IPEEC Energy Management Network
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Energy and Demand Reduction in Australian Manufacturing Industry – Amcor’s Experiences

By

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Amcor Products

Over 60 manufacturing plants in Australia
Over 200 sites across 43 countries.
Each year Amcor:

- Releases 1.0 Million tonnes of CO₂ 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 CO₂ emissions by 10% (100,000 tonnes CO₂)
- Reduce water use by 10% (150 ML)
- Reduce waste to land fill by 50% (35,000 tonnes)
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.

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

Population largely Based along the eastern seaboard

Central Australia
Very Hot
Few people
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.

CO₂ Facts
- Average CO₂ emissions for National market = 1.0 tonne CO₂/MWh.
  - Victoria highest @ 1.2
  - Tasmania lowest @ 0.6
- Australian CO₂ emissions = 550M tonnes/yr.
  - = 640Ktonnes CO₂ per $Bn GDP.
  - = 24 tonnes/capita
Typical Regional Electricity Hourly Demand for 2012

Spike in Peak Demand
Caused by air conditioners in summer
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 Standby Generators Details

- 3 x 1500 Kva
- Load approx = 3 x 1 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.
South Australia Electricity Spot Market prices 2011-12

High pool prices can last for 1-2 hours

A 1 MW standby generator could earn many $/yr
Value of DSR in Western Australia’s Reserve Capacity Market $/MW pa

Independent Market Operator (IMO) sets an annual value of capacity in the WA market.
Amcor Western Australia Aluminium Can Plant
DSR Trial results

1 MW load reduction for 4 hours
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
Benchmarking – High Level Gas Savings Estimation for similar manufacturing plants

- Indicative Savings Based on:
  - Average = $350K/yr
  - Best in class = $1.25M/yr
Benchmarking – High Level Electricity Savings Estimation for similar manufacturing plants

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

IEEJ: February 2013 All Right Reserved
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
Use of Electricity Load Profiles to review after hours performance

Typical Saturday/Sunday Demand Profile Comparing Site 1 & Site 5

Site 1 is using 3.5 times more electricity than site 5 during shutdown.
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 CO₂
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%
Multiple Site Benchmarking – Regression Analysis Example

After energy workshop

Best performing Facility

Altered compressed air strategy
Saved $60K/yr.

Worst performing Facility

Site C 08-09
y = 10586x + 726113
R² = 0.8266

Site B 08-09
y = 9422.8x + 374828
R² = 0.9711

Site B 05-06 Baseline
y = 9752.8x + 374828
R² = 0.9711
## Level 2

### Electricity Use Benchmarking – Similar Activities/Facilities

<table>
<thead>
<tr>
<th>System</th>
<th>Site C</th>
<th>Site B</th>
<th>Site C</th>
<th>Site B</th>
<th>Site C $/yr</th>
<th>Site B $/yr</th>
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</thead>
<tbody>
<tr>
<td>HP Compressed Air</td>
<td>2,813</td>
<td></td>
<td>5.20</td>
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<td>278,458</td>
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<tr>
<td>LP Compressed Air</td>
<td>1,420</td>
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<td>2.63</td>
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<td>140,611</td>
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<tr>
<td>Vacuum</td>
<td>1,433</td>
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<td>2.65</td>
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<td>141,871</td>
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<tr>
<td>Cooling Towers</td>
<td>484</td>
<td></td>
<td>0.89</td>
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<td>47,916</td>
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<tr>
<td>Lights</td>
<td>1,087</td>
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<td>2.01</td>
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<td>Air Conditioning</td>
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<td>0.37</td>
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<tr>
<td><strong>Totals</strong></td>
<td>7,437</td>
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<td>13.75</td>
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<td><strong>$ 736,292</strong></td>
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<tr>
<td><strong>Difference</strong></td>
<td>2,877</td>
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</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Company</th>
<th>Region</th>
<th>Water KL/Million Cans</th>
<th>Electricity MWH/Million Cans</th>
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<tbody>
<tr>
<td>Ball U.S.</td>
<td>US</td>
<td>70</td>
<td>20.80</td>
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<tr>
<td>AMCOR Dandenong</td>
<td>Australia</td>
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<td>FAMOSA Toluca</td>
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<td>FAMOSA Ensenada</td>
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<td>Latapack BrazilPB</td>
<td>Brazil</td>
<td>81</td>
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<tr>
<td>Superenvases Envalic</td>
<td>Venezuela</td>
<td>179</td>
<td>34.00</td>
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<tr>
<td>Thai Beverage Company</td>
<td>Thailand</td>
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<td>17.60</td>
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<tr>
<td>Ball Asia Pacific</td>
<td>China</td>
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<td>17.80</td>
</tr>
</tbody>
</table>
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