Together we make the difference

Managing Energy in a sustainable way

Energy and CO₂ reduction in the steel industry
Improvement of sustainability by energy efficiency

KSB energie efficiëncy dag
21 August 2015
Ron Weltevrede

Together we make the difference
## Content

1. **The Tata Group & Tata Steel**
2. **Energy efficiency approach**
3. **Pumps in energy efficiency**
4. **Other examples**
Tata Group
One of the world’s fastest-growing and most reputable corporations

- Spans 7 major industry sectors
- Operations in more than 80 countries and 450,000 employees
- Total revenues $100 billion (58% from outside India)
- Ranked world’s 11th most reputable and 17th most innovative company
- Tata Sons 66% owned by philanthropic trusts
- £170 million invested in community projects last year
The materials sector contributes 28% of Tata Group revenues

Sales in %

- Materials (including Tata Steel): 28%
- Engineering: 39%
- IT and communications: 16%
- Energy: 6%
- Services: 4%
- Consumer products: 4%
- Chemicals: 3%
Tata Steel Group
One of the world’s most geographically-diversified steel producers

- Top 12 global steel producer
- Annual crude steel capacity of more than 29 million tonnes
- Around 80,000 employees
- Manufacturing operations in 26 countries across 4 continents
- Present in both mature and developing markets
- Turnover in 2012-13: £24.82 billion
- Fortune 500 company
Our key markets
Serving the most demanding markets worldwide
Tata Steel in IJmuiden is an integrated steel production site.
Tata Steel in IJmuiden uses high-quality processes
Production of high-quality hot-rolled, cold-rolled and coated steel

Raw materials - Pig iron - Steelmaking - Casting - Rolling - Coating
Tata believes it is important to strive for sustainability

Tata Steel wants to maintain a consistent line of continuous improvement also for the benefit of society and contribute to solutions.

Major issues:

» Climate change
» Finiteness of resources
» Biodiversity

Improve the quality of life of the communities we serve through leadership in sectors of national economic significance

Jamsetji Tata, Founder, Tata Group
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The steel production in IJmuiden requires about 4% of the total energy need in the Netherlands.
Energy efficiency at Tata Steel in IJmuiden has improved by more than 30% since 1989 and we are 3rd in the World Steel CO₂ benchmark.
The Trias Energetica shows the way towards energy efficiency improvement in the steel industry

1. Reduce unnecessary energy consumption, by good heat insulation, innovative design, hot connect, start-stop management;

2. For the remaining energy requirement use sustainable energy, such as wind, solar, biomass or geothermal energy;

3. When renewable energy is not sufficient, make use of efficient fossil sources, for example, low-CO₂ power of an incinerator.
The Direct Sheet Plant (DSP) is more energy efficient than the conventional root

Caster
- Slab thickness: 70 mm
- Casting speed 5 - 6 m/min

Tunnel furnace
- Homogenises the slab temperature

7 stands rolling mill
- Exit thickness 1 - 3 mm

Ultra fast cooling

Integrates process of casting and hot rolling
→ Significant energy savings

Carrousel coiling after continuous rolling
Hisarna
Hisarna trialproject – Flagship of European staal research ("ULCOS")

HIsarna-technologie delivers 20% less CO$_2$-emission, with CCS 80% technology available as of 2020 on industrial level

Topics

- A significant new process: concept of direct use of raw materials
- Iron ore being melted in a cyclone
- Fine coals being directly injected into the smelter
- The use of pure Oxygen results in a Nitrogen free process gas
- Combination with CCS easy to enable

Direct use of coal and ore
No coking and agglomeration

Iron ore $\rightarrow$ Sinter $\rightarrow$ Blast furnace $\rightarrow$ Hot Metal
Coal $\rightarrow$ Coke $\rightarrow$ HIsarna
High Strength Steel: Weight reduction leading to lower energy consumption in use
The EE project structure promotes successful implementation of the most realistic improvement measures

0. Data gathering
   - 2 weeks

1. Analysis
   - 4 weeks
   - Analyze
     - Consumption
     - Process
     - Potential

2. Measure development
   - 4 weeks
   - Brainstorms to generate ideas
   - Prioritize ideas and develop measures

3. Measure evaluation and planning
   - 4 weeks
   - Evaluate and get approval for measures
   - Plan implementation

4. Implementation
   - Continuous improvement
   - Implement all approved measures

Gather data on:
- Consumption
- Processes

Assessment

2010  2011
X%
To achieve lasting impact, management infrastructure and behavioural change are as important as technical measures.

“The way physical assets and resources are configured and operated to create value and minimize losses”

“Technical system”

“Management infrastructure”

“The formal structures, processes, and systems through which the operating system is managed to deliver the business objectives”

“Mindset & behaviour”

“The way people think, feel, and behave in the workplace, both individually and collectively”
In the analysis phase, the theoretical limits for the major utilities and process steps are determined.

- **Performance level**
  - Current state
  - State after bottom-up design future state (Continuous Improvement)
  - Target state within 24 months and payback <2 years

- **Theoretical limit**
  - Allows for a higher aspiration level as it is free from influence of existing bottom-up ideas
  - Permits upfront identification of loss areas likely to have higher savings potential
  - Fosters thinking about process energy efficiency and opportunities
  - Typically excludes losses and/or opportunities from purchasing

Theoretical limit calculation
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Project Rotating Tata Steel IJmuiden is about Total Cost of ownership

Total Cost of Ownership (TCO) approach

- Purchase 5%
- Maintenance 5%
- Energy consumption 90%

Integrated approach

- Operations
- Mechanics and transmission
- Motor and control
- Piping and fittings

Phasing

1. quick scan
2. data collection
3. if necessary, additional measurements
4. final analysis
5. determine measures
6. business case
7. implementation
8. validation + measurement
Projects will benefit from the combined effort of procurement, corporate social responsibility and energy efficiency

- **Procurement:**
  - In search of the best supplier for Tata Steel

- **Energy Efficiency:**
  - Internal analysis on data and implementation of measures

- **Corporate Social Responsibility:**
  - Challenging suppliers for solutions of energy efficiency measures

- Collaboration and commitment is necessary for the best project results.
Energy saving at the Brackish Water Pump Station Tata Steel
To prevent cavitation energy inefficient measures have been taken

- The pumps have a designed total head of 35 meter while the total head needed = about 12 meter (static head= 9.4 meter and dynamic head at Q= 4000 m3/h should be less than 3 meter.
- To prevent cavitation, at the outlet of the pipe an extra restriction has been installed.
- In spite of these measures maintenance costs of the pumps and pipes are relatively high.
Best measure to save energy is to decrease the system pressure and operate pumps at their BEP

- The installation will be operated without extra restriction (the bypass open).
- In that case VSD’s will help to decrease the system pressure without getting cavitation.
- The yearly energy savings will be **30%**.
- Beside energy saving, maintenance costs will decrease about **50%**.
Pump surveys lead to interesting business cases.

Conclusions:

- Energy saving and decrease of maintenance costs (and so increase of production stability) often go hand in hand.

- At 50% of the pump installations, 20% energy saving is possible.

- For smaller pump systems the KSB pumpmeter is a practical tool.
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Hydraulic pumps can be switched off as a measure of Start – Stop Management

- 4 pumps can do the work of 8
- 3 pumps can be permanently dismantled
- 2 extra pumps can be switched off during standstill
Two surveys prove a potential of 130 kEUR/year savings at Packaging on compressed air consumption

<table>
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<tr>
<th>Scope of work &amp; costs</th>
<th>[kEUR]</th>
<th>Savings</th>
<th>[kEUR/year]</th>
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<td>Repair leakages PL12 &amp; CA12</td>
<td>10.3</td>
<td>Repair leakages PL12 &amp; CA12</td>
<td>11.5</td>
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<tr>
<td>Modifications PL12 &amp; CA12</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>21.3</strong></td>
<td><strong>Savings in compressed air</strong></td>
<td><strong>22.5</strong></td>
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(≈28% of total costs for Compressed Air at PL12&CA12)

Next steps & Remarks [kEUR/year]

- Yearly costs at TSP for Compressed Air: 540
- PL12&CA12 make up to <15% of total costs
- Savings found at PL12&CA12: 22.5
- Estimated total savings for TSP 25%: 130
- Make maintenance concepts
- Follow up

Compressed Air Vortex Cooler
Darkness policy Tata Steel IJmuiden to increase mindset and behaviour
Due to 24/7 operations and high replacement costs of the current lighting, using high bay LEDs and sensors is profitable

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<tr>
<td><strong>Measures:</strong></td>
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<tr>
<td>Replace high bay lights by LEDs incl. sensors</td>
<td></td>
<td>Energy saving by using LEDs at CPR:</td>
<td>94 kEUR</td>
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<td></td>
<td></td>
<td>Reduced replacement costs</td>
<td>21 kEUR</td>
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**Solution & Costs**

| Material cost: | 161 kEUR |
| Replacing cost: | 48 k EUR |

**Total Cost**

| 209 |

Energy saving by using LEDS at CPR: 94 kEUR
Reduced replacement costs: 21 kEUR

Total savings HDGL 2: 115
Pay back time: 1.8 yr

**Next steps**

- Develop a lighting plan (by Site Facilities)
- Switch off unnecessary lights
- Investigate where to make use of sensors
- Make use of LEDs when lights have to be replaced

Example from CPR Wave
Questions & Answers