MEASUREMENT AND VERIFICATION: EXAMPLE PROJECT WITH PRINCIPLES

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WHAT IS MEASUREMENT AND VERIFICATION?

Measurement and Verification (M&V) is the term given to the process for quantifying savings delivered by an Energy Conservation Measure (ECM), as well as the sub-sector of the energy industry involved with this practice.*

This includes:

- Clear definition of why the savings could or could not have occurred.
- Understanding the level of uncertainty in the savings
- Discipline being extremely thorough and careful.

*https://en.wikipedia.org/wiki/Measurement
KEY M&V APPLICATIONS

- Tax Incentives
- Perf. Contract
- Trials R&D
- KPI Automatic

M&V
BASIS OF M&V
VALUE FROM MATURITY

TECHNICALLY AND STRUCTURALLY ADVANCED PRACTICE
APPLIES STANDARDS, PROTOCOLS AND PROVEN GOOD PRACTICE
HAS PROFESSIONAL TRAINING AND CONTROL BODIES
SOUTH AFRICA IS A LEADER IN THE FIELD OF M&V PRACTICE AND STANDARDS – WITH EXPERIENCED PRACTITIONERS AND A NUMBER OF EXCEPTIONAL PROFESSIONALS DEVELOPING METHODS

ISO/IEC 17020:2012
BASIS OF M&V – TAX INCENTIVES

- TAX INCENTIVES 12I AND 12L – ALL ENERGY – ELECTRICAL EQUIPMENT, VEHICLES, FURNACES, ENERGY RECOVERY, ...
- A HIGHLY REGULATED PROCESS
- ADMINISTERED BY SANEDI
- UNDERPINNED BY SANAS ACCREDITED INSPECTION BODIES (ISO/IEC/SANS 17020 TO SANS 50010) – TOGETHER WITH SANEDI SPECIALISTS

- THE OUTCOME IS THAT THERE ARE PREDICTABLE INCENTIVES FOR VERIFIED ENERGY SAVINGS.
COUNTERFACTUAL PRINCIPLE

ONE CANNOT MEASURE THE QUANTITY THAT WAS NOT USED – THIS DOES NOT MEAN THAT THE QUANTITY IS GOING TO BASED ON GUESSES !!

MANY ENGINEERING AND ACCOUNTING PRACTITIONERS FAIL TO UNDERSTAND THE PRINCIPLES – WITH SIGNIFICANT CONSEQUENCES

REQUIRES EXPOSURE AND EXPERIENCE TO FULLY UNDERSTAND THE IMPORTANCE
Operational-improvement efforts have typically led to energy savings of 10 to 20 percent.

Achieved energy savings in % of total energy costs with payback <3 years

<table>
<thead>
<tr>
<th>Industry sector</th>
<th>Category</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced industries</td>
<td>• Semiconductors • Electronics • Data centers</td>
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<tr>
<td>Cement</td>
<td>• Clinker production • Cement production</td>
<td></td>
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<tr>
<td>Chemical</td>
<td>• Batch processing • Continuous processing • High intensity</td>
<td></td>
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<tr>
<td>Oil refining</td>
<td>• Advanced process control</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Consumer goods¹</td>
<td>• Dry goods • Liquid goods • Packaging</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Mining</td>
<td>• Coal mining • Iron-ore mining</td>
<td></td>
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<tr>
<td>Power</td>
<td>• Thermal (coal and gas) • CCGT²</td>
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<tr>
<td>Pulp and paper</td>
<td>• Paper processing</td>
<td></td>
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<tr>
<td>Steel</td>
<td>• Integrated upstream • Electric-arc furnace • Downstream processing</td>
<td></td>
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</tbody>
</table>

*Including cosmetics, food and beverage, and pharmaceuticals.
²Combined cycle gas turbines

**CONTEXT – ENERGY EFFICIENCY GAINS**

Energy efficiency is worth the effort.

Currently, significant opportunity for energy efficiency improvements (up to 50%) exist with new innovations!

Case Study
ENERGY TYPES FOR THIS CASE STUDY

All energy types are allowable with some restrictions.

<table>
<thead>
<tr>
<th>Type and form of Energy</th>
<th>Conversion Device</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas (chemical)</td>
<td>Steam boiler</td>
<td>Heat transfer to product – humidification and drying</td>
</tr>
<tr>
<td>Diesel (chemical)</td>
<td>Engine</td>
<td>Movement of paper and product</td>
</tr>
<tr>
<td>Electricity (potential)</td>
<td>Motor</td>
<td>Movement, forming, cutting, and printing of product</td>
</tr>
</tbody>
</table>
## SECTION 12L – QUALIFYING CRITERIA

<table>
<thead>
<tr>
<th>Qualifying</th>
<th>Non-Qualifying</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All Energy Efficiency Projects</strong></td>
<td><strong>Energy generated from renewable resources</strong></td>
</tr>
<tr>
<td>▶ All forms of energy including electricity, gas, diesel, waste heat recovery, energy generated from combined heat and power</td>
<td>▶ Biomass, geothermal, hydro, ocean currents, solar, tidal waves, wind</td>
</tr>
<tr>
<td><strong>Captive power plants</strong></td>
<td><strong>Projects funded by any other financial incentive for energy efficiency</strong></td>
</tr>
<tr>
<td>▶ Captive power plant is where generation of energy is consumed solely by the entity generating it – i.e. not fed into the grid</td>
<td>▶ From any sphere of government</td>
</tr>
<tr>
<td>▶ Where renewable energy is generated for own use and it constitutes in excess of 35% conversion efficiency it will be allowed.</td>
<td>▶ Any public entity (e.g. Eskom)</td>
</tr>
<tr>
<td><strong>There is no minimum or maximum threshold</strong></td>
<td>▶ Any power purchase agreements</td>
</tr>
<tr>
<td></td>
<td>▶ Energy generated for external use</td>
</tr>
</tbody>
</table>
WHAT DID THEY DO? – CASE STUDY

Boiler condensate return monitoring and corrective action.

Steam and water leaks monitoring and corrective action.

Air leak monitoring and corrective action.

Electrical consumption analytics and assigned accountabilities for corrective action.

Turning off machines during shift changes or production interruptions. “Switch off” when not needed policy.

Variable speed drives on the key equipment.

Using turbine ventilators versus continuously running axial fans.

Energy efficient lighting in production areas.
## BASE AND ASSESSMENT ENERGY – CASE STUDY

<table>
<thead>
<tr>
<th>Period</th>
<th>Production (kg)</th>
<th>Combined Energy (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline 2014</td>
<td>38,500,000</td>
<td>17,000,000</td>
</tr>
<tr>
<td>Assessment 2015</td>
<td>43,000,000</td>
<td>18,000,000</td>
</tr>
<tr>
<td>Saving</td>
<td></td>
<td>?</td>
</tr>
</tbody>
</table>

Different forms of energy need to be converted to equivalent units - kWh (essential to combine energy sources).

Savings cannot be determined from measured energy in the assessment period.
Baseline 2014 Measured energy

Adjusted Baseline 2015

Increase due to production increase in 2015

EE Saving 2015

Assessment 2015 Measured energy

What happened? More energy!!! No savings?

More energy for more production/work

Aha! The saving

Accounts for changes in energy for the work done
Counterfactual principle revisited:
You cannot measure savings – you can only estimate what the energy would have been in the absence of your efforts to improve energy efficiency.

This is why M&V professionals are needed!
A BRIEF DETOUR – MORE COMPLEX M&V
SECTION 12L – THE PROCESS

**Customer**
- Identify Energy Efficiency Projects
- Project Implementation
- Project Execution
- Claim S12L tax deduction

**ECS**
- Confirm eligibility of the project in terms of S12L
- Develop Baseline *
- Inform Stakeholders
- Develop the post implementation and performance assessment report and calculate savings with Adjusted Baseline *

**SANEDI**
- Register Project
- Upload the Baseline data and report
- Evaluate and approve the Baseline
- Upload post implementation and performance assessment report
- Evaluate and approve energy efficiency savings
- Update project on system
- Issue Tax Rebate certificate

Notes:
* The highlighted processes are necessary conditions for the process.
Q&A

What is the business financial fundamental for energy efficiency?
Key principle: You either pay to waste the energy or pay to save the energy – there are no alternatives. All other argued options are a fallacy.

What is the opportunity for energy saving (industrial)?
0% to 45% of your current energy – using technology, process design, and behaviour

What is the value to your company?
You avoid paying for energy that you were going to waste (biggest win).
You can invest the saving in improved production/business operations (securing your future).
You can get tax benefits for your efforts (cream on the top via SANEDI).

What is the cost for the value?

Other Questions?
THANK YOU

ECS: Connecting Solutions to Sustainable Business Performance