
Discussion on Need Assessment for Energy Efficiency Indicators

Energy Efficiency Program
BEE, Ministry of Power
Government of India

Framework for EE Indicators

1. Outline for EE Planning
2. Methodology of Target setting
3. Developing EE indicators
4. Capacity Building for data collection
5. Establishing Baseline and Benchmark
6. Developing EE Reporting parameters
7. Establishing M & E framework

EE Target Planning Requirements

- Transparent
- Scientific
- Objective
- Reasonable
- Technically feasible
- Long term progressive goals
- Best practice guidance

Legislative framework

- “National Mission on Enhanced Energy Efficiency”, the Energy Conservation Act, 2001 has identified 15 large Energy Intensive Industries for energy efficiency improvements.
- The Government has, in March, 2007, notified 9 industrial sectors, namely Aluminum, Cement, Chlor-Alkali, Pulp & Paper, Fertilizers, Power Generation Plant, Steel, Railways as designated consumers.
- These industries have to:
 - appoint an energy manager, file energy consumption returns every year and conduct mandatory energy audit;
 - adhere to the energy consumption norms specified by the Government.
- Almost all the industrial sectors are characterized with a wide bandwidth of specific energy consumption (SEC) which is also indicative of the large energy-savings potential in the sector.

Roadmap

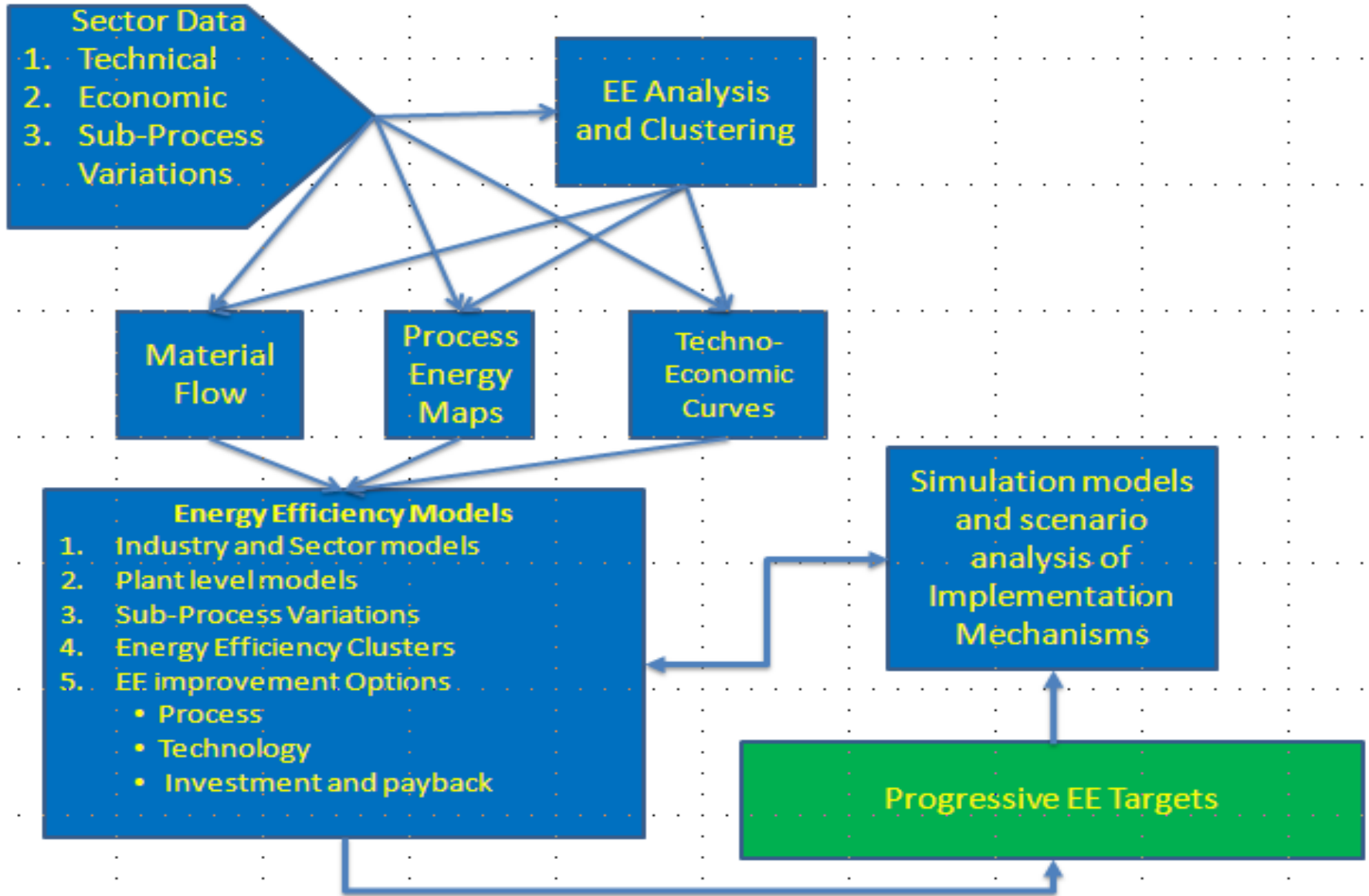
- Almost **all** the industrial sectors are characterized with a wide bandwidth of specific energy consumption (SEC) which is also indicative of the large energy-savings potential in the sector.
- In almost all sectors, most new plants are amongst the most energy efficient in the world. The wide bandwidth is a reflection of the differences in the energy-saving possibilities amongst plants because of their varying vintage, production capacity, raw material quality, product mix etc.
- This also makes it **difficult to specify a single benchmark SEC** for a sector as a whole since it would either be impossible to achieve for the older plant if set at the level of a newer plant, or would be trivial if set at the level of the older plant.

PAT Mechanism: *A market based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy-intensive large industries and facilities, through certification of energy savings that could be traded.”*

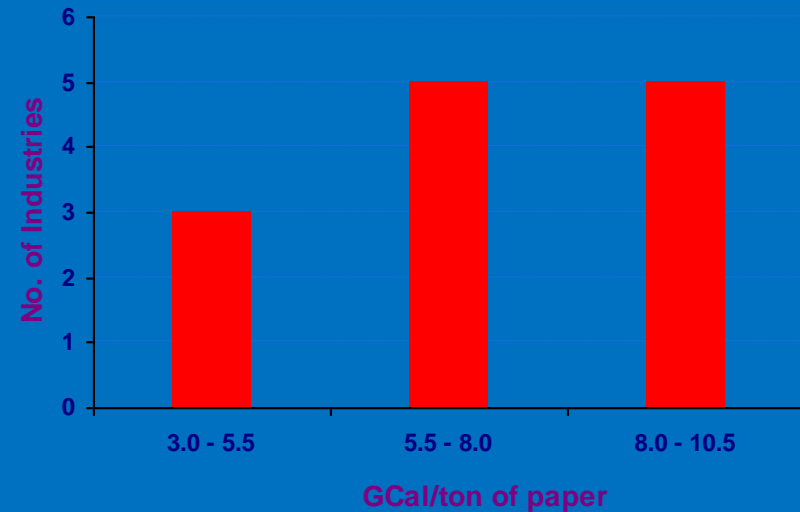
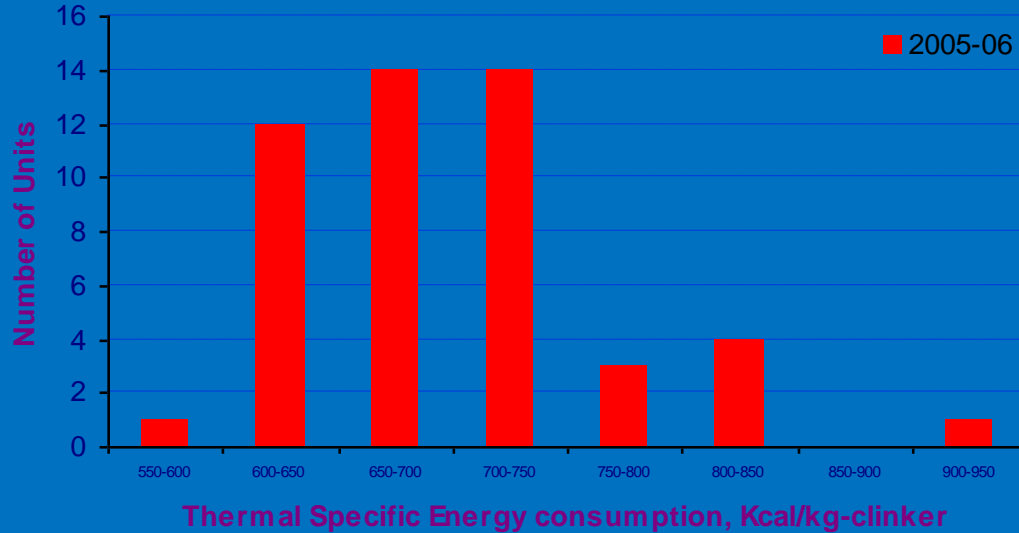
Methodology for Specifying Specific Energy Consumption

- Energy Efficiency in Designated Category Consumers
- Target Setting for Energy Efficiency Enhancement
- Definition of Specific Energy Consumption
- Baseline of the plant
- Targets to be defined
- Target Setting for each range
- Setting up system boundaries, subsector in the sector
- Defining Range within Bandwidth

Energy Efficiency Methodology



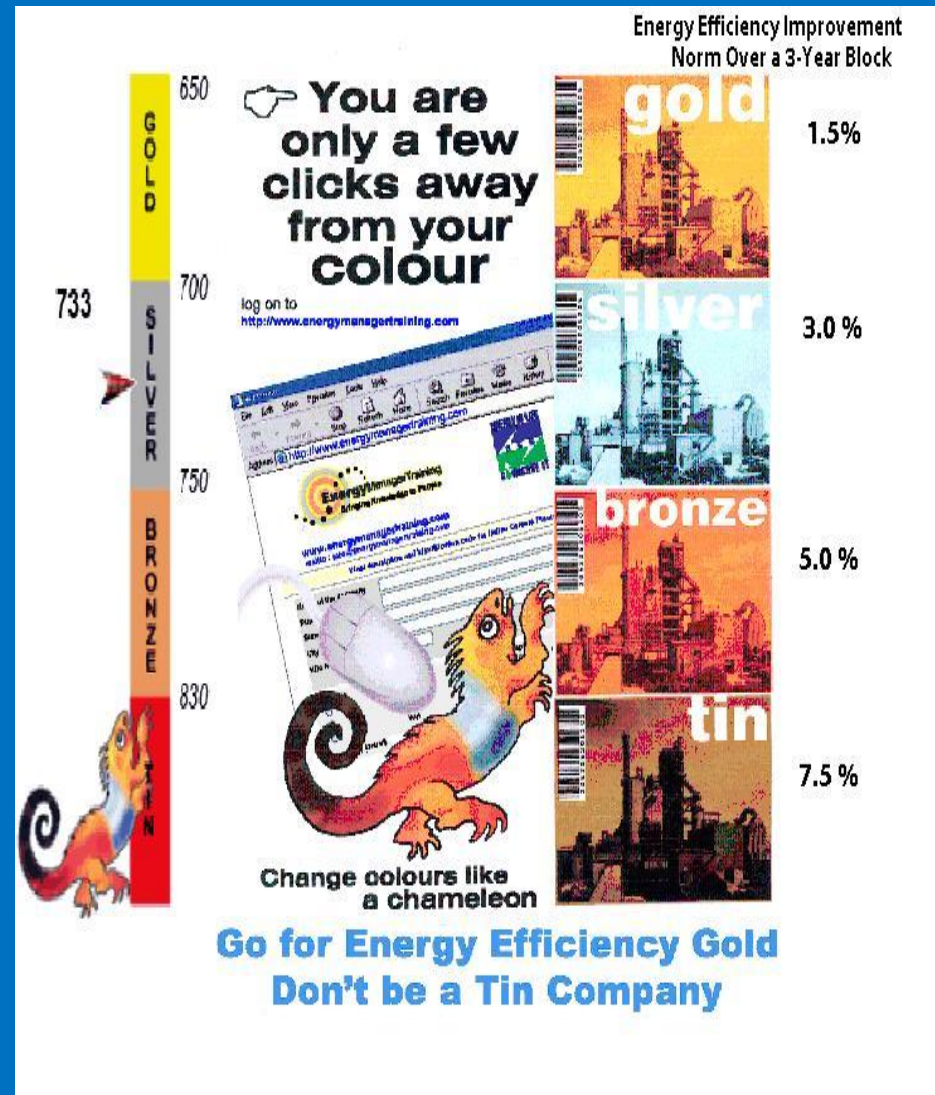
Huge Diversity in Specific Energy Consumption within sectors



- Large bandwidth in specific energy consumption in all sectors
- In almost every sector, the most energy-efficient unit is also amongst the most efficient units in the world

Energy Efficiency in Industries: Perform, Achieve and Trade (PAT) Mechanism

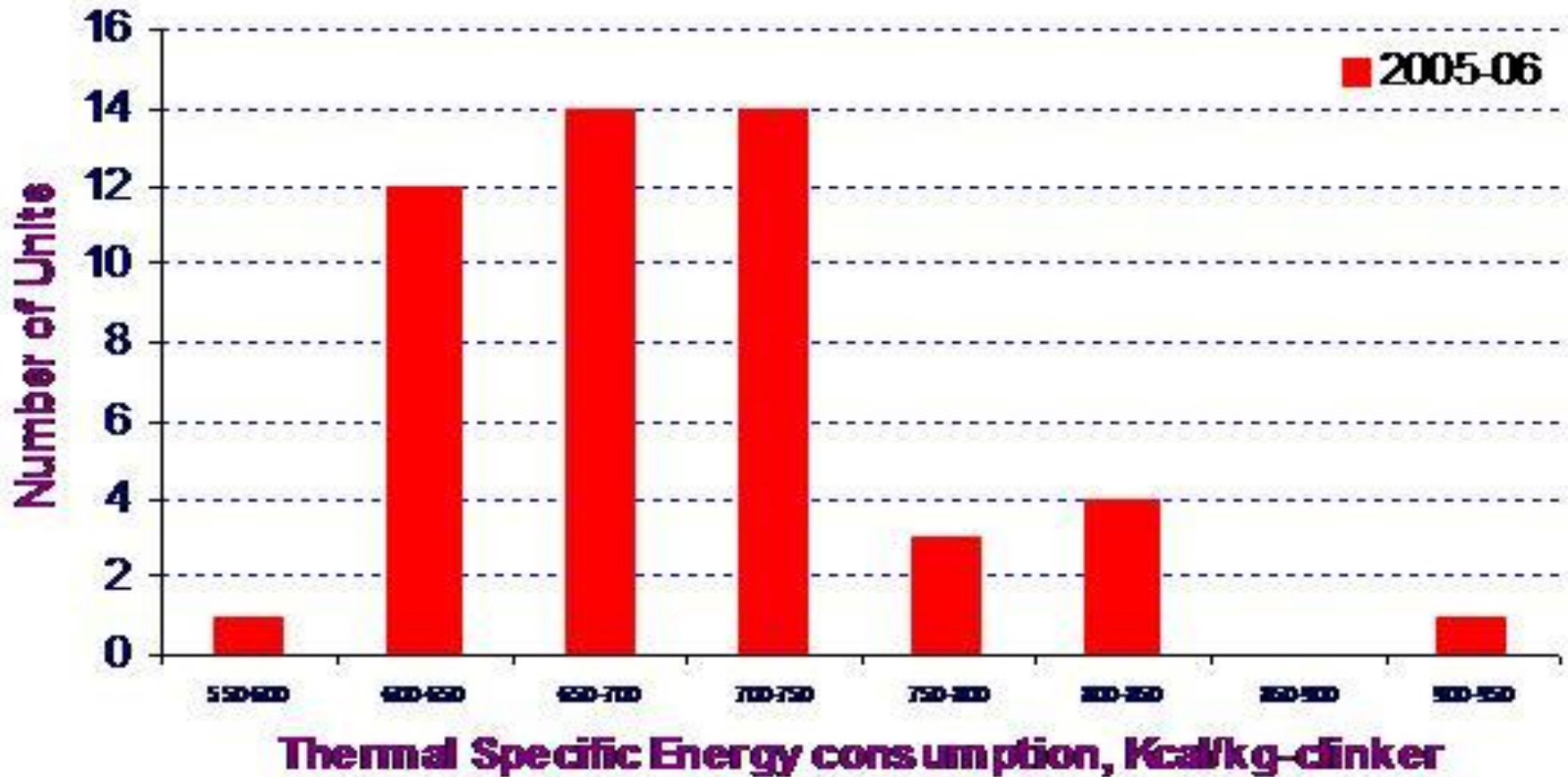
- Every one wins and everyone gets energy efficient.
- A wide **bandwidth** of energy efficiencies occurs in almost all sectors
- This creates a **differentiated potential for energy savings**
- Each **DC mandated** to reduce its SEC by a fixed percentage, based on its current SEC within the sectoral bandwidth
- **Trading** of savings allows maximum cost-effective savings as plants with “low-cost savings” exceed their “mandated “ savings for trade



PAT – current status

- 714 units in 9 energy intensive sectors notified as Designated Consumers under EC Act. They sectors are: Aluminum, Cement, Iron & Steel, Chlor Alkali, Thermal Power Plants, Fertilizer, Pulp & Paper, Textiles and Railways.
- Baseline studies are underway and will be completed by June 2010.
- Methodology for target setting under preparation
- The protocols for trading, monitoring and verification will be set up by July, 2010
- Notifications for Accredited Energy Auditors under examination with Ministry of Law
- Amendments to EC Act to be introduced in this session of Parliament

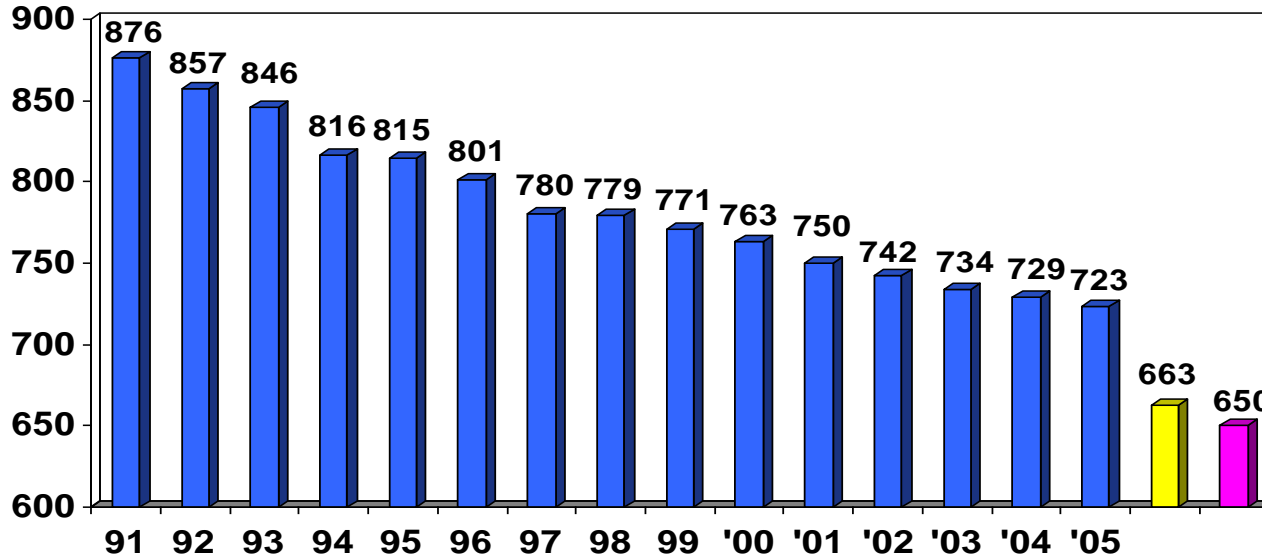
Plant Level SEC Spectrum



ENERGY CONSUMPTION PROFILE

(DRY PROCESS PLANTS - WTD. AVG.) [CMA]

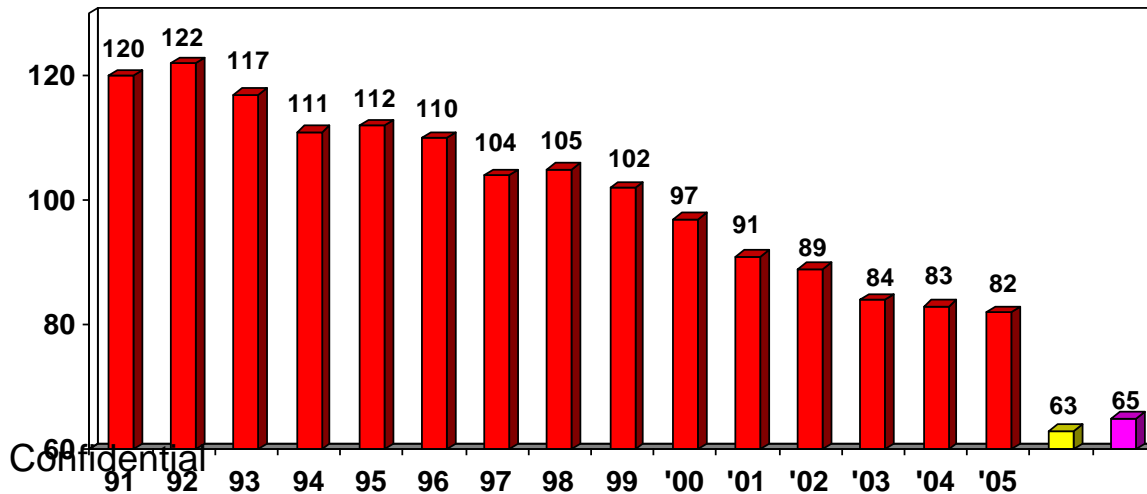
**THERMAL
ENERGY
KCAL/KG CL.**



BEST IN INDIA

BEST IN WORLD

**ELECTRICAL
ENERGY
KWH/T CEMENT**



Environmental Aspects

Quarrying

- Dust
- Noise
- Vibration
- Landscape impact
- Raw materials
limestone
clay
sand

Grinding

- Dust
- Noise
- Electricity

Clinker Production

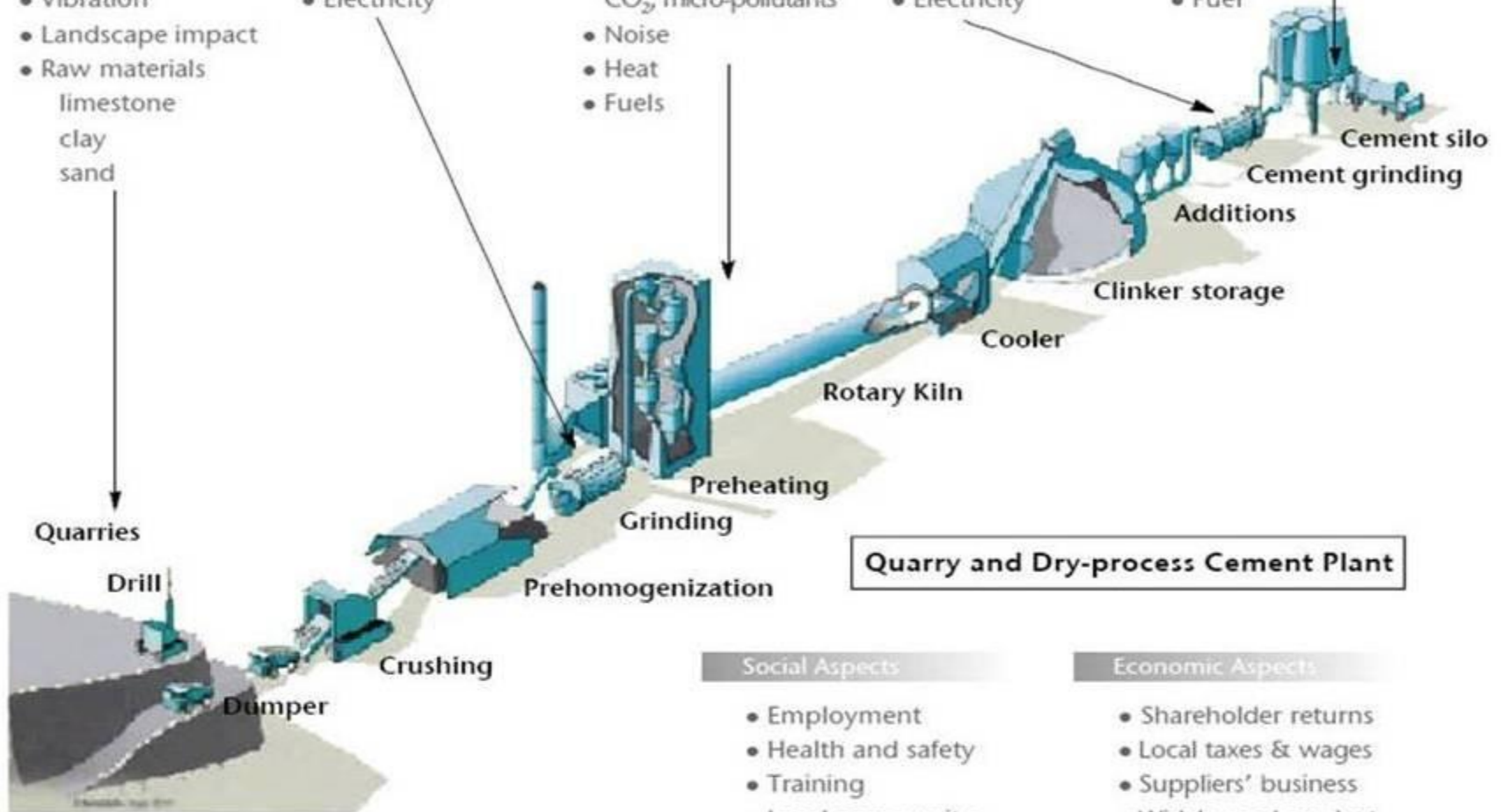
- Dust
- Gases: SO₂, NO_x, CO₂, micro-pollutants
- Noise
- Heat
- Fuels

Grinding cement

- Dust
- Noise
- Electricity

Storage/shipping

- Dust
- Noise
- Fuel



Quarry and Dry-process Cement Plant

Social Aspects

- Employment
- Health and safety
- Training
- Local community impacts

Economic Aspects

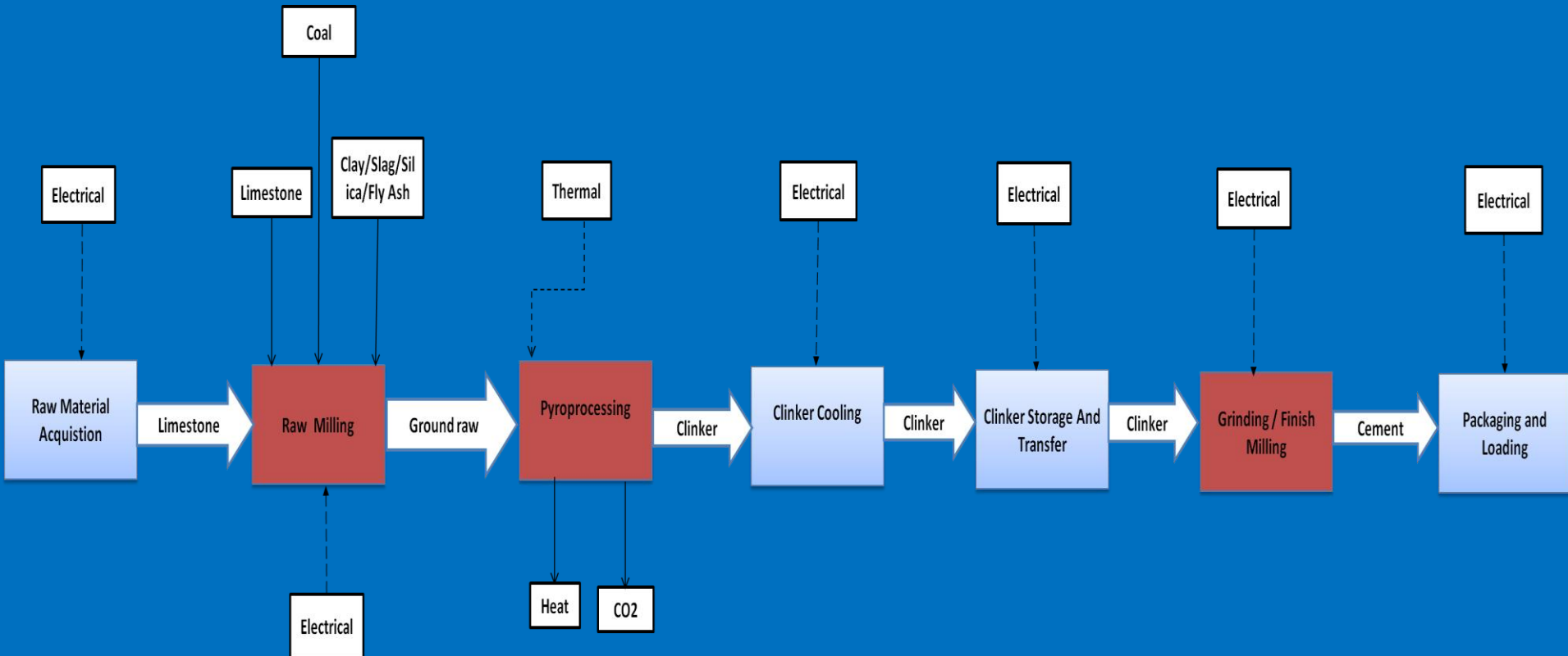
- Shareholder returns
- Local taxes & wages
- Suppliers' business
- Widely used product
- Community investment

Source: World Business Council for Sustainable Development

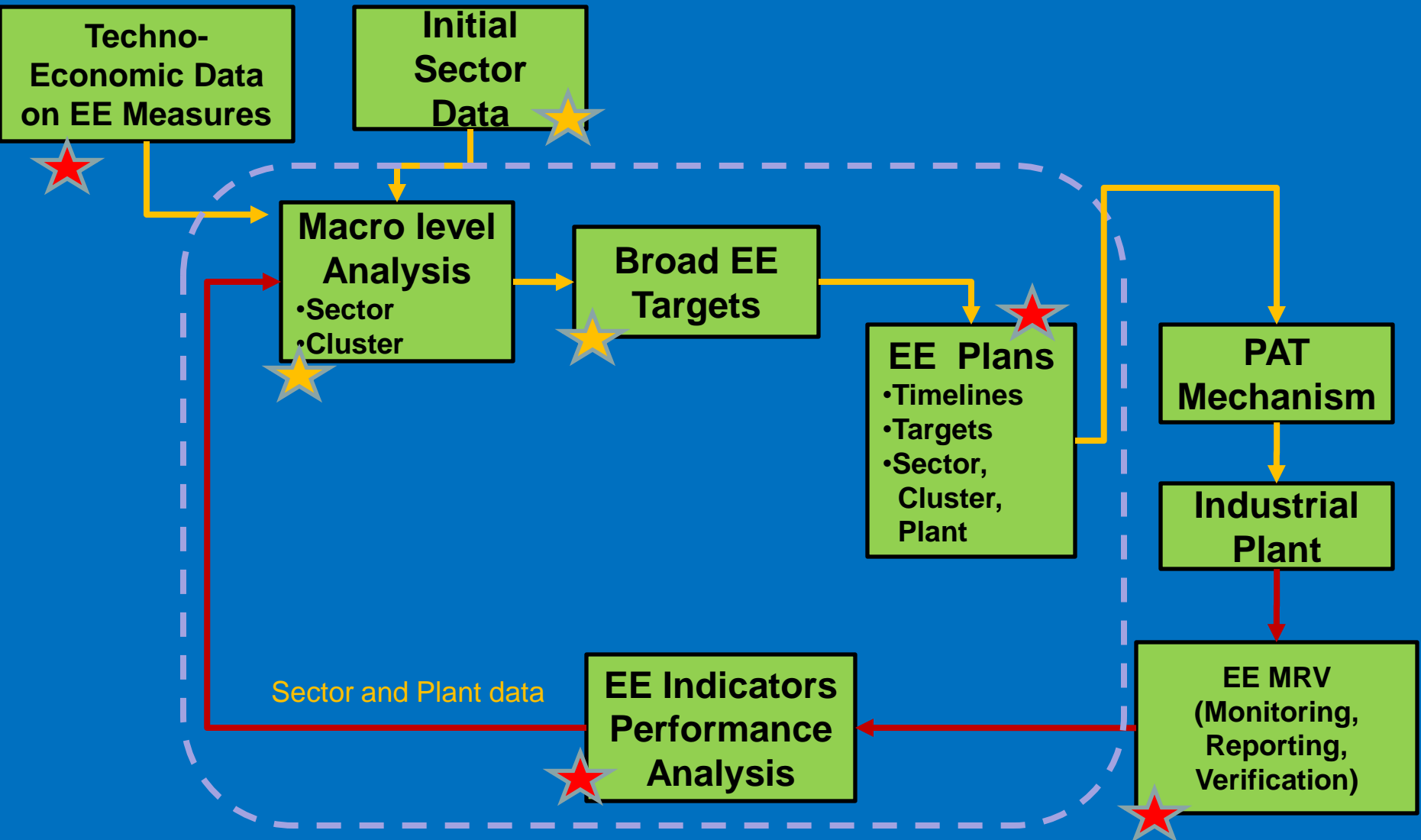


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Cement Process Flow Diagram

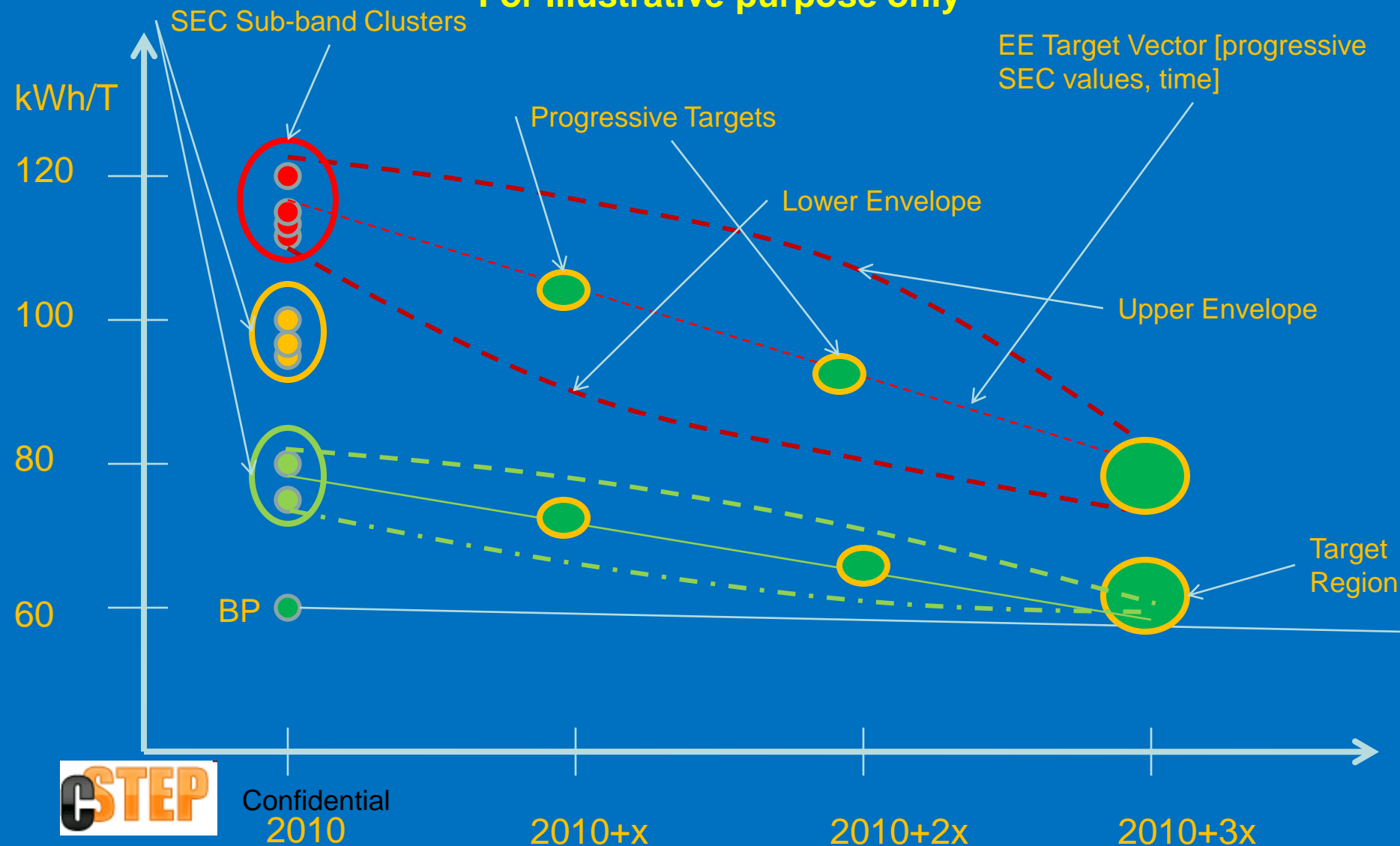


Broad EE Planning Process Flow



EE Broad Target Planning

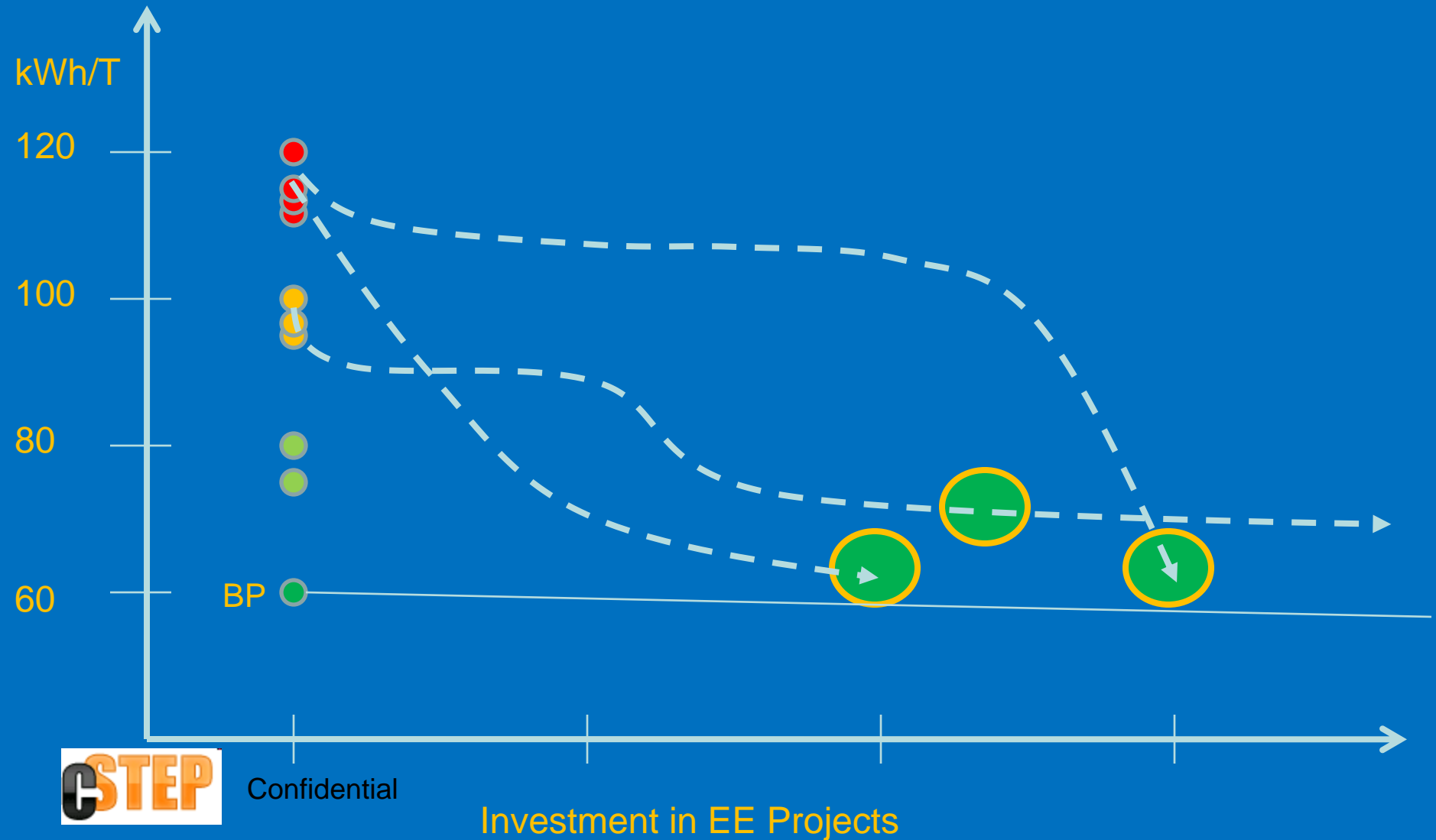
For illustrative purpose only



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2010

Flexible EE Planning

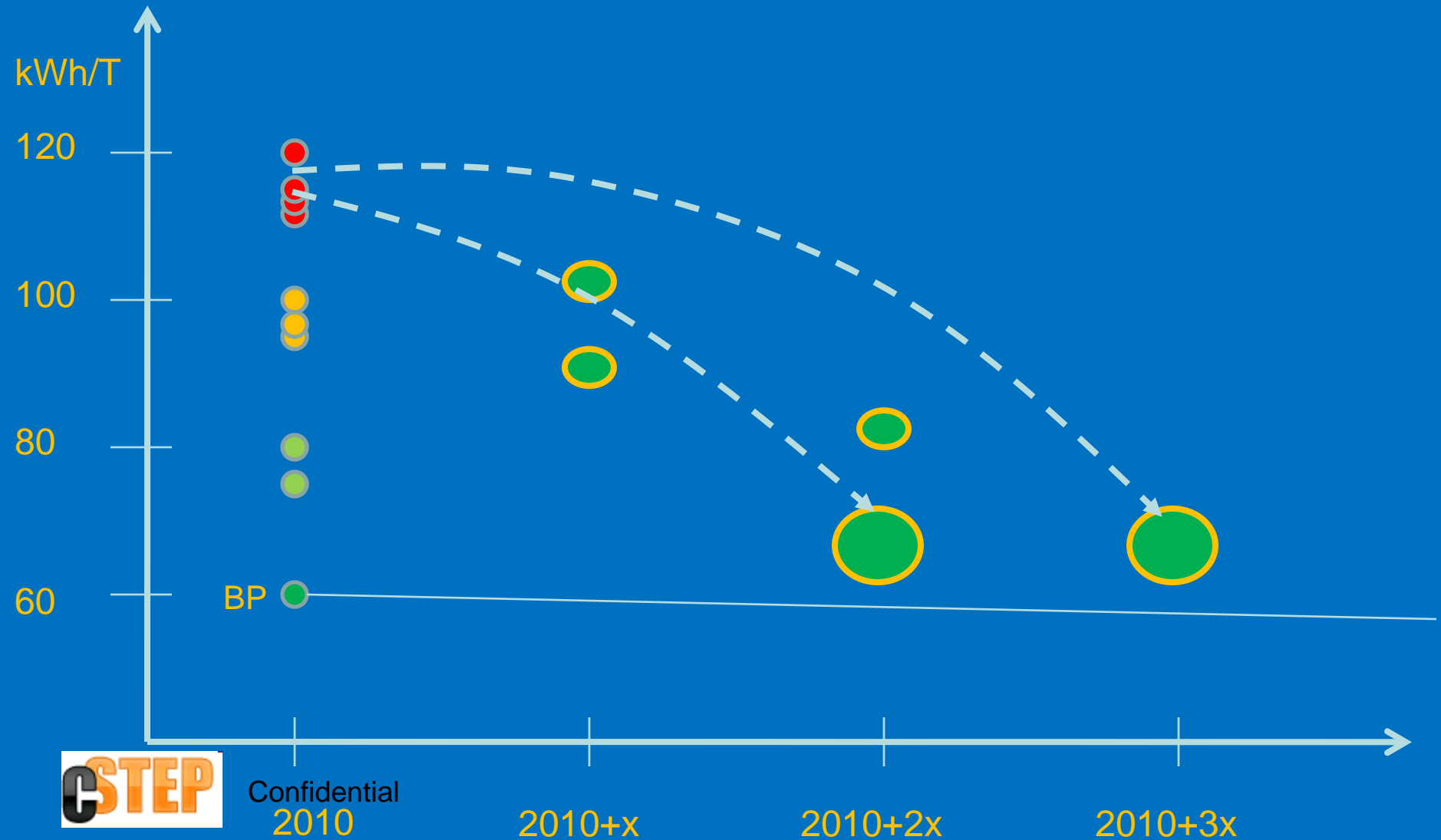
SEC-Investment , Conservation Supply Curves for Sector, Plant, or Sub-Process



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Investment in EE Projects

Flexible EE Planning



Sub-Process BP Variations

- Two plants can have similar plant level SEC but different BP, Cost and Energy Savings curves
- Insufficiency of Plant SEC data due to various parameters at the Sub-process level such as:
 - Raw material quality
 - Hardness of the limestone, feedstock
 - Input material mix
 - Cement: Fly Ash, Blast Furnace Slag, Additives etc
 - Process Technology eg. Grinding technology
 - Ball mill, VRM, Roller press
 - Throughput and capacity
 - Output product mix

Sub-process Level Analysis

- Clustering
 - Capacity, throughput
 - Vintage
 - Location
 - Input Raw material
 - Feedstock quality
 - Output product variability
 - Process, technology

Sub-Process Best Practice

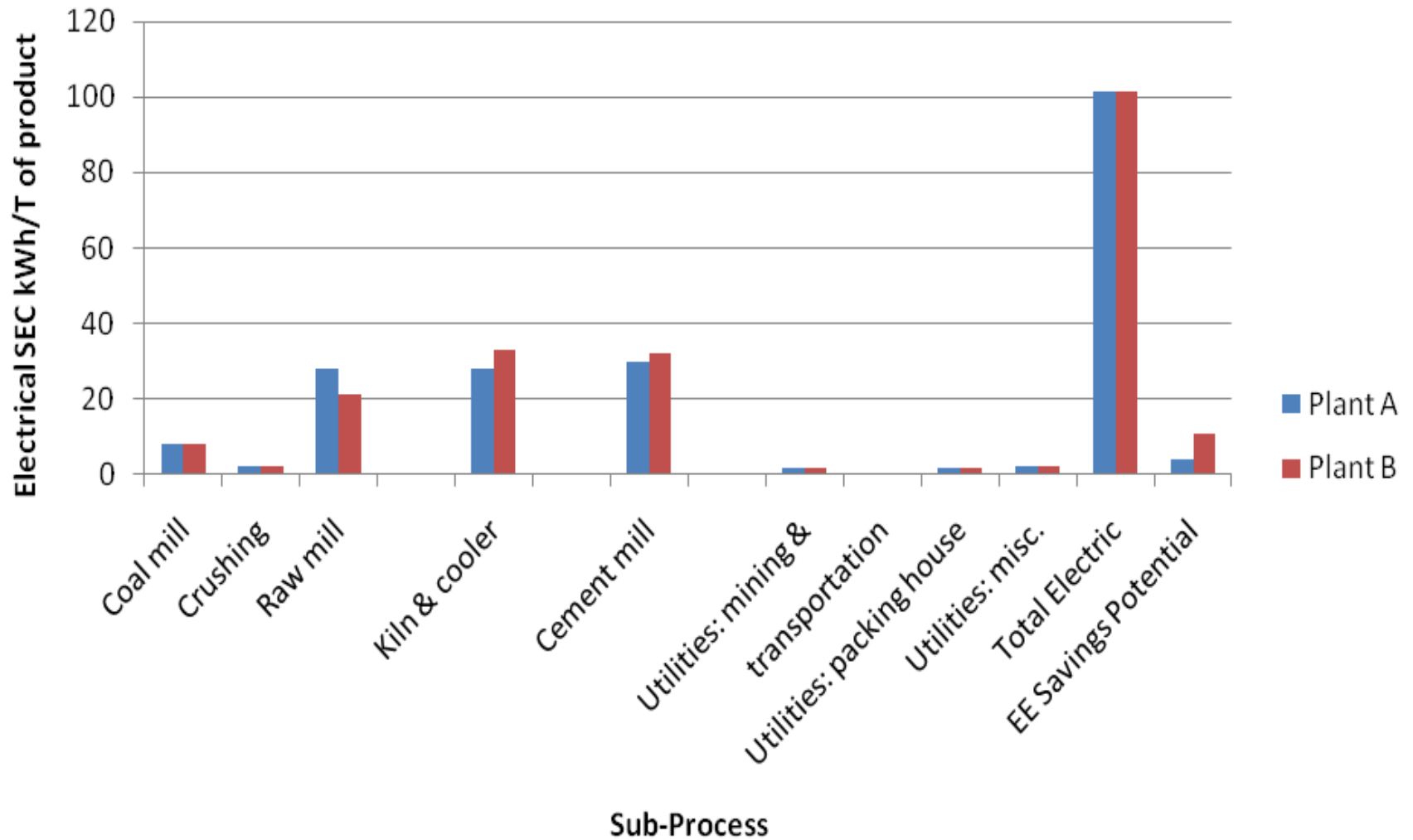
World Best Practices			
Sub Process	Energy Type	Product Unit	GJ/t Cement
Raw Materials Preparation	Electricity	t raw meal	0.07
Clinker Making	Fuel	t clinker	2.71
	Electricity	t clinker	0.08
Additives Preparation	Fuel	t additive	
	Electricity	t additive	
Cement grinding 625 cement	Electricity	t cement	0.07
Total 625 cement	Electricity	t cement	2.93

Ref: World Best Practice Energy Intensity Values for Selected Industrial Sectors, Ernst Worrell, Lynn Price, Maarten Neelis, Christina Galitsky, Zhou Nan, Feb 2008.

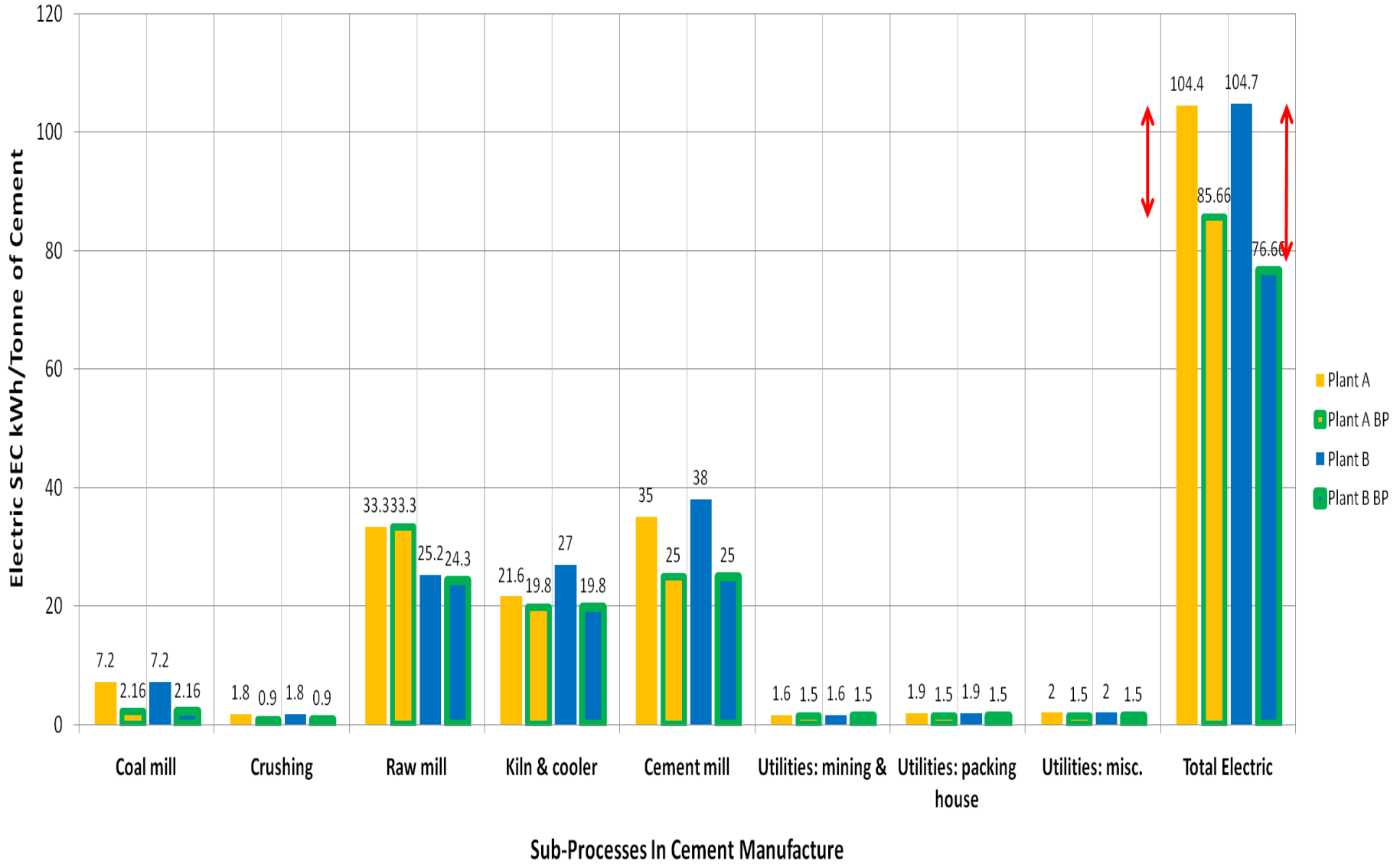


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EE Sub-Process Spectrum Analysis



Sub-Process Spectrum Analysis of SEC, BP and EE Potentials



Energy Savings

Independent Agency verification

Programme	BEE		NPC	
	Electricity Saved (MU)	Avoided Generation (MW)	Electricity Saved (MU)	Avoided Generation (MW)
Standard & Labeling	2106.16	567.63	2106.06	599.44
Industry EC Awards	1633.25	239	1633.25	239
SDA Reported	2807.05	667	2755.48	660.43
ECBC - Green Buildings	33.36	7.0	33.36	6.1
Total:	6759.82	1480.63	6528.15	1504.97

Total for 2007-08 and 2008-09 : 2128 MW



Target Setting

- Consultations with industry on
 - Boundaries for target setting in each sector, and associated measurement & verification protocols
 - Methodology for target setting
 - Design of the trading scheme
- Notification of targets and operational rules
- Notification of designated verifiers
- Creation of trading mechanism

Thank You



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