ENERGY AUDIT AND INCENTIVE SCHEMES

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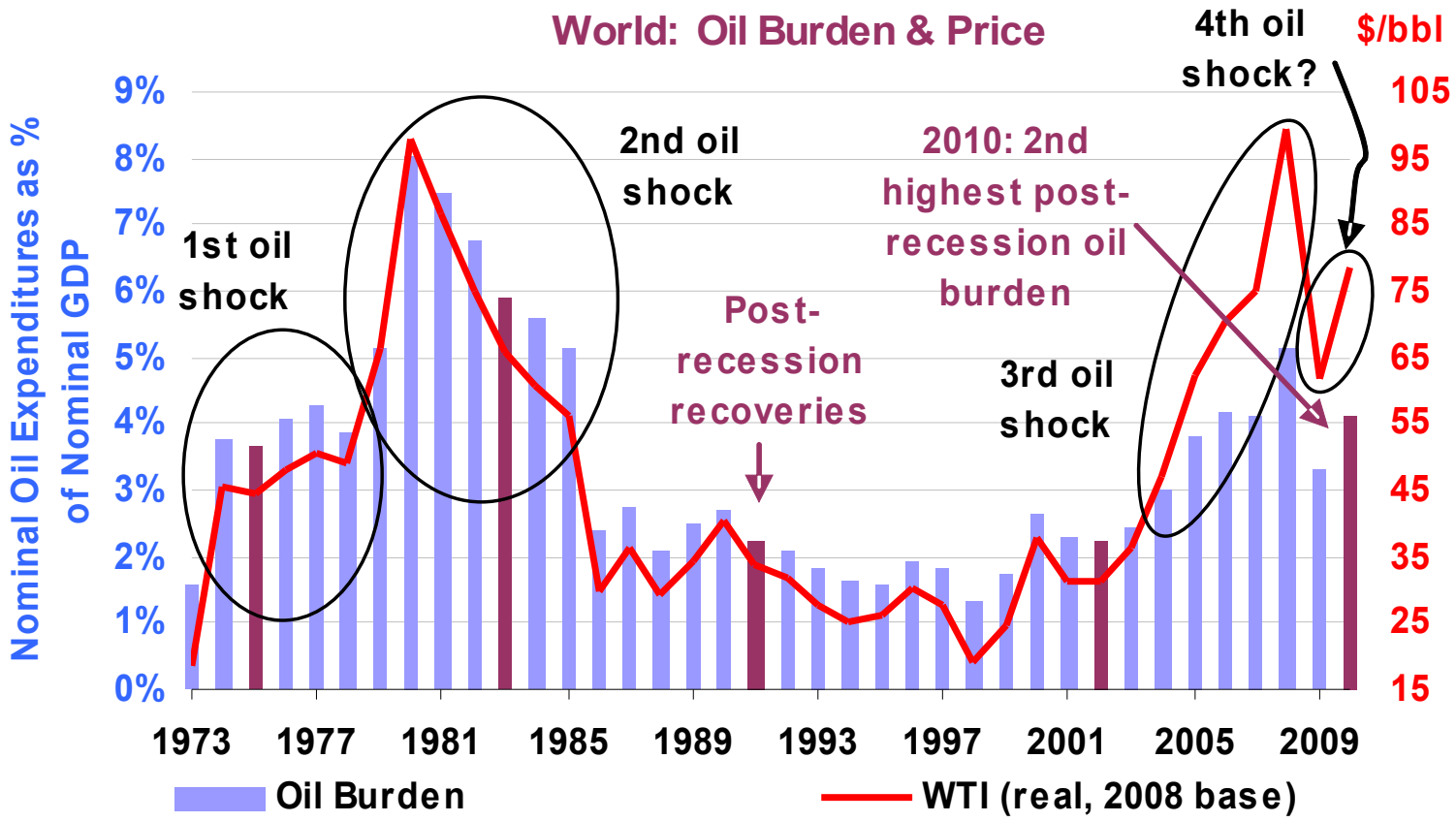
Bureau of Energy Efficiency

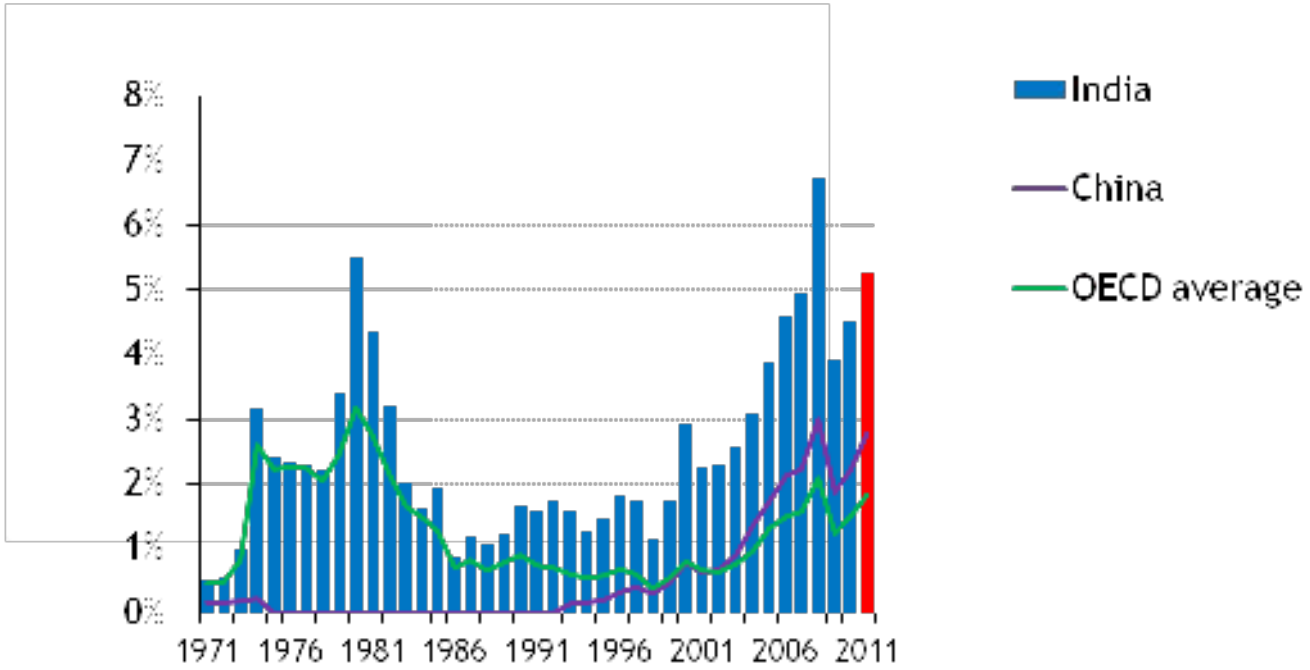
World Oil Burden & Price



Source: WEO 2010

India's Oil Import

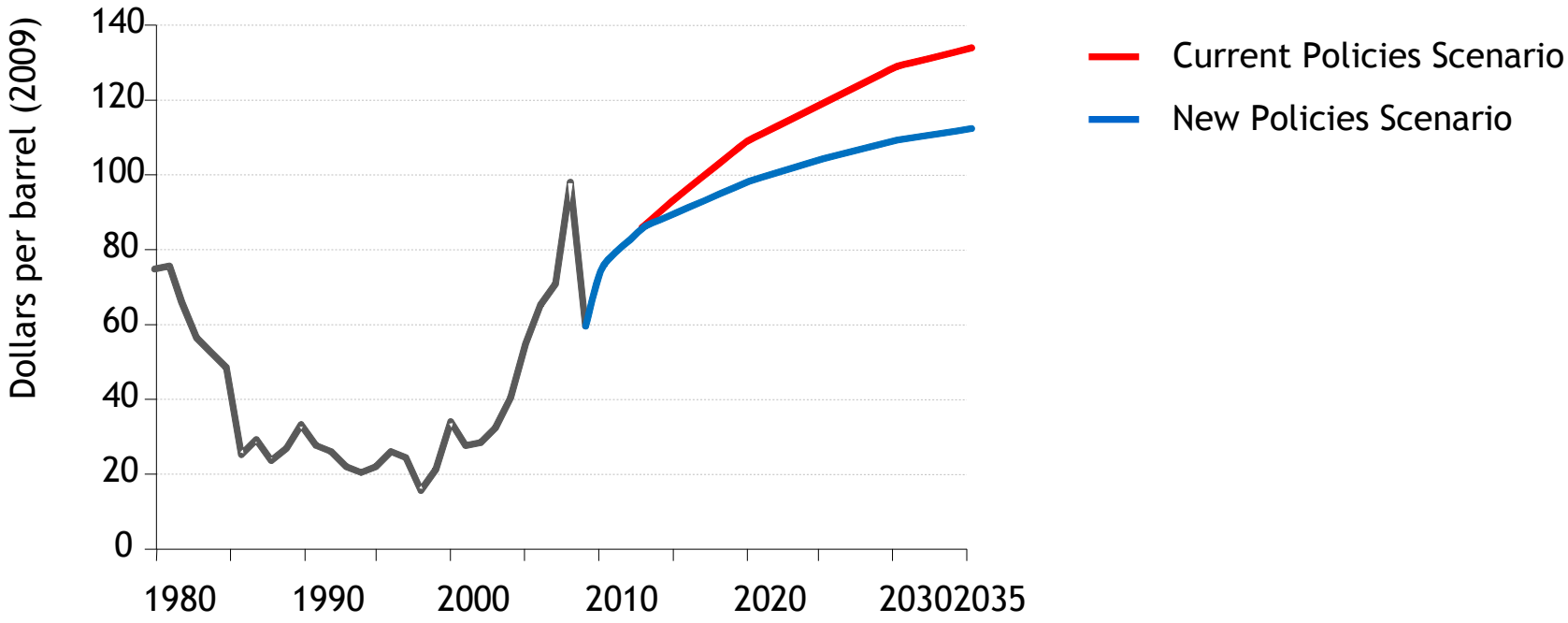
Historic expenditure on net imports of oil as a share of GDP at market exchange rates (with a projection for 2011)



Source: WEO 2010

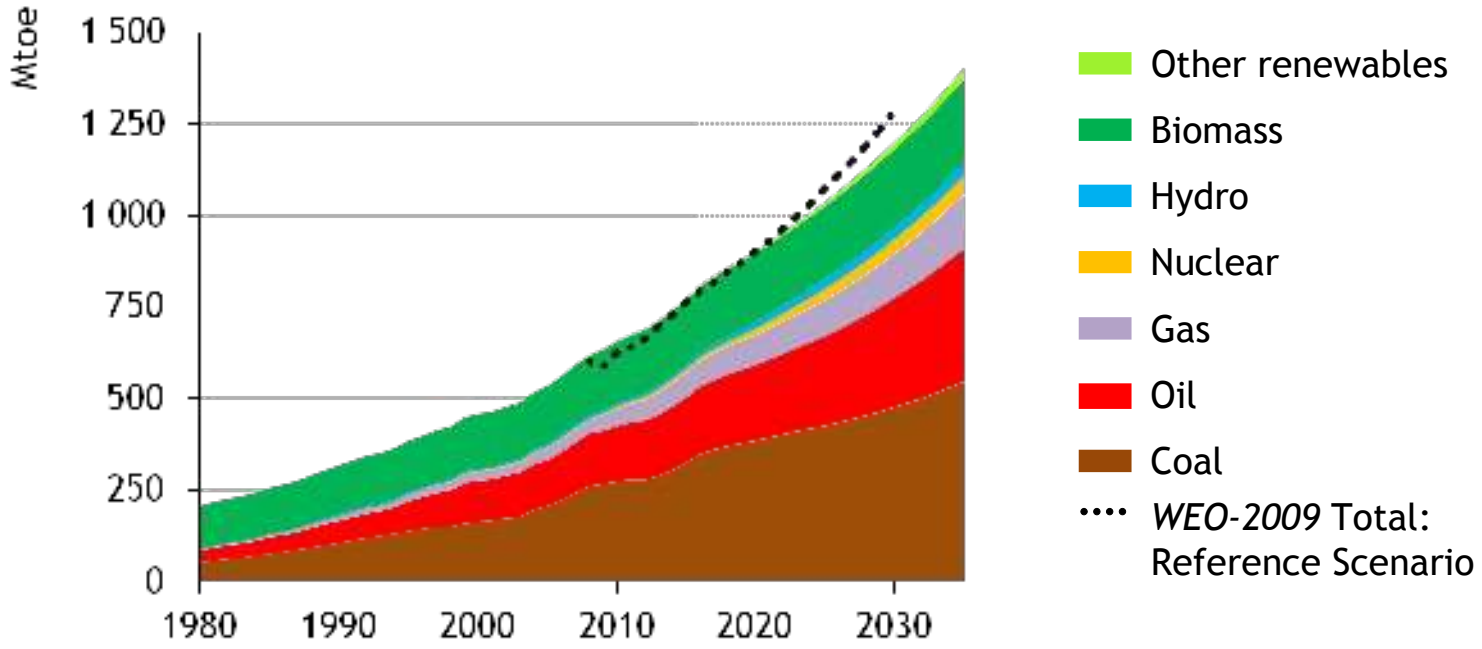
In 2011 India's oil import burden will exceed 5% of GDP for only the third time in history if prices average the current level of $92/bbl for the entire year

International Oil Price Trends



Source: WEO 2010

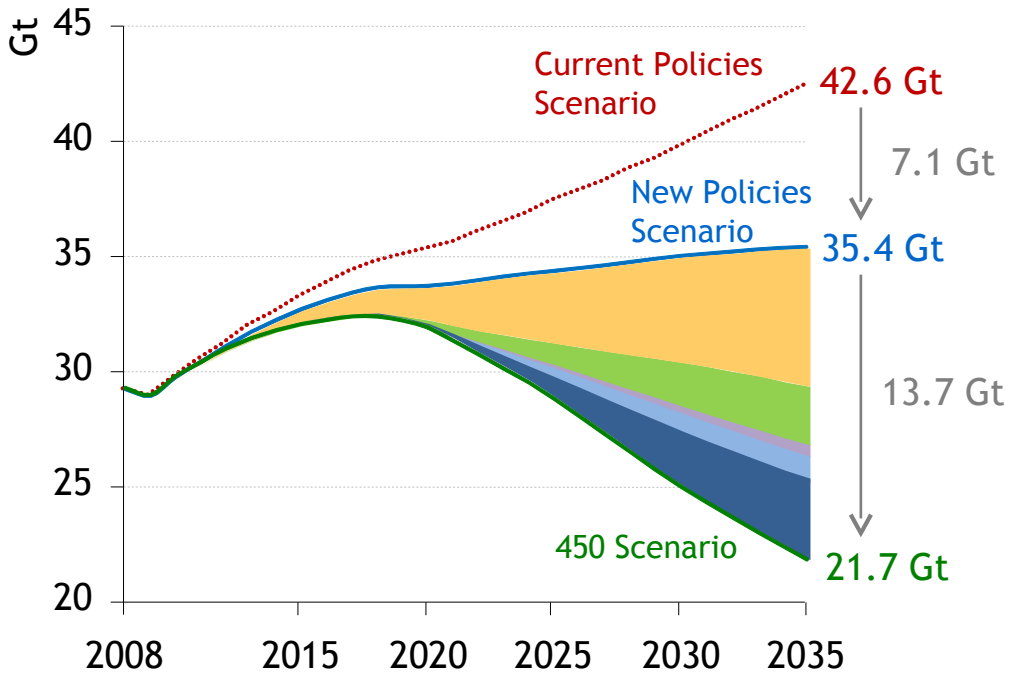
India Primary Energy Demand



Source: WEO 2010

Total primary energy demand in India grows at 3.1% per year on average in 2008-2035, an overall increase of 127%

World CO_2 Emission Savings



Share of cumulative abatement between 2010-2035	
Efficiency	50%
Renewables	18%
Biofuels	4%
Nuclear	9%
CCS	20%

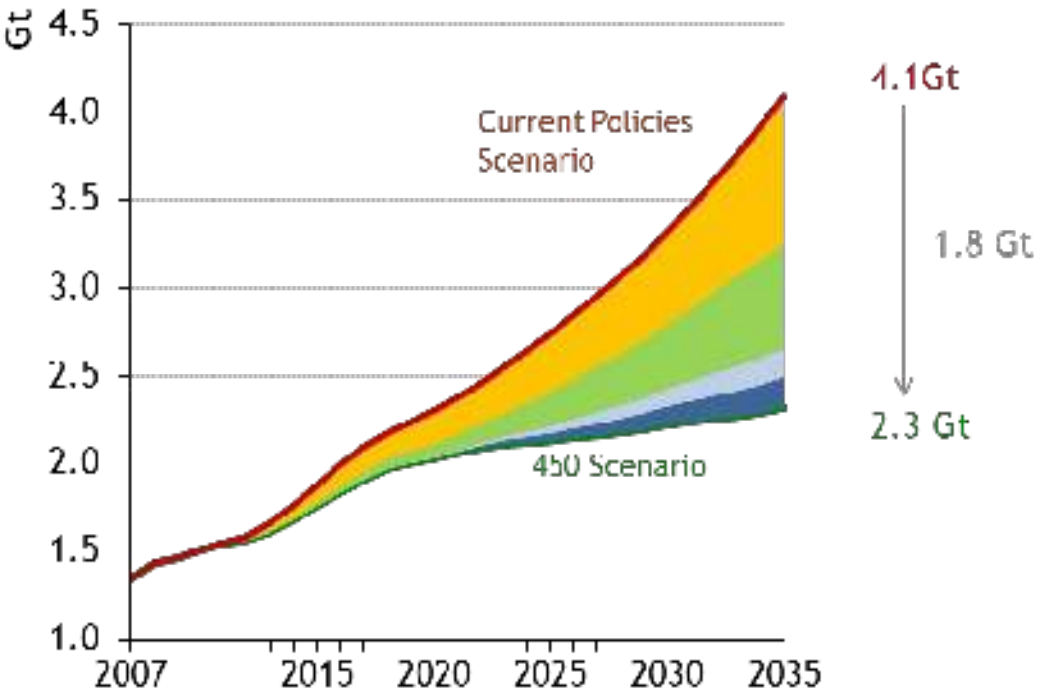
Source: WEO 2010

New Policies Scenario is the central scenario in WEO-2010

> assumes cautious implementation of recently announced commitments & plans, even if yet to be formally adopted

The 450 Scenario sets out an energy pathway consistent with the goal of limiting increase in average temperature to 2°C

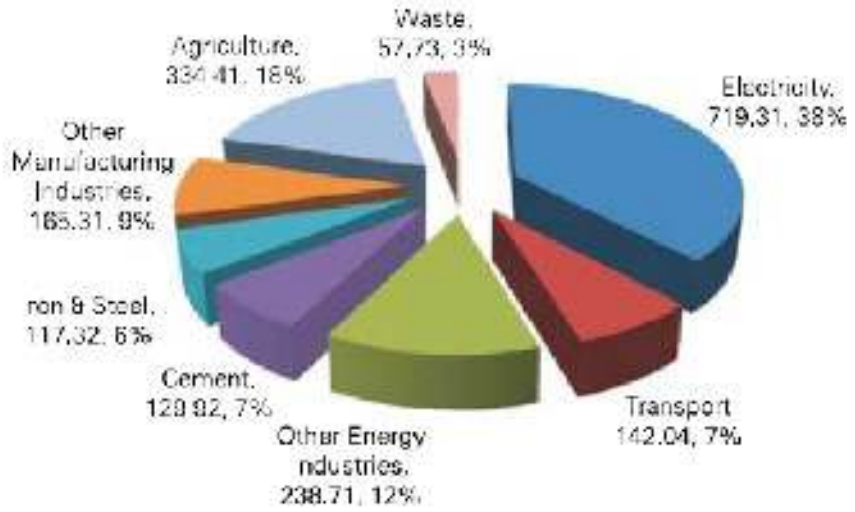
India – CO_2 Emission Reduction



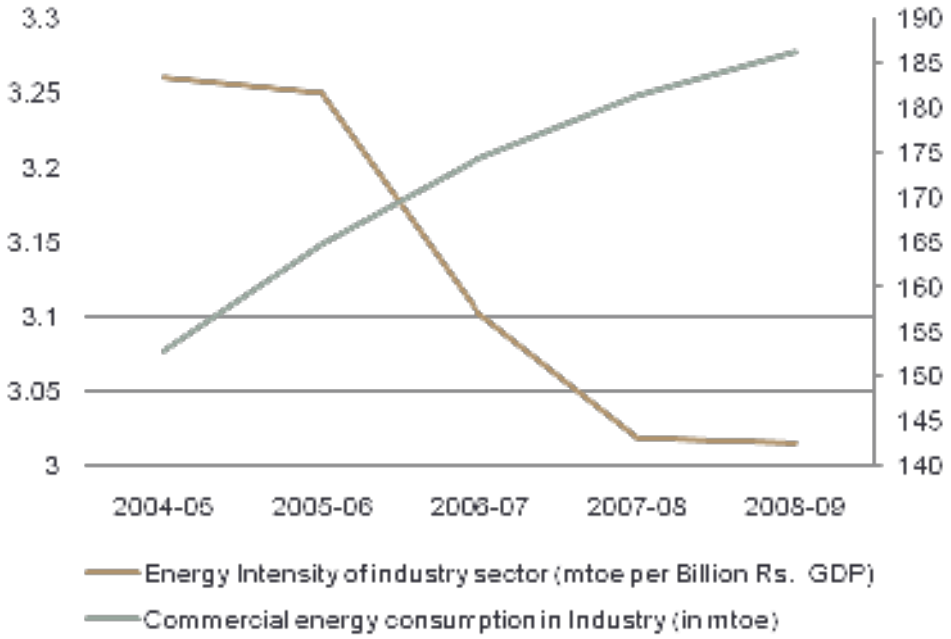
Share of cumulative abatement between 2010-2035	
Efficiency	51%
Renewables	32%
Biofuels	1%
Nuclear	8%
CCS	8%

Energy Profile - India

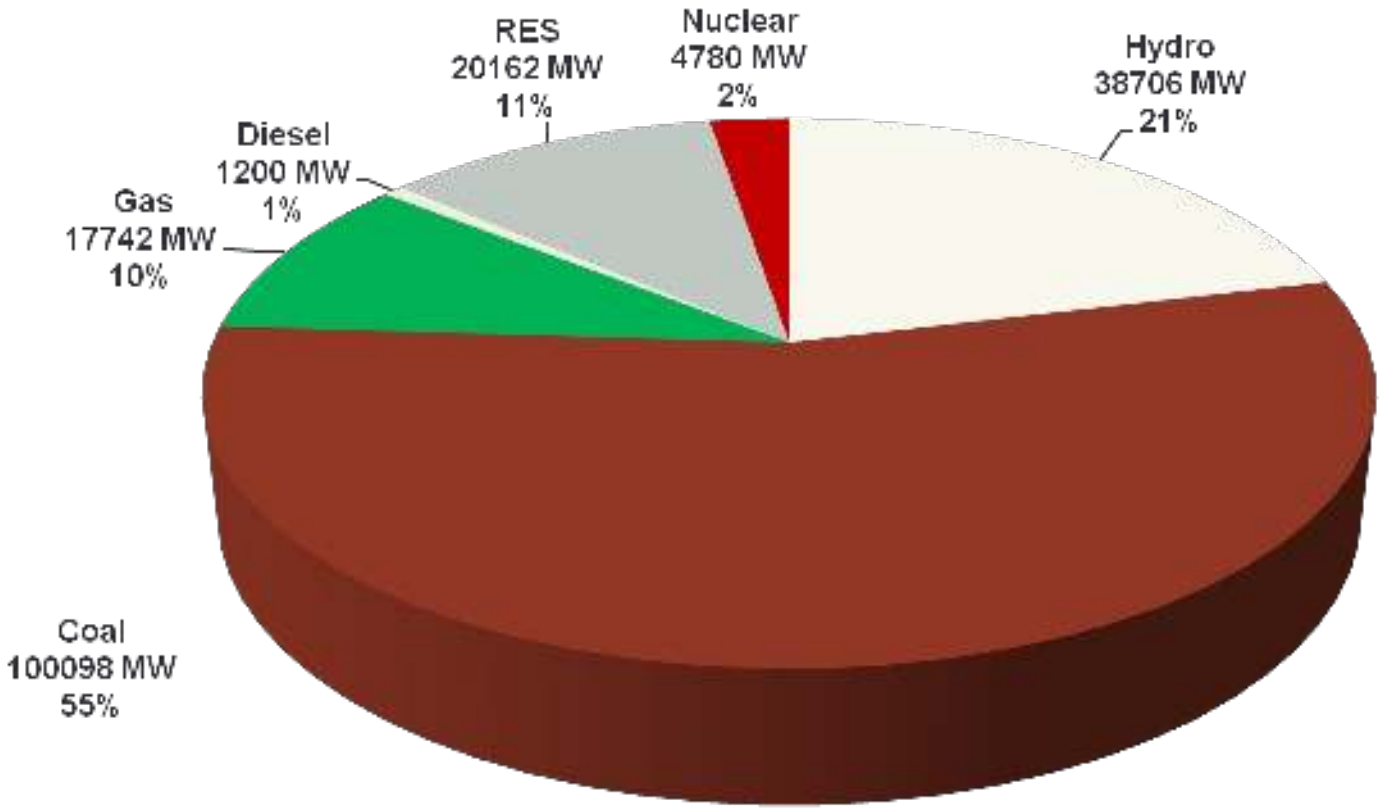
GHG Emissions Across Sectors



Energy Intensity - Industrial Sector

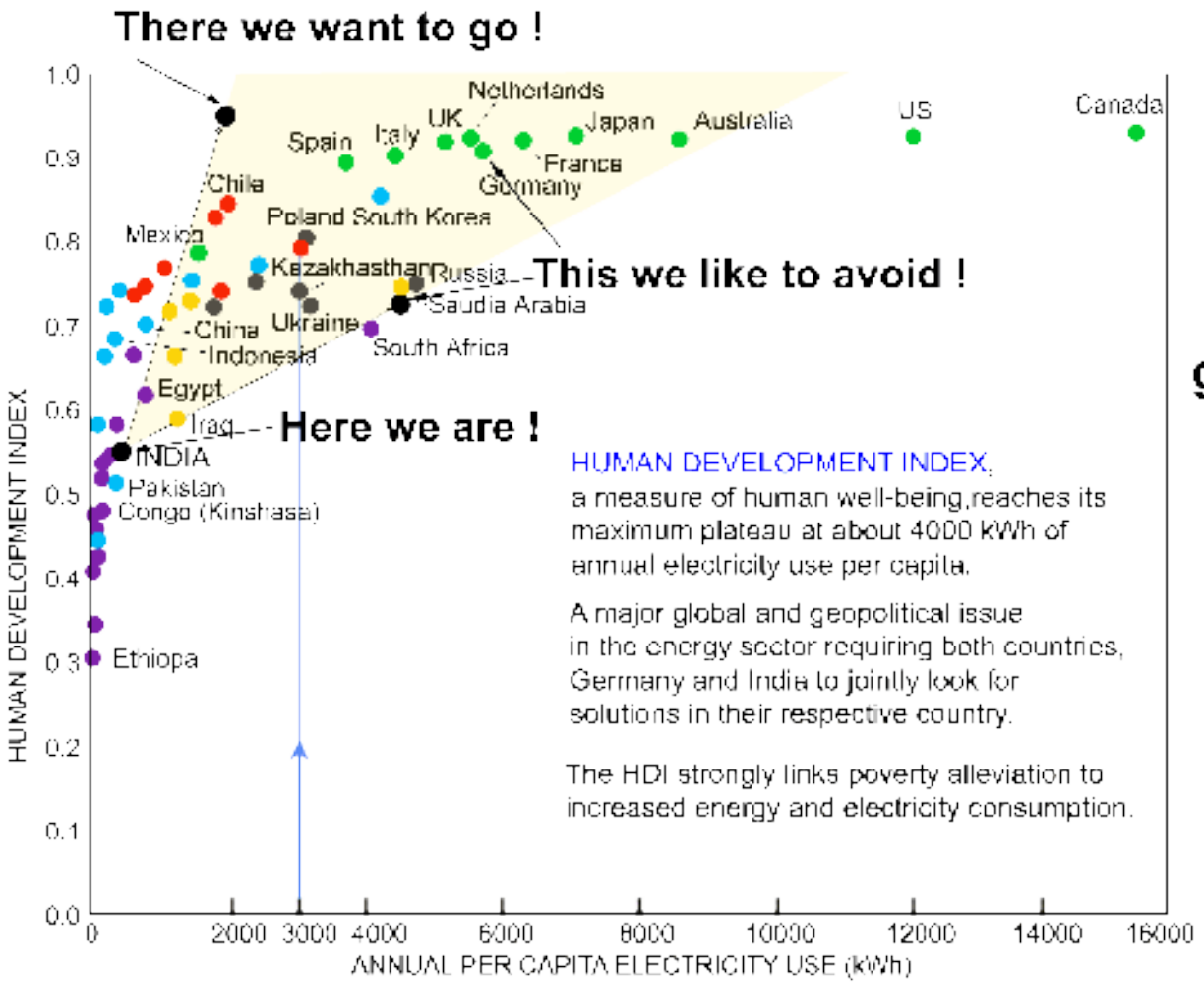


Energy Generation - India



Installed Capacity = 1,82,689 MW

Energy Efficiency is Essential



Inclusive growth and poverty alleviation options.

ENERGY MANAGEMENT

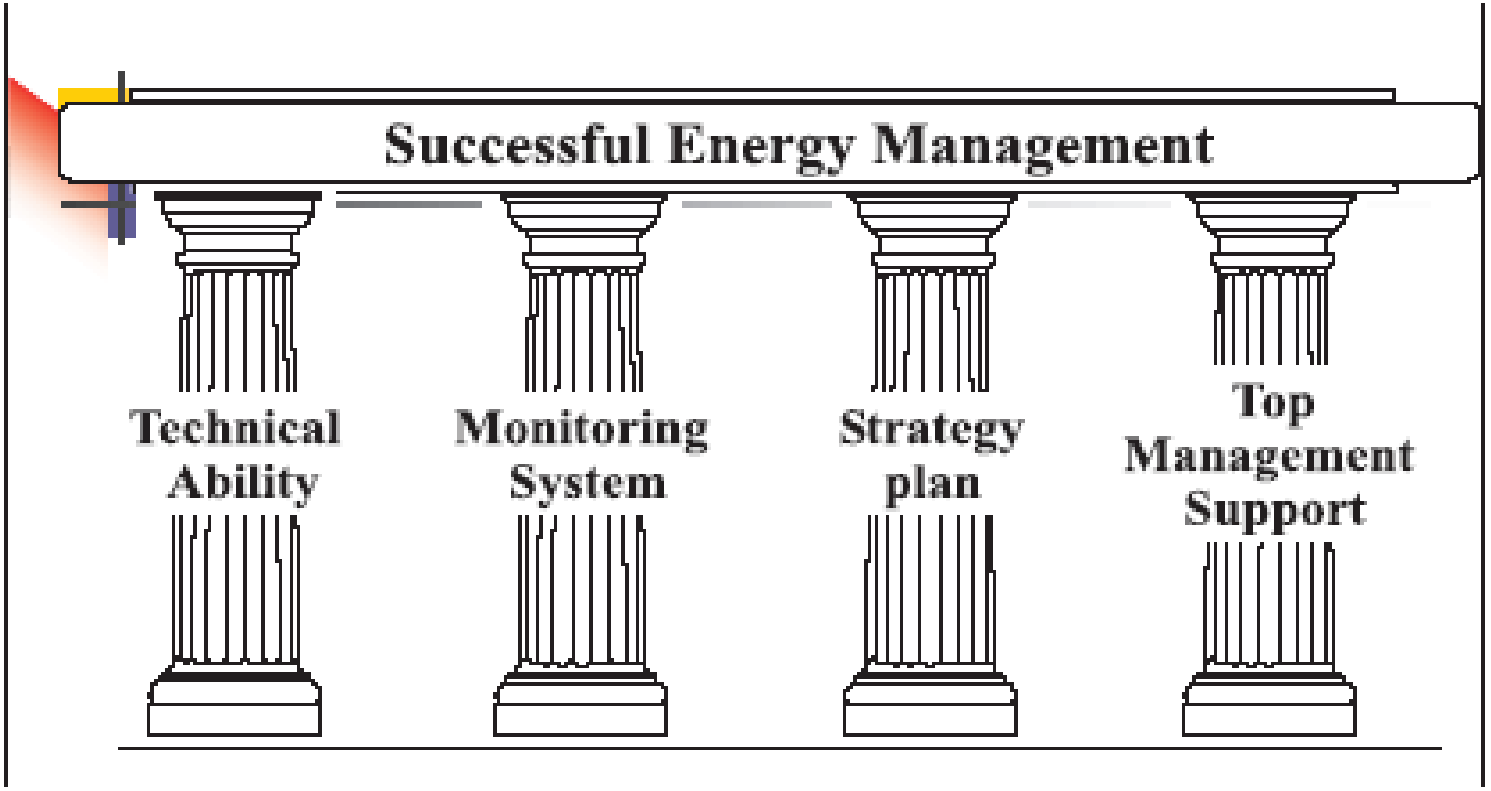
Definition of Energy Management

"The judicious and effective use of energy to maximize profits (minimize costs) and enhance competitive positions"

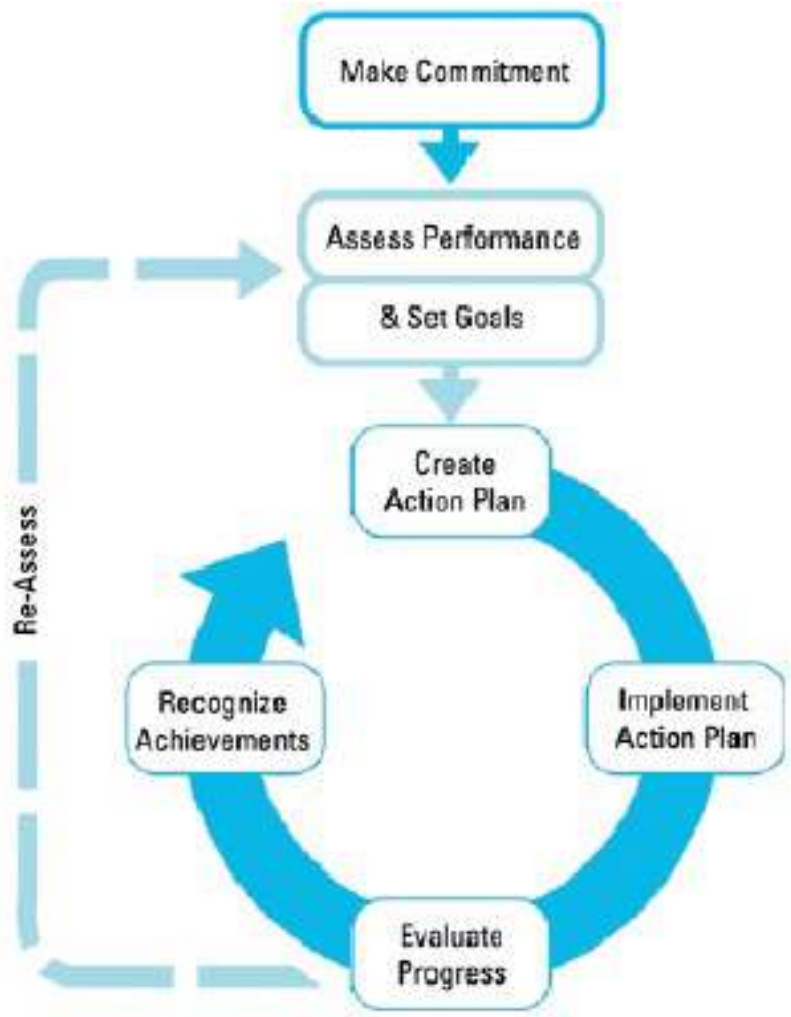
"The strategy of adjusting and optimizing energy, using systems and procedures so as to reduce energy requirements per unit of output while holding constant or reducing total costs of producing the output from these systems"

ENERGY MANAGEMENT

- The 4 Pillars of Successful Energy Management are as follows:



Steps in Energy action Planning



ENERGY CONSERVATION ACT 2001

EC ACT-2001

- Recognizing the fact that efficient use of energy and its conservation is the least-cost option to mitigate the gap between demand and supply, Government of India has enacted the Energy Conservation Act – 2001 and established Bureau of Energy Efficiency w.e.f 1st March, 2002

- The Act provides for institutionalizing and strengthening delivery mechanism for energy efficiency services in the country and provides the much-needed coordination between the various entities.

- Institutional Mechanism:
  - Nodal Agency : BEE
  - State Level Agency : SDA

Important Definitions

- 2(a)“accredited energy auditor” means an auditor possessing qualifications specified under clause (p) of sub-section (2) of section 13;

- 2(c) “building” means any structure or erection or part of a structure or erection, after the rules relating to energy conservation building codes have been notified under clause (a) of section 15 of clause (l) of sub-section (2) of section 56, which is having a connected load of 500kW or contract demand of 600 kVA and above and is intended to be used for commercial purposes;

- 2(g)“designated consumer” means any consumer specified under clause (e) of section 14;

- 2(h)“energy” means any form of energy derived from fossil fuels, nuclear substances or materials, hydro-electricity and includes electrical energy or electricity generated from renewable sources of energy or bio-mass connected to the grid;

Contd….

- 2(i) “energy audit” means the verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption;

- 2(j) “energy conservation building codes” means the norms and standards of energy consumption expressed in terms of per square meter of the area wherein energy is used and includes the location of the building;

- 2(k) “energy consumption standards” means the norms for process and energy consumption standards specified under clause (a) of section 14;

- 2 (m) “energy manager” means any individual possessing the qualifications prescribed under clause (m) of section 14;

Designated Consumers

Thermal Power Stations- 30,000 metric tonne of oil equivalent (MTOE) per year and above
Fertilizer- 30,000 metric tonne of oil equivalent (MTOE) per year and above
Cement- 30,000 metric tonne of oil equivalent (MTOE) per year and above
Iron & Steel- 30,000 metric tonne of oil equivalent (MTOE) per year and above
Chlor-Alkali- 12,000metric tonne of oil equivalent (MTOE) per year and above
Aluminium- 7,500 metric tonne of oil equivalent (MTOE) per year and above
Railways-As per the details given in the subsequent slides
Textile-3,000 metric tonne of oil equivalent (MTOE) per year and above
Pulp & Paper-30,000 metric tonne of oil equivalent (MTOE) per year and above

Energy Auditors and Managers

- Five national examinations conducted to certify energy managers and auditors
  - 4731 persons have qualified as energy auditors and energy managers, and 2835 have qualified as energy managers only
- The Accreditation Procedure by Bureau for accredited energy auditors is under Progress.

Responsibilities of Energy Managers

- Prepare an annual activity plan and present to management concerning financially attractive investments to reduce energy costs
- Establish an energy conservation cell within the firm with management's consent about the mandate and task of the cell
- Initiate activities to improve monitoring and process control to reduce energy costs
- Analyze equipment performance with respect to energy efficiency
- Ensure proper functioning and calibration of instrumentation required to assess level of energy consumption directly or indirectly
- Prepare information material and conduct internal workshops about the topic for other staff
- Improve disaggregating of energy consumption data down to shop level or profit center of a firm

Duties of Energy Manager

- Report to BEE and State level Designated Agency once a year. The information with regard to the energy consumed and action taken in the recommendation of the accredited energy auditor, as per BEE Format.
- Establish an improved data recording, collection and analysis system to keep track of energy consumption.
- Provide support to Accredited Energy Audit Firm retained by the company for the conduct of energy audit.
- Provide information to BEE as demanded in the Act, and with respect to the tasks given by a mandate, and the job description.
- Prepare a scheme for efficient use of energy and its conservation and implement such scheme keeping in view of the economic stability of the investment in such firm and manner as may be provided in the regulations of the Energy Conservation Act.

ENERGY AUDITORS

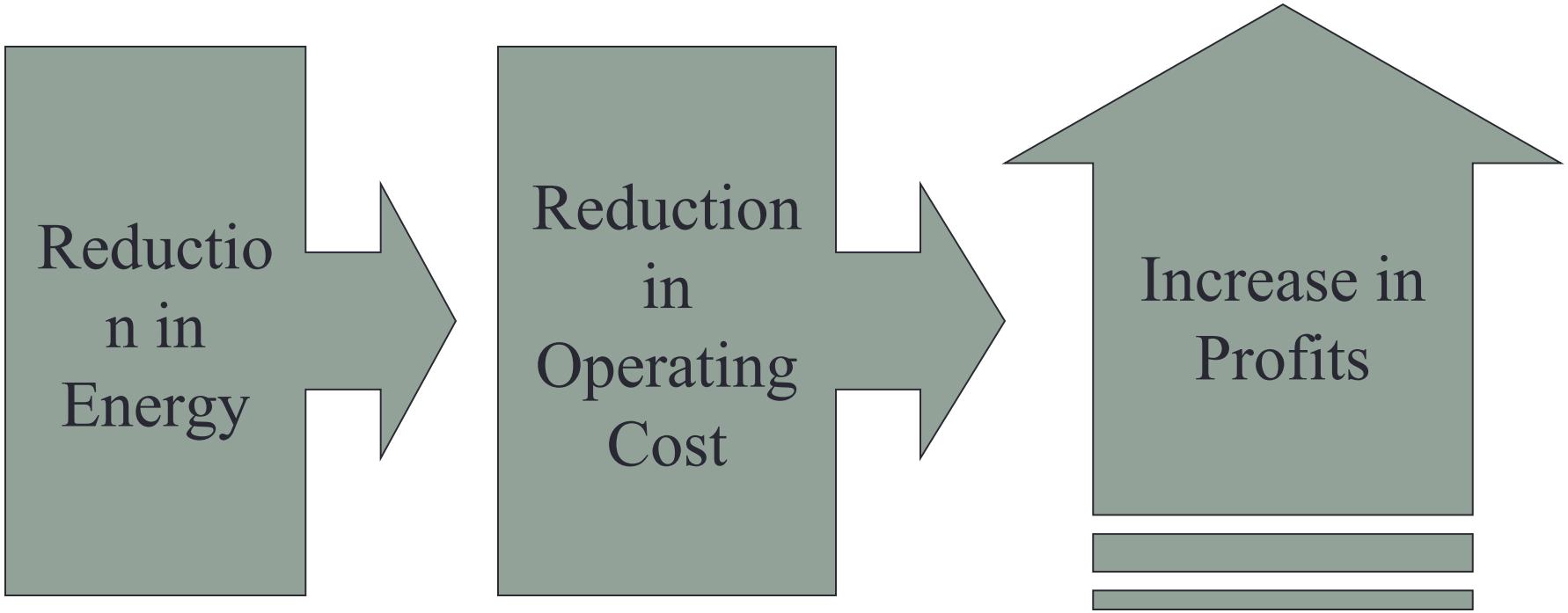
- **RESPONSIBILITIES**
  - Conduct internal audit of individual equipment/system once a year
- **ROLES**
  - Submit copy of reports to Energy Manager with recommendation on action
  - Keep record of calibration status of all energy measurement instruments/devices
  - Maintain portable tools/instruments required for audit
  - Keep abreast of all Codes of practices for energy efficiency testing
  - Training of measurement staff on use of instruments and Codes
  - Be a team member of the external audit team
  - For ESCO performance contract projects be verifier for M&V system and baseline and savings.

Definition of Energy Audit

- As per the Energy Conservation Act, 2001, Energy Audit is defined as

- “the verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption “

Need for Energy Audit



Need for Energy Audit

- Three top operating expenses are energy (both electrical and thermal), labour and materials.
- Energy would emerge as a top ranker for cost reduction
- primary objective of Energy Audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs
- Energy Audit provides a “ bench-mark” (Reference point) for managing energy in the organization

Types of Energy Audit

- Preliminary energy audit
- Detailed energy audit

- Type of energy audit chosen depends on
  - Function and type of industry
  - Depth to which final audit is needed
  - Potential and magnitude of cost reduction desired

Preliminary Energy Audit Methodology

- Preliminary energy audit uses existing, or easily obtained data

Establish energy consumption in the organization

- Estimate the scope for saving
- Identify the most likely areas for attention
- Identify immediate (no-/low-cost) improvements
- Set a ‘reference point’

Identify areas for more detailed study/measurement

Detailed Energy Audit

- Evaluates all energy using system, equipment and include detailed energy savings and costs

- Carried out in 3 phases
  - Pre-audit Phase
  - Audit Phase
  - Post-Audit

Ten Steps Methodology for Detailed Audit

Step No	PLAN OF ACTION	PURPOSE / RESULTS
	Phase I –Pre Audit Phase	
Step 1	• Plan and organise • Walk through Audit • Informal Interview with Energy Manager, Production / Plant Manager	• Resource planning, Establish/organize a Energy audit team • Organize Instruments & time frame • Macro Data collection (suitable to type of industry.) • Familiarization of process/plant activities • First hand observation & Assessment of current level operation and practices
Step 2	• Conduct of brief meeting / awareness programme with all divisional heads and persons concerned (2-3 hrs.)	• Building up cooperation • Issue questionnaire for each department • Orientation, awareness creation

Step 3	Phase II –Audit Phase • Primary data gathering, Process Flow Diagram, & Energy Utility Diagram	• Historic data analysis, Baseline data collection • Prepare process flow charts • All service utilities system diagram (Example: Single line power distribution diagram, water, compressed air & steam distribution. • Design, operating data and schedule of operation • Annual Energy Bill and energy consumption pattern (Refer manual, log sheet, name plate, interview)
Step 4	• Conduct survey and monitoring	• Measurements : Motor survey, Insulation, and Lighting survey with portable instruments for collection of more and accurate data. Confirm and compare operating data with design data.

Step 5	• Conduct of detailed trials /experiments for selected energy guzzlers	• Trials/Experiments: - 24 hours power monitoring (MD, PF, kWh etc.). - Load variations trends in pumps, fan compressors etc. - Boiler/Efficiency trials for (4 – 8 hours) - Furnace Efficiency trials Equipments Performance experiments etc
Step6	• Analysis of energy use	• Energy and Material balance & energy loss/waste analysis
Step 7	• Identification and development of Energy Conservation (ENCON) opportunities	• Identification & Consolidation ENCON measures ▪ Conceive, develop, and refine ideas ▪ Review the previous ideas suggested by unit personal ▪ Review the previous ideas suggested by energy audit if any ▪ Use brainstorming and value analysis techniques ▪ Contact vendors for new/efficient technology
Step 8	• Cost benefit analysis	• Assess technical feasibility, economic viability and prioritization of ENCON options for implementation • Select the most promising projects • Prioritise by low, medium, long term measures
Step9	• Reporting & Presentation to the Top Management	Documentation, Report Presentation to the top Management.

Step10	<u>Phase III –Post Audit phase</u> • Implementation and Follow-up	Assist and Implement ENCON recommendation measures and Monitor the performance ▪ Action plan, Schedule for implementation ▪ Follow-up and periodic review

Identification of Energy Conservation Opportunities

- Energy generation
- Energy distribution:
- Energy usage by processes:
- Fuel substitution:

Technical and Economic feasibility

Technology availability, space, skilled manpower, reliability, service, Impact of measure on safety, quality, production or process. Maintenance requirements and spares availability

Sample Worksheet for Economic Feasibility

Name of Energy Efficiency Measure

i. Investment

a. Equipments
b. Civil works
c. Instrumentation
d. Auxiliaries

2. Annual operating costs

- Cost of capital
- Maintenance
- Manpower
- Energy
- Depreciation

3. Annual savings

- Thermal Energy
- Electrical Energy
- Raw material
- Waste disposal

Net Savings /Year (Rs./year)
= (Annual savings-annual operating costs)

Payback period in months
= (Investment/net savings/year) x 12

Benchmarking for energy performance

- **Internal Benchmarking**
  - **Historical and trend analysis**
- **External Benchmarking**
  - **Across similar industries**

Scale of operation, vintage of technology, raw material specification and quality and product specification and quality

Benchmarking parameters

- **Gross production related**
- e.g. kWh/MT clinker or cement produced (cement plant)
- e.g. kWh/MT, kCal/kg, paper produced (Paper plant)
- e.g. kCal/kWh Power produced (Heat rate of a power plant)
- e.g. Million kilocals/MT Urea or Ammonia (Fertilizer plant)

- **Equipment / utility related**
- e.g. kWh/ton of refrigeration (on Air conditioning plant)
- e.g. % thermal efficiency of a boiler plant
- e.g. kWh/NM^3 of compressed air generated
- e.g. kWh /litre in a diesel power generation plant.

Energy Audit Instruments

 	**Electrical Measuring Instruments:** These are instruments for measuring major electrical parameters such as kVA, kW, PF, Hertz, kvar, Amps and Volts. In addition some of these instruments also measure harmonics. These instruments are applied on-line i.e on running motors without any need to stop the motor. Instant measurements can be taken with hand-held meters, while more advanced ones facilitates cumulative readings with print outs at specified intervals.
	**Combustion analyzer:** This instrument has in-built chemical cells which measure various gases such as CO_2, CO, NO_X, SO_X etc
	**Fuel Efficiency Monitor:** This measures Oxygen and temperature of the flue gas. Calorific values of common fuels are fed into the microprocessor which calculates the combustion efficiency.
	**Fyrite:** A hand bellow pump draws the flue gas sample into the solution inside the fyrite. A chemical reaction changes the liquid volume revealing the amount of gas. Percentage Oxygen or CO_2 can be read from the scale.
	Contact thermometer:

Energy Audit Instruments

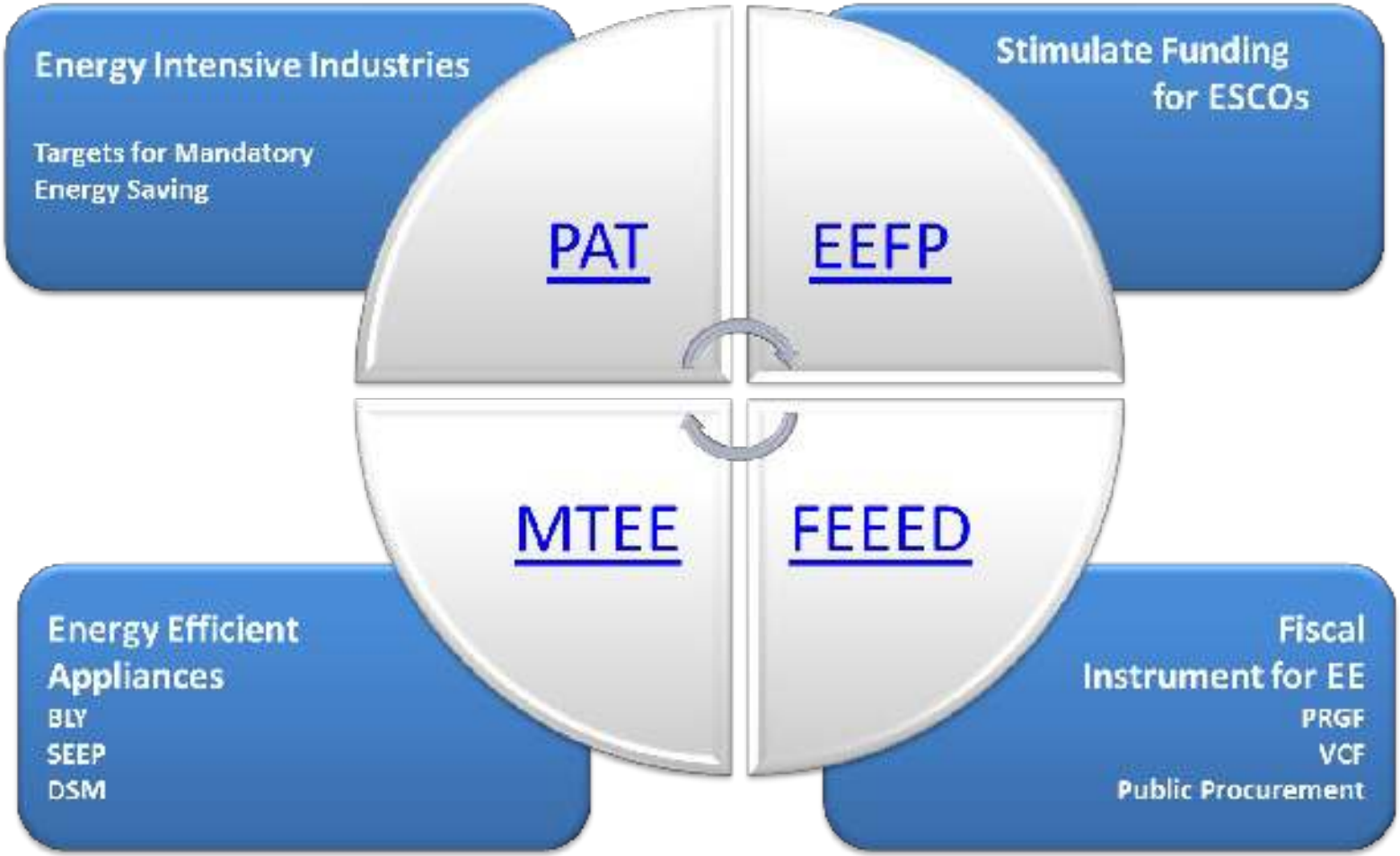
	**Contact thermometer:** These are thermocouples which measures for example flue gas, hot air, hot water temperatures by insertion of probe into the stream. For surface temperature a leaf type probe is used with the same instrument.
	**Infrared Pyrometer:** This is a non-contact type measurement which when directed at a heat source directly gives the temperature read out. Can be useful for measuring hot jobs in furnaces, surface temperatures etc.
	**Pitot Tube and manometer:** Air velocity in ducts can be measured using a pitot tube and inclined manometer for further calculation of flows.
	**Ultrasonic flow meter:** This a non contact flow measuring device using Doppler effect principle. There is a transmitter and receiver which are positioned on opposite sides of the pipe. The meter directly gives the flow. Water and other fluid flows can be easily measured with this meter.

BEE SCHEMES

BEE Schemes


BEE Schemes
Standard and Labelling
Energy Conservation Building Code
Bachat Lamp Yojana
Agricultural DSM
Municipal DSM
Small and Medium Enterprises
National Mission for Enhanced Energy Efficiency
Certification Examination for Energy Managers /Auditors
Strengthening of State Designated Agencies
Utiliity Based DSM

NMEEE


Energy Intensive Industries
Targets for Mandatory Energy Saving
Stimulate Funding for ESCOs
PAT
EEFP
MTEE
FEEED
Energy Efficient Appliances
BLY
SEEP
DSM
Fiscal Instrument for EE
PRGF
VCF
Public Procurement

THANK YOU FOR YOUR KIND ATTENTION

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