12L Tax Incentive National Roadshow

M&V principals and project case studies
Overview:

- Background
- M&V in a nutshell
- Case Studies
- Conclusion
- Q&A
“What gets measured, gets managed.” – Peter Drucker

“You can’t manage what you don’t measure. This is especially true for saving energy.” – Charles Warner
Background:

JC Bekker
M&V in a nutshell:

Measurement and Verification (M&V) is the term given to the process for quantifying savings delivered by an Energy Conservation Measure (ECM)

**M&V Plan** - defines how the savings analysis will be conducted before the ECM is implemented

**Baseline** - defines the model that will be used to determine the “would have been used” energy.

**Assessment** - Baseline model is applied on the actual data and the avoided energy is obtained
M&V in a nutshell:

Figure 1: Baseline Adjustment, edited from [1].

$$E_s = B_{peu} - R_{peu} \pm A,$$

where

- $E_s$ denotes energy savings,
- $B_{peu}$ denotes baseline period energy use,
- $R_{peu}$ denotes reporting period energy use, and
- $A$ denotes adjustment [2].

Impact = Adjusted Baseline - Actual
Case studies overview:

• Case study 1: Bunker effect
  • Outliers
  • Bunker/Silo/Stock pile/delay effect
  • Normalisation and scaling

• Case study 2: Waste heat recovery
  • Waste energy recovery
  • Conservative reporting

• Case study 3: Multiple product streams
  • Outliers
  • Different product streams
Case study 1: Bunker Effect
Case study 1: Bunker Effect

Overall Process

Raw Material → M₁ → Coal Bunkers → M₂ → Process → Product → Waste

Coal

M₁

M₂

Process

Coal Bunkers
Case study 1: Bunker Effect

Overall Process

Raw Material → Process → Product → Waste

Coal Bunkers

Coal
Case study 1: Bunker Effect

Initial Model: CS1 - Model 1

\[ R^2 = 0.4792 \]
Case study 1: Bunker Effect

Initial Model: CS1 - Model 1

Daily Energy [kWh] vs. Daily Production [t]

R² = 0.4792

Possible Outliners
Case study 1: Bunker Effect
Case study 1: Bunker Effect
Case study 1: Bunker Effect

\[ R^2 = 0.6251 \]
Case study 1: Bunker Effect

Overall Process

Raw Material → M1 → Coal Bunkers → M2 → Process → Product → Waste

Coal
Case study 1: Bunker Effect

CS1 - Model 3

R² = 0.7427
Case study 2: Waste Heat Recovery

Overall Process

Raw Material → Energy → Product → Waste
Case study 2: Waste Heat Recovery

Overall Process

Raw Material → Process → Product
Energy → Process → Waste
Case study 2: Waste Heat Recovery
Case study 2: Waste Heat Recovery

Impact (WHR) = Energy_{M1} − Energy_{M2}
Case study 2: Waste Heat Recovery

Impact (WHR) = Energy_{M1} – Energy_{M2}
Case study 2: Waste Heat Recovery

Overall Process

- Raw Material
- Energy
- WHR Input
- WHR

Product 1
Waste
M_1
M_2

WHR Product
Case study 2: Waste Heat Recovery

Impact = Impact (WHR) + Impact (Process)
Impact = \( E_{M1} - E_{M2} + [\text{Adjusted Baseline Energy (Process)} - \text{Actual Energy (Process)}] \)
Case study 3: Multiple Products

Overall Process

- Raw Material
- Energy
- Product 1
- Product 2
- Waste
Case study 3: Multiple Products

Overall Process

Raw Material + Product 1 + Total Process = M₁

Energy + Product 2 + Waste = M₂

Product 1

Product 2

Total Process

M₁

M₂
Case study 3: Multiple Products

**CS 3 - Baseline Model 1**

![Graph showing correlation between Total Energy [MWh] and Total Production [Tonnes]](image)

- $R^2 = 0.8362$
- Possible Outliners
Case study 3: Multiple Products

CS3: Baseline Model 2

R² = 0.789
Case study 3:

<table>
<thead>
<tr>
<th></th>
<th>Product 1 [t]</th>
<th>Product 2 [t]</th>
<th>Total [t]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Year</td>
<td>71 989</td>
<td>212 946</td>
<td>284 935</td>
</tr>
<tr>
<td>Assessment Year</td>
<td>129 280</td>
<td>236 793</td>
<td>366 073</td>
</tr>
<tr>
<td>Difference</td>
<td>80%</td>
<td>11%</td>
<td>28%</td>
</tr>
</tbody>
</table>
Case study 3: Multiple Products

CS3 - Baseline Model 3 considerations

- Product 1
- Product 2
- Linear (Product 1)
- Linear (Product 2)

Standard Linear Regression:
\[ y = a(x_1) + c \]

Multi Variable Linear Regression:
\[ y = a(x_1) + a(x_2) + c \]

R² = 0.3658

R² = 0.8194

R² = 0.863
Conclusion:

• Investing in developing a baseline, will pay off in the long run.
• Get a M&V professional involved sooner than later!
• 12L Tax Incentive is a great way to assist you in increasing your company’s sustainability through energy efficiency. Do not miss out!
References:


Any questions?

Contact Information:
JC Bekker
neliusb@sun.ac.za
083 68 98 216