Benchmarking energy efficiency in the Iron & Steel Industry

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Why Benchmarking?

- **A Reality Check**
  - “What you don’t measure, you can’t manage”
  - Companies often have the perception that they are highly energy-efficient
  - Benchmarking provides a tool to test this perception using accepted benchmark values for technology
  - Benchmarking can improve the understanding of a process and help identify best practices

- **Benchmarking**
  - Benchmarking provides insight in the efficiency relative to a reference (or benchmark) performance/technology
  - Benchmarking can help enterprises to identify inefficiencies and search for more efficient technology opportunities
  - Experience with benchmarking programs worldwide has shown increased attention for energy-efficiency and performance

- **Benchmarking approach depends on goals**
Is this benchmarking?

NO!

What is Benchmarking?

- **A *fair* comparison of the performance**
  - NOT comparing energy intensities
  - NOT an infinite number of correction factors
  - NOT comparing apples and oranges

- **Benchmarking addresses the specific product and feedstock mix:**
  - Differences in feedstock
    - Raw materials
  - Differences in product
    - Iron and steel
    - Types of steel products
Iron & Steelmaking

1. Sintering
2. Blast furnace
3. Coke oven
4. Converter
5. Electric arc furnace
6. Refining stand
7. Continuous casting
8. Rolling mill
9. Sheet in coils
10. Iron ore
11. Coal
12. Molten pig iron
13. Coke
14. Slag
15. Raw liquid steel
16. “Graded” liquid steel
17. Slab
18. Scrap
Steel & Energy Use

- **Steel is a complex product**
  - Primary vs. secondary steel, that partially serve overlapping markets
  - Degree of processing
  - Alloys

- **Energy use affected by**
  - Process route
  - Degree of processing
  - Finishing
  - Energy efficiency
  - Material losses

- **Many energy efficiency options**
  - In each process
  - Heat recovery
  - Process integration (e.g. thin slab casting, smelt reduction)

- **Difficult to benchmark**
  - What products to distinguish?
  - System boundaries

  - Limited Experience to date

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History Energy Benchmarking

- Benchmarking first introduced as tool for the petroleum refining industry by Solomon (1980’s).
  - Later extended to ethylene plants
- Intra-company efforts to understand differences
- Extension of private benchmarking to other sectors (1990’s)
  - Various consultants offering services (not for steel)
- Government Programs SUPPORTING benchmarking (1990’s)
  - Norway, Canada, Malaysia, United Kingdom, United States
- Government programs USING benchmarking (2000):
  - Netherlands/Flanders: Benchmarking Covenant
  - EU ETS allocation new entrants (e.g. Germany, UK)
  - EU ETS: allocation tool in 3rd trading periods
  - ENERGY STAR: benchmarking to recognize plants achievements
- International sector-driven initiatives
  - WBSCD- Cement Sustainability Initiative
  - IAI – Aluminium industry
  - World Steel Association (?)
Accounting for Apples and Oranges

\[
EEI = 100 \cdot \frac{\sum_{i=1}^{n} P_i \cdot EI_i}{\sum_{i=1}^{n} P_i \cdot EI_{i,BP}} = 100 \cdot \frac{E_{tot}}{\sum_{i=1}^{n} P_i \cdot EI_{i,BP}}
\]

EEI = energy efficiency index
n = number of products to be aggregated
EI_{i} = actual energy intensity for product i
EI_{i,BP} = best practice energy intensity for product i
P_{i} = production quantity for product i
E_{tot} = total actual energy consumption for all products
Energy efficiency in the iron and steel industry

EU–ETS – 3rd Period Allocation

- Benchmarking to be used as tool to coke to more fair allocation of emission rights
- Developed by Ecofys and Fraunhofer Institute
- In contrast to other sectors
- No aggregated benchmark curve for EU iron & steel industry

- Developed benchmark approach by intermediate product:
  - For some processes benchmark curves were (are being) established (by Eurofer)
    - Sinter plant
    - EAF
  - For some based on IISI 1998 best practices and assumed fuel mix
    - Coke ovens
    - Blast furnace
BEST

- Based on international comparisons work (1994-1996)
- Combines benchmarking with opportunity assessment
- Approach developed by LBNL/Utrecht University
  - Approach presented in 2006 paper
  - Tested on hypothetical Chinese integrated mill

UNIDO

- UNIDO released a report on the importance of benchmarking in 2010
- Based on research Utrecht University an estimated benchmark for the global steel industry was developed (2005)

Source: UNIDO & UU (2010)
ENERGY STAR: EPI

• ENERGY STAR provides focus companies a benchmarking tool to:
  • Evaluate performance
  • Identify potential for improvement
  • Recognize the ENERGY STAR Partner of the Year

• Based on statistical model for EAFs, using:
  • Data from the US Census
    • Reported on a consistent basis for all plants
    • Confidentiality assured
  • Public data collected from various sources
    • EAF Roundup
    • Data provided by companies

• Results in statistical model
  • Confidentiality

• Currently under development and tested by industry
Canada – 2007 Benchmarking Study

- Benchmarking of energy *intensity*
- Benchmarking of individual processes
  - Against 1998 IISI Ecotech ‘Best Practice’ performance
  - Unclear for what factors has been corrected
  - Example: blast furnaces

Source: NRCan (2007) Benchmarking the Energy Intensity of the Canadian Steel Industry
Wrap Up – Challenges and Opportunities

• There is no single tool or approach that is accepted by the industry and/or policymakers

• Benchmarking has taken different forms
  • Most often based on “best practices” approach
  • Intensity
  • Efficiency index
  • CO₂
  • System boundaries and correction factors differ

• Need to develop a widely accepted method
  • Develop system boundaries
  • Determine structural correction factors
Thank you for your attention

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