific	China	184	17.80

amcor
Sustainability Plus

Conclusions - Benchmarking Benefits

Benchmarking Energy and Resource Usage allows you to:

- Compare performance of similar sites locally and globally
- Identify trends and poor performers
- Quantify potential for savings
- Capture energy efficiency gains
- Encourages competition between sites

However:

- Need accurate and timely data into database.
- Regular review of data to eliminate errors.
- Easily updatable benchmarking charts.
- Needs to be resourced with enthusiastic, qualified people

amcor

Sustainability Plus