Energy Management Training:
Common Issues observed in EnMS documentation

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Overview

- When reviewing site Energy Management System (EnMS) documentation, ADDC has identified a number of common issues.
- In some cases these are areas that sites may have misunderstood.
- In other cases, sites need to apply more attention to ensure that their EnMS delivers savings.

Issue #1: Benchmarks and best practice

Includes:

- Selecting a reliable benchmark to measure future improvement
- Developing its own internal benchmark against which to measure future improvements.
- Difference between benchmark & saving targets.
- Mapping energy efficiency best practice examples against site processes. (sources, relevant practices, what to include) guide the development of opportunities
- Best practices vs planned energy saving projects
- Using the list of best practice to guide observations made during the site walk-around and survey.

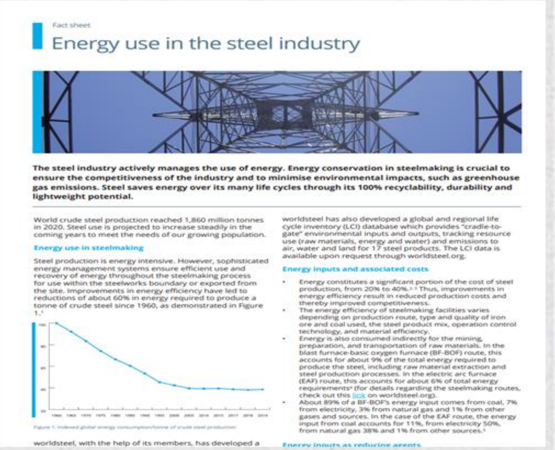
Energy benchmarking in general:

- A powerful tool for defining energy performance targets and monitoring improvements in energy efficiency.
- The process of comparing the energy performance of facilities, processes or equipment to something similar or the best.

Courtesy of the Canadian Institute for Energy Training.

Identification of external benchmarks

- External benchmarks:
  - ➢ Compare performance against a metric “outside” of the organization.
  - ➢ Identify “Best in Class” performance
  - ➢ Define “best in class” for an industry or building type
- Take into account issues such as:
  - ➢ Industry sector-specificity, using the 6-digit NAICS code (or more refined characterisation)
  - ➢ Considering energy data at the whole facility level.
  - ➢ Source energy intensity.
  - ➢ Normalisation for key variables.



Fact sheet

Energy use in the steel industry

The steel industry actively manages the use of energy. Energy conservation in steelmaking is crucial to ensure the competitiveness of the industry and to minimise environmental impacts, such as greenhouse gas emissions. Steel saves energy over its many life cycles through its 100% recyclability, durability and lightweight potential.

World crude steel production reached 1,860 million tonnes in 2020. Steel use is projected to increase steadily in the coming years to meet the needs of our growing population.

Energy use in steelmaking

Steel production is energy intensive. However, sophisticated energy management systems ensure efficient use and recovery of energy throughout the steelmaking process for use within the steelworks boundary or exported from the site. Improvements in energy efficiency have led to reductions of about 60% in energy required to produce a tonne of crude steel since 1960, as demonstrated in Figure 1.[3]

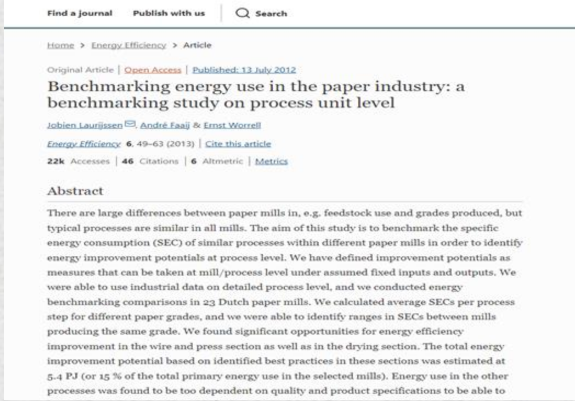
worldsteel, with the help of its members, has developed a

worldsteel has also developed a global and regional life cycle inventory (LCI) database which provides “cradle-to-gate” environmental inputs and outputs, tracking resource use (raw materials, energy and water) and emissions to air, water and land for 17 steel products. The LCI data is available upon request through worldsteel.org.

Energy inputs and associated costs

- Energy constitutes a significant portion of the cost of steel production, from 20% to 40%.[1,2] Thus, improvements in energy efficiency result in reduced production costs and thereby improved competitiveness.
- The energy efficiency of steelmaking facilities varies depending on production route, type and quality of iron ore and coal used, the steel product mix, operation control technology, and material efficiency.
- Energy is also consumed indirectly for the mining, preparation, and transportation of raw materials. In the blast furnace-basic oxygen furnace (BF-BOF) route, this accounts for about 9% of the total energy required to produce the steel, including raw material extraction and steel production processes. In the electric arc furnace (EAF) route, this accounts for about 6% of total energy requirements[4] (for details regarding the steelmaking routes, check out this link on worldsteel.org).
- About 89% of a BF-BOF's energy input comes from coal, 7% from electricity, 3% from natural gas and 1% from other gases and sources. In the case of the EAF route, the energy input from coal accounts for 11%, from electricity 50%, from natural gas 38% and 1% from other sources.[3]

Energy inputs as reducing agents



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Original Article | Open Access | Published: 13 July 2012

Benchmarking energy use in the paper industry: a benchmarking study on process unit level

Jobien Laurijssen, André Faaij & Ernst Worrell

Energy Efficiency 6, 49–63 (2013) | Cite this article

22k Accesses | 46 Citations | 6 Altmetric | Metrics

Abstract

There are large differences between paper mills in, e.g. feedstock use and grades produced, but typical processes are similar in all mills. The aim of this study is to benchmark the specific energy consumption (SEC) of similar processes within different paper mills in order to identify energy improvement potentials at process level. We have defined improvement potentials as measures that can be taken at mill/process level under assumed fixed inputs and outputs. We were able to use industrial data on detailed process level, and we conducted energy benchmarking comparisons in 23 Dutch paper mills. We calculated average SECs per process step for different paper grades, and we were able to identify ranges in SECs between mills producing the same grade. We found significant opportunities for energy efficiency improvement in the wire and press section as well as in the drying section. The total energy improvement potential based on identified best practices in these sections was estimated at 5.4 PJ (or 15 % of the total primary energy use in the selected mills). Energy use in the other processes was found to be too dependent on quality and product specifications to be able to

Courtesy of The World Steel Association, Laurijssen et al, “Energy Efficiency” 6, 49-63 2013.

Identification of internal benchmarks

- Internal benchmarks make comparisons within a single organization in order to define baselines, targets and best practices.
  - Between similar facilities within sister sites (sites within the UAE or around the world).
  - Against other examples of the same process or equipment that are owned (furnaces, electrolyzers, ball mills etc.)
  - Between internal subdivisions (Off-Shore & On-Shore).

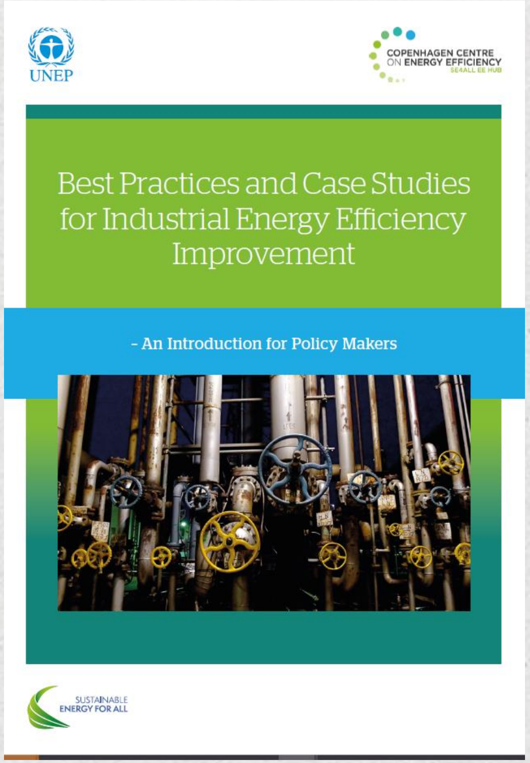
Types of benchmark for energy management

Management Objective	Scope		
	Scale	Focus	Time Frame
Assess equipment efficiency	Equipment or process	Internal – comparison against other owned equipment or process External – comparison to industry standard or cooperative study with other organizations	- Peak demand period - Three-month sample - Weekly - Monthly - Annual - Continuous from baselines
Assess facility performance	Whole facility or sub metered portion	Internal – comparison of single facility over time. Comparison of similar facilities within single organization External – comparison of facility against national performance rating	- Continuous from baseline - Monthly - Quarterly - Annual
Assess department or divisional energy use	Facilities or sub-metered portions of facilities	Internal – comparison against internal subdivisions	- Continuous from baseline - Weekly - Monthly - Quarterly - Annual
Assess organizational performance	All facilities	Internal – comparison over time or towards goal. External -Comparison of portfolio average against a national performance rating	- Continuous from baseline - Monthly - Quarterly - Annual

Sources of best practice

Information on industrial processes and industry best practices can be found from sources available on the Internet, including:

- US Department of Energy
- European Commission
- UK Department for Business, Energy, and Industrial Strategy.
- US Environmental Protection Agency
- US Energy Information Agency
- Natural Resources Canada
- Bureau of Energy Efficiency, India
- Department of Industry, Canada
- Electric Power Research Institute
- The Environment Agency (Abu Dhabi)



Courtesy of the United Nations Environment Programme.

Classifying best practices

- **Good housekeeping:** the opportunities that cost little or nothing . Includes implementing good maintenance, turning things off when they are not needed, reinstating and improving insulation and air leakage, reducing waste, leaks, idle time, production rate losses, and turning off taps and hoses when not needed.
- **The use of control systems:** Some small investment may be necessary. E.g. introducing temperature control limits in air conditioning systems, using variable speed drives and monitoring the performance of key plant items.
- **The need for systems thinking:** Applying systems thinking in energy savings projects. using compact heat exchangers, waste heat recovery boilers, pre-heaters and economizers, the use of variable speed drives to match supply with demand.
- **Step changes in process design and/or energy supply:** refitting the production line with a new process technology, extending the energy or waste heat into a district heating and/or cooling network, combined heat and power plants.

Mapping best practices onto reality

The mapping of best practice onto the process should be done to a sensible level of detail, covering larger energy-using components and grouping together numbers of smaller components.

Main processes	Common practices
• Ball mill • Steel melting • Rolling mill • Paper machine • Casting and extrusion • Coating, finishing , machining • Washing, pasteurization (heat treatment), cooking. • Motor management.	• Motors • Compressed air units • Chillers • Lights • Waste recovery • Sub-metering • AC units • Renewable energy

Issue #2: The walk around survey :

Walk Around Survey Results:

- Describes what was found around the premises and compare observations with international best practice.

- High level description accompanied by photographs and covering key items of equipment that use energy.

Develops a picture of the quality of plant and identify areas of obvious waste by:

* Identifying which equipment uses energy.
* Understanding why energy is being used.
* Identifying when energy is used.
* Understanding what the process needs.
* Identifying areas for savings.

What does the survey need

The walk around survey must describe **the current operational condition of the equipment** and **identify areas of obvious improvement and savings**.

Useful tools include:

- Digital camera.
- Infra-red thermometer.
- Light meter.
- Temperature probe.
- Pressure gauge.
- A good pair of eyes and ears.
- Ultrasonic leak detector.
- Tachometer.
- Air flow meter.
- Vibration meter.
- Notebook.




When to survey

- Perform your main walk-around during a period of full production. Back up with higher level checks at different periods to spot differences that can be compared with your main findings:
  - During lunch breaks.
  - At night or during weekends.
  - Maintenance and cleaning.
  - When the cooling season starts and finishes.
  - During production changeovers.
  - During shift changes.
- A typical walk-around team consists of the energy manager, production manager, maintenance manager and a member of the electrical engineering team.

Example:

1. Lighting:

# of lights , size , current conditions , energy saving opportunities (LED, skylight, control)

2. Compressed air lines: obvious leakage, Load-Unload pressures, motor type, equipment's age.

3. Pump:

motor types, speed, size, capacity, NPSH, maintenance.

4. Agitator:

speed, # of impeller/propellor, shaft length, motor size.

Issue #3: Calculating energy intensity:

Energy Intensity = Total energy consumed (kWh/GJ etc.) ⁄ Total output (AED, tonnes, m^3, m^2 etc)

Method type	Data needs	Method for grouping products
Product Line Approach	Annual submetered energy data for each production line and total annual number of units produced per production line	Calculate the energy intensity metric for each production line separately. This approach may require extensive submetering but usually leads to the most accurate calculation.
Standard Unit of Output: Energy Intensity	Annual total energy consumption for the facility, annual number of units produced per production line and the relative energy intensity for each production line at the facility	Develop a "standard unit of output" based on relative energy consumption needed to develop each product (i.e. relative energy intensity). Estimate the approximate percent of total energy consumption required to produce each product (e.g. product 1 requires 80%, product 2 requires 20%). The method does not require submetered data but does require the relative energy intensity of each production line. This approach is typically the second most accurate method; however, it requires an estimation of the relative energy needs of each process.
Standard Unit of Output: Other	Annual total energy consumption for the facility and total annual number of units produced per production line	Develop a "standard unit of output" based on a metric other than energy intensity, such as the mass or area of output. Company accounting staff may have an equivalent metric suitable for this approach. The ratio of annual energy consumption to mass or area (or other selected metric) would be used in place of the energy intensity equation. This is the recommended method when submetered energy data are not available and the relative energy intensities of different classes of product are not known, since the energy consumption often has a higher correlation to mass or area than revenue or labor hours.
Non-Output-Based Approach	Annual total energy consumption for the facility and annual revenue or labor hours for the facility	Use an alternative unit of output other than production, such as revenue, labour hours, etc. The ratio of annual energy consumption to annual revenue or labor hours would be used in place of the energy intensity equation. A benefit of this approach is that the necessary data are often easy to obtain. However, it is the least accurate of the approaches since the revenue or labor hours may not be directly correlated to the energy consumption of the facility.

Issue #4: Not taking enough time

- Issues with late submission to external reviewers:
  - No time to do a proper site survey and might miss saving opportunities.
  - Delays in awarding of compliance certificates.
  - Facing unexpected issues such as IT or email
  - Delayed response from reviewer due to high volume of application .
  - Using outdated forms and templates.

- 2-3 months elapsed time is recommended to review and improve the system every year.

Issue #5: Lack of detail in the opportunities table

Opportunity Table :

Summary of all energy saving opportunities relevant to the site. combined with research on international best practice with a view as to whether that best practice would be feasible within your own process.

No.	Target Process	Best Practice	Current Practice	Recommendation	Estimated Savings (kWh or MMBtu)	Basis for Savings Estimate	Risk H/M/L	Simple Payback (Months)
1	Machine cooling	Recirculation	Recirculation	-	-		L	-
2	Machine cooling	Shut off during idling	Always on	Add electronic valves	2% chilled water		L	6
3	Machine cooling	Zoned use of cooling water	Cooling water directly to and from cooling mains	Change routing	5% chilled water		L	12

Issue #6: Energy saving targets:

- Use available data along with energy saving opportunities to set **clear**, measurable targets for reducing energy
  - Ex: 10% annual energy reduction by December 31st!!!!!
- Allow yourself a contingency to manage the expectations of stakeholders.
- To be achievable, targets need to be **SMART:**
  - Specific;
  - Measurable.
  - Achievable.
  - Realistic.
  - Time-bound.
- Also:
  - Cost Effective.
  - Based on a thorough understanding of your current energy consumption and of the potential for savings to be made.
  - Compliant with local regulations.

Issue #7: Proper monthly energy reporting to the executive team

Historic Annual Performance:

	Year minus 3	Year minus 2	Year minus 1
Electricity Consumption (kWh)	5,500,000	5,250,000	5,000,000
Gas Consumption (GJ)	2,000,000	1,950,000	1,900,000
Water Consumption (m3)	250,000	240,000	230,000
Production tonnage	30,000	31,000	32,000
Annual Revenue (M.AED)			
Electricity/tonne	183.33	169.35	156.25
Gas/tonne	666.67	629.03	593.75
Water/tonne	8.33	7.74	7.19
Electricity/M.AED			
Gas/ M.AED			
Water/ M.AED			

Monthly performance this year to date:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Electricity	410,000	410,000	410,000	410,000	410,000	410,000	410,000	410,000	410,000			
Gas	160,000	160,000	160,000	160,000	160,000	160,000	160,000	160,000	160,000			
Water	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000			
Production	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500			
Revenue												
Electricity/tonne	164	164	164	164	164	164	164	164	164			
Gas/tonne	64	64	64	64	64	64	64	64	64			
Water/tonne	8	8	8	8	8	8	8	8	8			

Issue #8: Clear comparison with previous years and benchmark

Compare previous year with benchmark :

Intensities should be compared with the selected benchmark for production.

Identifies the scale of the gap against best practice.

Explain that if the site consumed energy at the same rate as the best-in-class benchmark, the annual savings in energy would be **XXX** worth **XXX.AED**.

Issue #9: Not following the listed compliance requirements

Revision	Date	Created by	Description of Changes From Previous
V3.00	01/01/2023	ADDC/AADC	Third Version, additional requirements included.

ADDC/AADC Energy Management Qualification Criteria

This document describes the energy management qualification criteria for the Energy Tariff Incentive Programme (ETIP). These criteria must be passed in order for a site to initially receive the incentive tariff, and they also define the ongoing performance standards that the site must meet in order to continue receiving the tariff.

Each site will submit evidence that they have in place the basic elements of simple energy management systems to their Certifying Body (CB). The evidence will be tested against specific pass/fail criteria, all of which must be passed in order for the site to receive a Certifying Body's Report from the CB. If a site is admitted to the scheme, ongoing assessment by ADDC/AADC of site performance against other criteria also dictates whether or not it will continue to receive the tariff during the year. There are thus two separate sets of energy management criteria:

- Initial joining and reapplication criteria that must be satisfied in order for the site to receive a Conformance Certificate from its Certifying Body and join/rejoin the scheme as part of the qualification process at the start of each year.
- Ongoing performance criteria that must be satisfied for the site to continue receiving the tariff.

Evidence requirements at the start of the year for both new joiners and existing scheme members, including for those who use ISO certificates, are given in Table 1 that follows.

The same documentary evidence that was submitted during a previous year's application may be used to apply for a new year, so long as the dates and templates used are still valid and the evidence meets the specific quality requirements for that new year.

All site must also satisfy ongoing performance criteria in order to maintain access to the incentive tariff.

Where a site has special characteristics or circumstances that puts its energy management evidence outside of the prescribed quality specifications, ADDC/AADC should be consulted by the Certifying Body to ensure that a flexible and fair assessment takes place.

Scoring and Qualification Criteria to Receive an Industrial Incentive Tariff

Table 1: Requirements to submit evidence at the start of each new ETIP 2.0 year.

Item		New Joiners		Reapplicants		Scores	
		Not using ISO route	Using ISO route	Not using ISO route	Using ISO route	Non ISO Route Scores	ISO Route Scores
1	Supply Details Form	Y	Y	Y	Y	5	5
2	Single Line Diagram(s)	Y	Y	Y	Y	5	5
3	Direct Debit Evidence	Y	Y	Y	Y	5	5
4	Energy Management Checklist	Y	Y	Y	Y	5	5
5	5 Year Power Forecast	Y	Y	Y	Y	5	5
6	Nominate Senior Executive Responsible for energy	Y	N	Y	N	5	
7	Nominate Energy Manager	Y	N	Y	N	5	
8	Policy for Energy Management	Y	N	Y	N	5	
9	Executive Team/ Main Board Energy Reporting	1 example	1 example	12 examples	12 examples	10	10
10	Energy Survey	Basic survey	Basic survey	Detailed survey	Detailed survey	25	25
11	Energy Management Plan and Targets	Basic plan	Basic plan	Detailed plan	Detailed plan	25	25
12	Energy & Production Analysis report	Y	Y	Y	Y		
13	ISO 50001 or ISO 14001 Certificate	N	Y	N	Y		15
14	Certifying Body's Report	Y	Y	Y	Y		
					TOTAL	**100**	**100**

In order to enter the ETIP, all sites must submit all items of energy management evidence as listed above, depending on their status as re-applicants or new joiners to the scheme.

Evidence submitted will be subjected to the overall weighted scoring as detailed in columns 7 and 8 in the table above, and the 10 ETIP 2.0 marks for energy management will be awarded proportionately to the scores.

Each item of evidence will be scored according to detailed criteria that will be publicly available.

Issue #10: Not clearly calculating savings & paybacks

When completing this section, make sure to :

- List the energy projects implemented in the previous year.
- Use the correct basis for the savings calculation .
- Understand the difference between expected Vs actual savings
- Use simple payback periods & the correct tariff rate

$$Payback\ Period = \frac{Cost\ of\ Invesment}{Average\ Annual\ Cash\ Flow}$$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