International experience and standards on energy efficiency improvement in industry

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Why do industries waste energy and money ?

Seven Reasons to Waste Energy

- The firm is not aware of how much money they waste

- The Government does not intervene and does not care

- The firm feels they waste energy but can't get professional advise to reduce energy costs in a technically viable and financially attractive manner

- Domestic market energy prices are extremely low

- There is no competition among firms

- The firm makes already too much profit

- The percent energy cost on product is very small < 5%

ONE financial reason to save energy

Statistics of at least one thousand EE projects in the region have proven beyond any doubt for the last 15 years

Under the EC Act Indian firm invested about US$ 500 Million a year in over 1000 EE measures.

(2004-2008 annual survey 5,000-12,000 firms)

The average payback period of implemented EE measures recommended in quality energy audit reports is about 1 year

450 kW water pump in paper mill replaced by 250 kW pump

Electricity savings	554 MWh/year
Investment	US$ 40,000
Electricity bill savings	US$ 43,000 / year
Payback	1 year
Electricity Tariff (2005)	US ¢ 7.8/kWh

Find hundreds of other cases at
http://www.emt-india.net/eca2010/2010.htm

Better housekeeping measures defined as investments of US$ 100 to US$ 10,000

To invest in many smaller better housekeeping measures shows returns on your investment of 100% to 1000 % for many years

Real time switch to turn on and off a 81 kW forced draft fan

Electricity savings		65 MWh/year
Investment		US$ 20
Electricity bill savings		US$ 5,833/year
Payback		1 day
Electricity Tariff (2005)		US ¢ 8.8/kWh

Air pressure regulator retrofit to lower 95 psi to 75 psi

Electricity savings		10 MWh/year
Investment		US$ 200
Electricity bill savings		US$ 900/year
Payback		5 months
Electricity Tariff (2005)		US ¢ 9.0/kWh

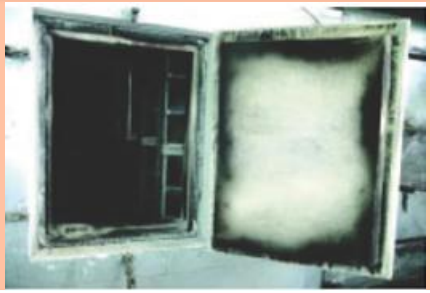
64 natural draft roof ventilators

Electricity savings		86 MWh/year
Investment		US$ 12,800
Electricity bill savings		US$ 6,450/year
Payback		2.2 years
Electricity Tariff (2006)		US ¢ 7.5/kWh

Waste heat recovery boiler at Ts = 300 C for preheating of air

Energy savings		24,000 liter oil/year
Investment		US$ 14,000
Fuel cost savings		US$ 13,000/year
Payback		1 year
Fuel oil cost (2004)		US$ 0.54 /liter

Change of inner surface emission with paint to lower outside surface temperature of furnace from 49 C to 41 C

Investment		**US$ 2,500**
Energy cost savings		**US$ 1000/year**
Payback		**< 3 years**

33 Cyclic timer for air conditioners, 20 min on, 5 min off with seasonal optimization

Investment		**US$ 1,350**
Energy savings		**39 MWh/year**
Energy cost savings		**US$ 3,440/year**
Payback		**5 months**

Technology	% Saving	Problem
Fans/Blowers	25% -50%	Duct design error, wrong fan selection, no performance chart
Pumps	15%-35%	Wrong selection/no performance chart
Electric motors	7 %	Local production/cheap imports, rewinding
Lighting systems	30%-80%	Short service life if power quality is bad
Compressors	10%	Hot air intake
Transformers 25 kVA-100 kVA	10%	Local production, overheating, THD
Furnaces and kilns	10%	Requires process specialist !

Seven technologies with a confirmed high cost effective energy efficiency improvement potential

Small group activities of a firm

"Energy auditors" are usually not very good in catching the many hidden better housekeeping measures but they are excellent to check their technical viability and merit

Step 1: A larger industrial firm forms "small groups"

Step 2: Each group is asked to identify and recommend energy saving measures within their area of responsibility in the firm

Step 3: The ideas and recommendations are discussed with a coach (external "energy auditor")

Step 4: The firm as a policy provides the budget to invest in measures that cost less than US$ 5000.

Step 5: The proposal also recommends how to verify the energy cost savings

Benchmarks, ratings, norms and standards

Excellent to questionable benchmarks, standards and norms are presented as examples

The ultimate Energy ~~Efficiency~~ Indicator

$$Energy\ Intensity = \frac{primary\ energy\ use}{gross\ domestic\ product}$$

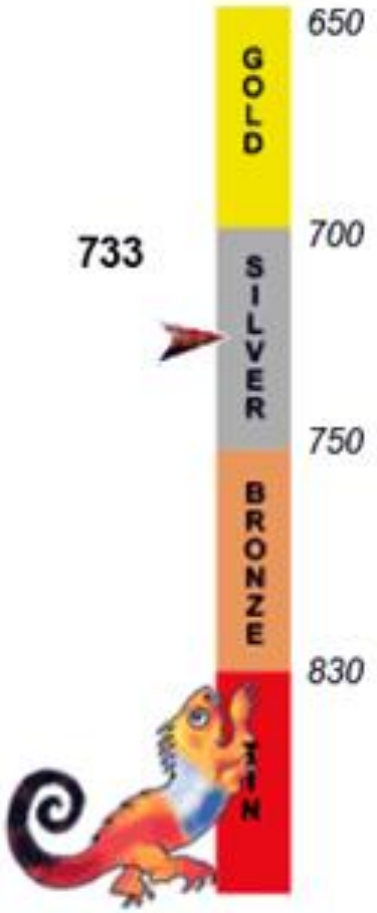
There are two types of **GDP**
"**real (= constant prices)**" or "**nominal (= current prices)**"

Applied only to industry Nepal it is about 0.33 kg OE/US$.

A reasonable to expect figure would be 0.25 to reduce the energy dependence of Nepal' economy to a manageable level and to save foreign exchange.

Specific consumption cement firms

Cement, kCal/kg clinker

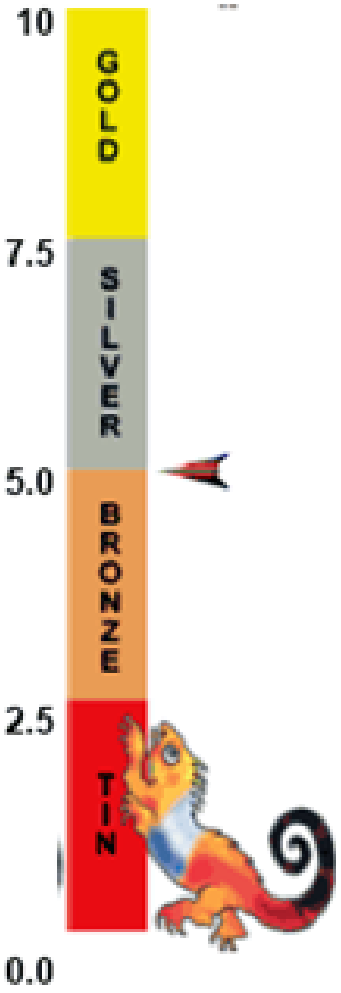


<u>The specific energy consumption</u> of cement production is given to the left in kCal/kg clinker
It is roughly between 650 and 900 kCal per kg of clinker depending on age, size, process and type of cement. Rarely it is above 1000 kCal/kg

Verify your own national position and range !

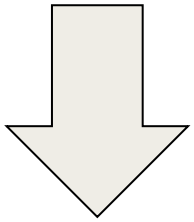
Rating efforts of a country and an industry

Effort Rating 0-10 Points



Rating and comparing <u>efforts</u> to improve industrial energy efficiency based on international standards is very helpful since it reflects political will and industry management attitude towards energy efficiency

Find out your own score by going through the following checklist.



Effort Checklist 0-10 Points (GIZ Projects 1985- Today)	Points
Certified energy manager employed at firm	2
One certified energy audit report available of firm	1
Annual certified energy audit report with progress submitted	0.5
Specific energy consumption of firms in sector authenticated	1
Energy Conservation Act passed	0.5
Website for energy efficient equipment/appliances available	1
Technical performance charts for equipment available	0.5
Process improvement specialists for important sector available	1
Chamber of commerce and industry or equivalent is involved	0.5
Water and power utilities targeted and classified as “industry”	1
Equity/retail financing for EE measures < US$ 5,000 available	1

What is your score ?

Reheating furnaces 0.5 to 20 t/h

This benchmarking for widespread pusher type reheating furnaces of billets into construction and angle steel is very useful since it deals with one single product "Red glowing billet at rolling temperature of 1100-1250 C"

Ton/h	Liter oil/ton
0.5	85
1	75
2	65
3	55
6	40
8	35
12	33
20	<30

Very necessary standard for electric motors

4 Pole			
kW	Efficiency %		
	EFF 1 equal to or above	EFF 2 equal to or above	EFF 3 below
1.1	**83.8**	**76.2**	
1.5	85.0	78.5	
2.2	86.4	81.0	
3	87.4	82.6	
4	88.3	84.2	
5.5	89.2	85.7	
7.5	90.1	87.0	
11	91.0	88.4	
15	91.8	89.4	
18.5	92.2	90.0	
22	92.6	90.5	
30	93.2	91.4	
37	93.6	92.0	
45	93.9	92.5	
55	94.2	93.0	
75	94.7	93.6	
90	**95.0**	**93.9**	

"Ceramic" industry benchmarks

Masonry bricks	1-2 MJ/kg
Roofing tiles	2-3 MJ/kg
Refractory products	3-9 MJ/kg
Sanitary ware	5 MJ/kg
Kitchen ware and art ceramics	4-25 MJ/kg
Average (Nation) ?	3. 4 MJ/kg

The above table demonstrates that national benchmarking and averaging of an "ceramic" industry gives little insight view of who is efficient and who not.

The products, manufacturing cycle and firing temperature of the 5 major product groups (800 C - 1400 C) are too different.

A simple recipe

1. Get e-managers into firms and buildings
2. Support and back them up with e-auditors
3. View EE in a firm or building as stream of large number of smaller projects and investments
4. Control the quality and reputation of the EE service professionals whom advise consumers
5. Identify efficient and also inefficient technology available for sale in the local market
6. Prevent irreversible investment mistakes in highly energy intensive equipment

“Everything should be made as simple as possible, but not simpler”

(ALBERT EINSTEIN)