

Energy Saving Opportunities in Steel Industry

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Energy Management

○ **Definition**

- The judicious and effective use to maximize profits and enhance competitive position

○ **Objective**

- To achieve & maintain optimum energy procurement & utilization
- To minimize cost/waste without affecting production/quality
- To minimize environmental effects

Energy Audit

○ Definition

- Energy Audit is a systematic exercise to identify end-uses that consume a significant amount of energy.
- Estimation of the efficiency in each of these end-uses and
- **devise** methods for improving efficiency, **curbing** losses and wasteful use thereby reducing the Specific Energy Consumption

Energy Audit

○ Need

- To understand the ways energy & fuel are used in any industry.
- To identify areas where waste can occur & where scope of improvement exists.
- To identify energy conservation technologies.
- To retrofit for energy conservation equipment.
- Primarily to determine ways to reduce energy consumption per unit of production.

Types of Energy Audit

- The type of energy audit to be performed depends on
 - Function & type of industry
 - Depth to which final audit is needed
 - Potential & magnitude of cost reduction desired
- Preliminary Audit
- Detailed Audit

Types of Energy Audit

- Preliminary audit is relatively quick exercise to
 - Establish energy conservation in the organization
 - Estimate the scope for saving
 - Identify the most likely areas
 - Set a reference point
 - Identify areas for detailed study

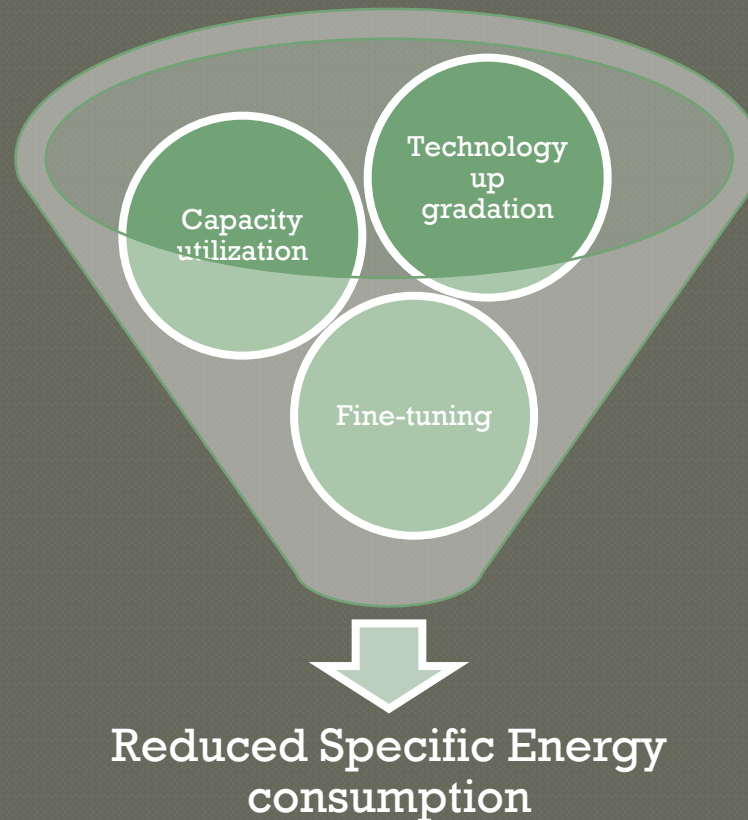
Types of Energy Audit

● Detailed Audit

- Offers the most accurate estimate of energy saving cost
- Considers the interactive effects of all projects
- Includes detailed cost saving calculations and project costs

Energy Conservation

- Three pronged approach



Types of Losses

- Any process/unit operation



Energy Conservation

◎ **Focus should be**

- **To concentrate on avoidable losses**
- **Quantify the losses**
- **Identify ways and means for reduction**
- **Implementation**

Energy conservation opportunities in steel units

Steel Facts

- Cost of energy in steel making is nearly 20% of the cost.
- Main source of this energy is either coal or electricity generated from coal.
- Recycling of steel takes 33% less energy than making steel from ore.
- 68% of present steel production is by recycling.

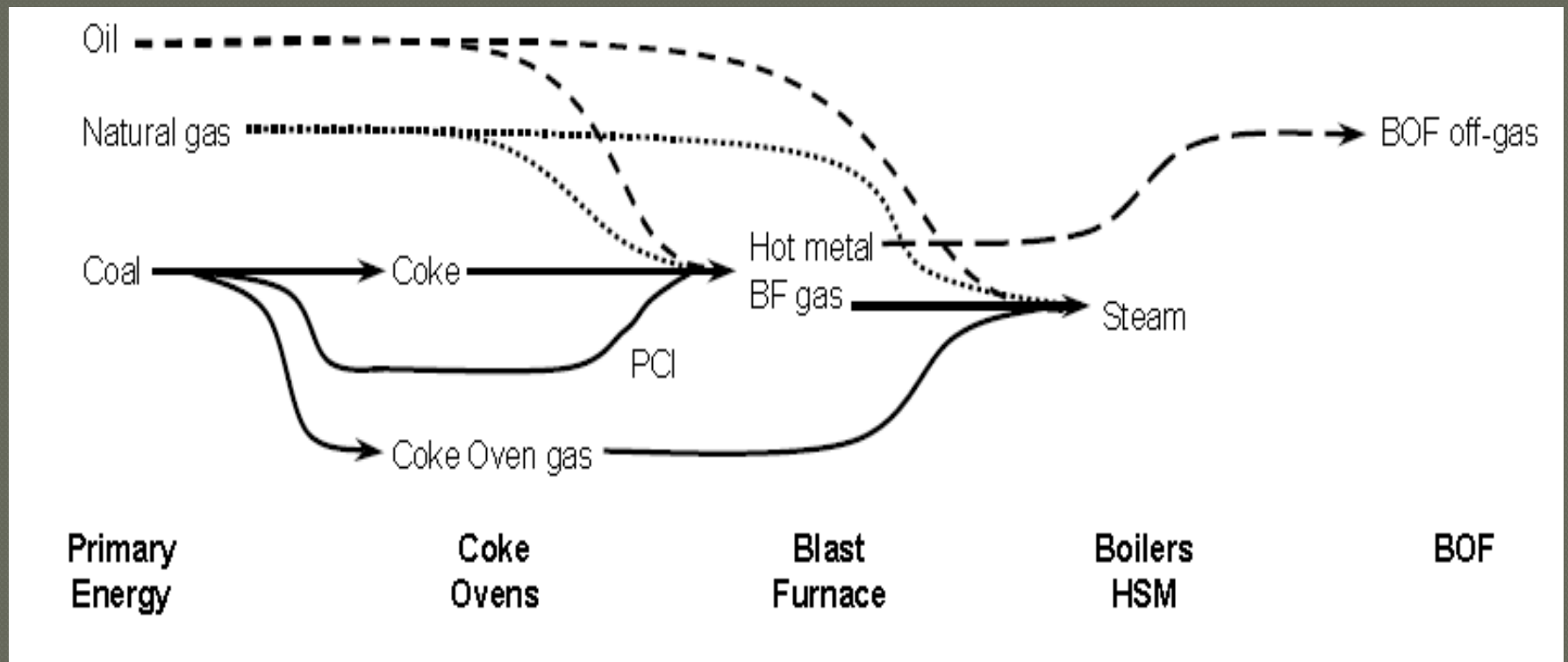
Steel Facts

- Steel is now the leading recycled product.
- Large amount of total plant energy, somewhere between 65% to 80%, is used for reheating and heat treating of the production parts – commonly known as process heating operations.
- For some plants boiler energy use can be between 20% to 30% of the fuel energy used in the plant.
- The process heating equipment (furnaces, ovens etc.) have relatively low efficiency, between 20% to 60%, compared to higher than 75% for many boilers.
- Waste heat from furnaces and ovens represents the largest amount of energy wasted in the plant.

Application and Sources of Energy

Source of Energy	Application as Energy	Application as Reductant
Coal		Coke Production, BF pulverized coal injection, DRI production
Natural Gas	Furnaces	BF Injection, DRI Production
Electricity	EAF, Rolling mills and various other motors	
Oil	Steam Production	BF Injection

Energy Transformations in Steel Plants



Product, By-Products and Process Losses

- Steel (consisting of metallic iron and other elements)
- Gaseous by-products (Blast Furnace gas, Coke Oven gas or BOF gas)
- Molten by-products (Blast Furnace slag or BOF/EAF steelmaking slag), with sensible heat losses subsequently dissipated through cooling
- Liquid by-products (coal tar and benzene)
- Solid by-products (coke breeze or Blast Furnace dust & sludge)
- Process product yield losses (scrap, scale or iron oxides)
- Stack gas sensible heat, cooling, friction and other losses.

3 Rules for cost reduction

1. Energy Savings
2. Energy Substitution
3. Energy Recovery

Energy Savings

These are defined as reduction in demand of energy per tonne of steel produced and always involve process innovations and detailed metallurgical studies.

e.g. The use of AHSS (Advanced High Strength Steel) by automakers has resulted in low consumption of steel per vehicle unit and thus saved energy.

Energy Savings

Most of the energy is consumed for preparation of hot metal. But it can be lowered by:

- Improved energy management (better sensors, post combustion handling)
- Increased yields (near Net Size Castings)
- Reduced Refractory consumption
- Reduced Flux Consumption

Energy Savings

The other general saving opportunities exist in:

1. Electricity use

1. Peak Demand Management.
2. Use of proportional control instead of On-Off control.
3. Avoid Part loading.
4. Reduce openings between zones to avoid radiation heat losses.
5. Use efficient pumps.
6. Use microprocessor based compressed air distribution system.
7. Avoid motor over sizing.
8. Use VSDs.

Energy Savings

2. Heat applications

1. Air: Fuel ratio control
2. Use of O₂ enrichment.
3. Air Preheating
4. Turn Down Capability
5. Flame Size and Shape
6. Enhanced Heat Transfers
7. Temperature profile control

Energy Savings

2. Heat applications

8. Radiation Loss Control
9. Pressure Control
10. Cracks and openings.
11. Heat cascading

Energy Savings

- Oxygen Enrichment can be the new answer.
- This can help increase production.
- Economic issues to consider oxygen enrichment are Increased productivity, better product quality, reduced slag, possible increase in furnace wall temperature (maintenance).

Energy Substitution

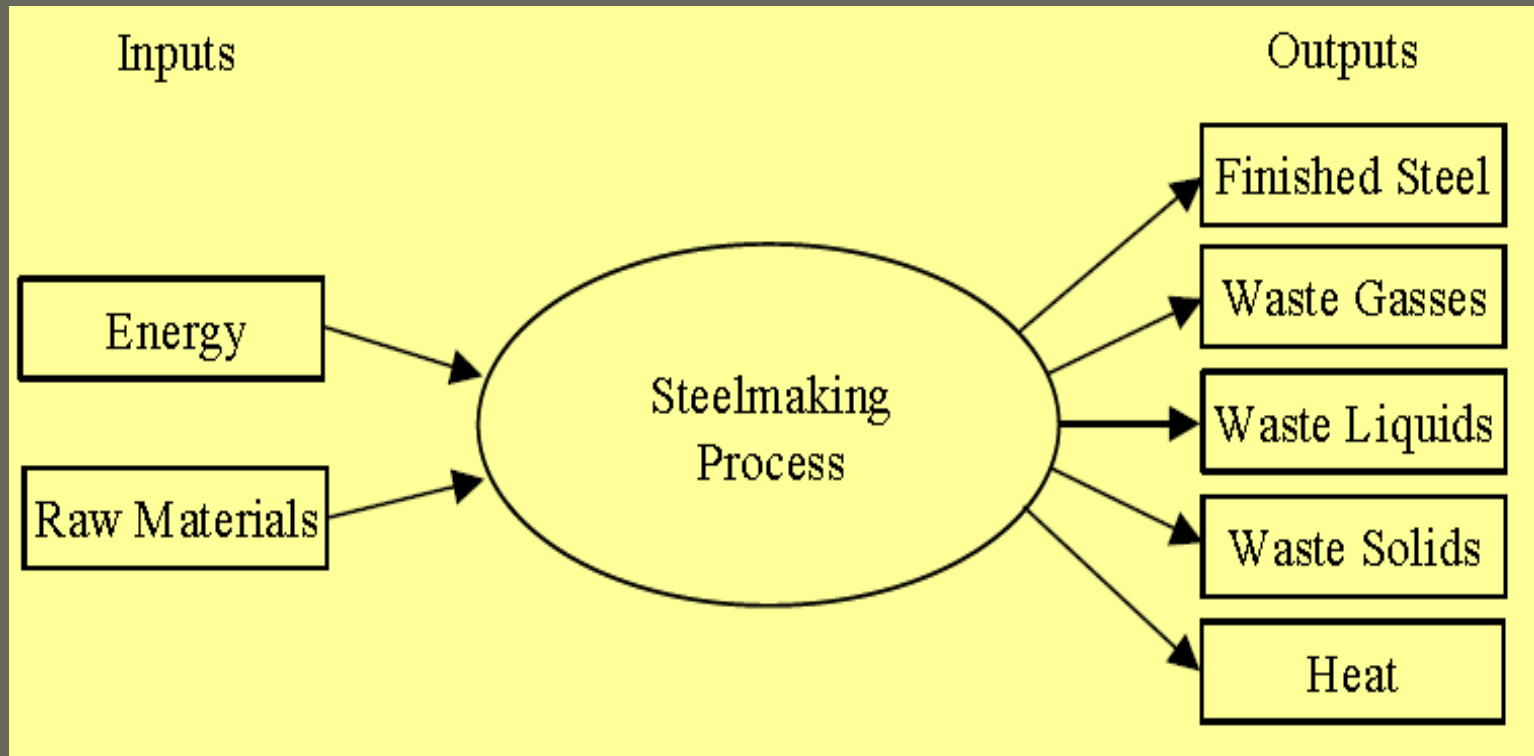
Energy Substitution relates to use of various other available fuels and technologies so as to achieve better product at lower energy consumption.

e.g. use of charcoal from trees, sillage and saw mill wastes could be used as a fuel and as a replacement for coke oven in the blast furnace.

Energy Substitution

- Hydrogen, as it becomes available could be used to reduce iron ore or as a fuel in furnaces and transportation equipment. The steel industry is a producer of hydrogen in its cokemaking facilities and blast furnaces.

Energy Recovery



Energy Recovery

Waste heat recovery is very important issue and selection of proper heat exchanger for the same is very important.

PHEs are available now a days in various metallurgies which can increase the heat transfer rate and reduce the fluid quantum by providing higher heat exchange.

Thank You!!

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