Industrial energy efficiency: electricity consumption

The industrial sector demands more energy than any other in South Africa, and more than a third of the final energy demand. Its share of electricity consumption is approximately half the national demand[1]. Within industry the largest consumers of electricity are the mining, iron and steel and non-ferrous metals sub-sectors.

For the mining sector the processing of ore, pumping and heating, ventilation and cooling (HVAC) systems are the primary consumers. In iron and steel production it is electric-arc furnaces which are electricity-intensive. In the Non-ferrous Metals sub-sector electrochemical processes account for most of the electricity consumed .

Technological improvements in combination with process optimisation would improve energy efficiency and in turn reduce demand for electricity.

Industrial energy efficiency savings attributed to electrical appliances, for Levels 1 to 4

Level	1[2]	2[2]	3[3]	4[3]
high temp heat	1%	15%	23%	30%
compressed air	1%	20%	38%	50%
lighting	2%	40%	60%	80%
cooling	0.5%	10%	38%	50%
HVAC	1.5%	30%	38%	50%
pumping	0.5%	8%	38%	50%
fans	0.5%	10%	23%	30%
other	0.3%	5%	38%	50%
electrochemical	0%	10%	20%	40%

[1] National Energy Balance (Department of Energy, 2006).
[2] Industrial Energy Efficiency Draft Report (ERC, 2011).
[3] Stakeholder consultation (perscomm DEA, 2013)

Level 1

Level 1 represents the "business-as-usual" pathway whereby a gradual diffusion of largely technological progress occurs in line with a status quo maintenance program. As a result, electricity demand decreases by ca. 1% in 2050 relative to 2006.

Level 2

Level 2 represents a concerted effort to introduce technological efficiency. Electricity consumption decreases by ca. 13% in 2050 2050 relative to 2006.

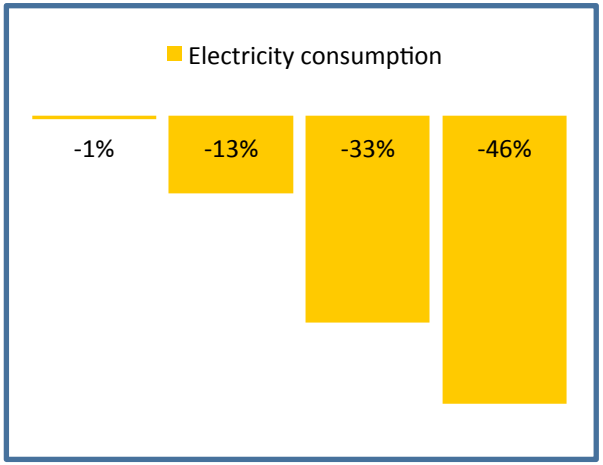
Level 3

In addition to the progress indicated in level 2, level 3 includes process improvements to effect savings of approximately 33% in electricity consumption by 2050.

Level 4

Level 4 represents the best available technological and best practice pathway. Industry is highly optimised for the local environment and proactively benchmarks electricity consumption. This suggests a ca. 46% saving by 2050 in electricity relative to 2006.

Underground mineworker and electric arc furnace
Source: www.cleantechinvestor.com (above); www.corporate.arcelormittal.com (below)



Industrial electricity consumption by 2050, relative to 2006 for Levels 1 to 4.

Industrial energy efficiency: boiler and furnace systems

Energy demand for industry is primarily for process heat in most of the sub-sectors except for the mining and non-ferrous metals[1]. Examples include steam production by boilers and annealing furnaces.

The energy efficiency of these industrial appliances are dependent on factors such as age, the type of technology (e.g. Stoker vs. CFB boilers), the fuel types and the frequency of maintenance. A systems appraisal would identify opportunities for energy efficiency improvements that could comprise, for example, improving insulation, reducing steam traps, eliminating leaks and optimising furnace temperatures.

An improvement of 40% is assumed as the maximum efficiency gain for either boiler and furnace systems and is adapted from the Long Term Mitigation Scenario technical report (2008). Thus the levels are varying improvements that approach this limit.

In addition, an overall maximum system efficiency limit is set at 95%. That is, boiler and furnace system efficiencies cannot exceed this limiting value.

Level 1

Level 1 assumes that industrial improvements in this category occur as ageing equipment is replaced with no efficiency initiative. As a result, energy demand by industrial boilers and furnaces is reduced by 1% in 2050 relative to that of 2006.

Level 2

Level 2 assumes that efficiency initiatives are adopted and largely comprise technological interventions. As a result approximately 13% of total final energy is saved by 2050 relative to that of 2006.

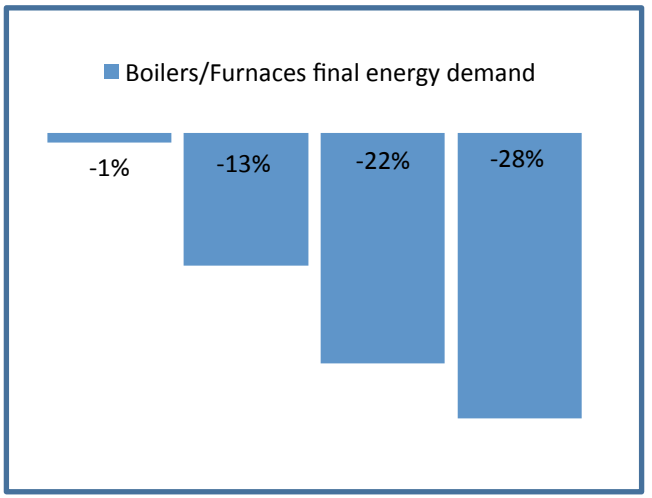
Level 3

In addition to the progress indicated in level 2, level 3 includes process improvements to effect savings of approximately 22% in final energy demand by 2050 relative to that of 2006.

Level 4

Level 4 assumes that boiler and furnace systems are operated efficiently in accordance with best practice and best available technology to achieve the maximum possible saving of 28% in final energy demand by 2050 relative to that of 2006.

A stoker boiler. Source: www.indiamart.com



Industrial boiler and furnace system final energy demand relative to 2006, by the year 2050 for levels 1 to 4.

[1] Industrial Energy Balance, 2006 (ERC,2013).
[2] Stakeholder consultation (perscomm DEA, 2013)