Blueprint for Energy Efficiency

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India Everywhere

- **One of the fastest growing economies**
- **Swelling foreign exchange reserve**
- **Inflation under check despite high oil price**
- **Significant FDI inflows**
- **BSE sensex crossed 10,000 mark**

Indian Energy Sector - Overview

- Low per capita energy consumption
- Skewed distribution of primary commercial energy
- Net importer of energy
- High energy intensity, 1.5 times higher than world average
- High level of emission of pollutants like C02, SPM, Nox etc
- Distorted energy pricing
- Indian energy sector structurally handled by five different ministries, each concerned with its own turf and inter-linkages and synergy among then severely missing

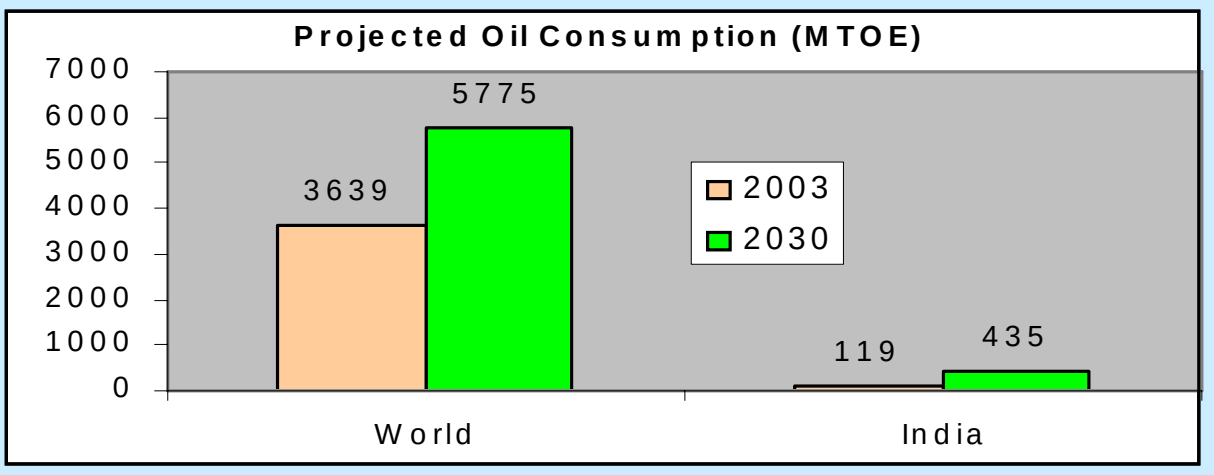
Energy Sector

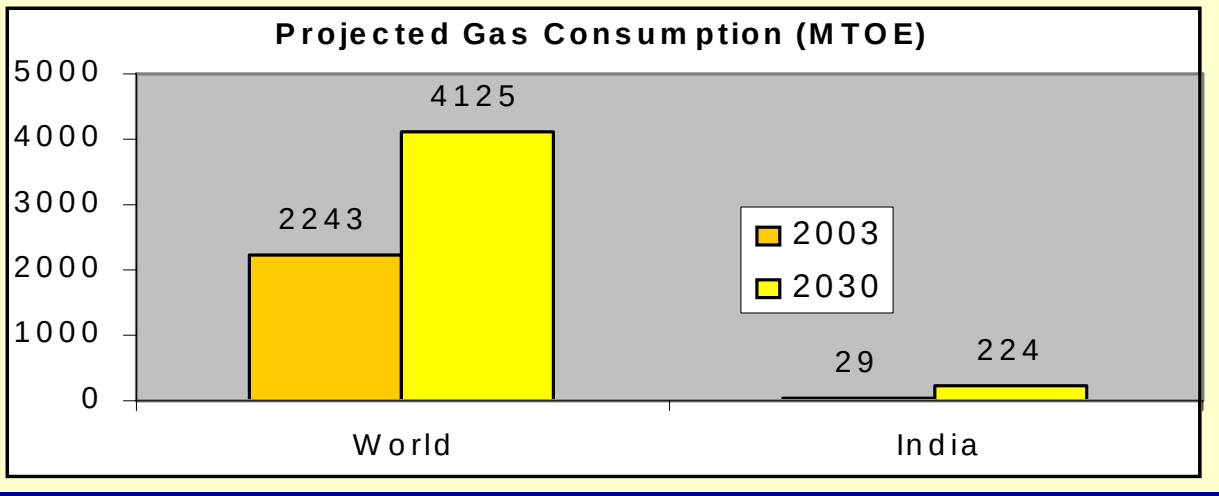
- **Per capita energy consumption & energy efficiency**

Country	GDP Per Capita PPP (US$ 2000)	TPES per capita (Kgoe)	TPES/ GDP (Kgoe/ US$ 2000 PPP)
China	4838	1090	0.23
Australia	28295	5630	0.20
Brazil	7359	1094	0.15
Denmark	*29082*	*3852*	*0.13*
US	35487	7835	0.22
Japan	26636	4052	0.15
India	**2732**	**520**	**0.19**

- **Energy consumption per capita in India is one of the lowest, implies huge scope in demand**
- **India's energy use efficiency better than China & US**

India's Growing Share in Global Energy Consumption

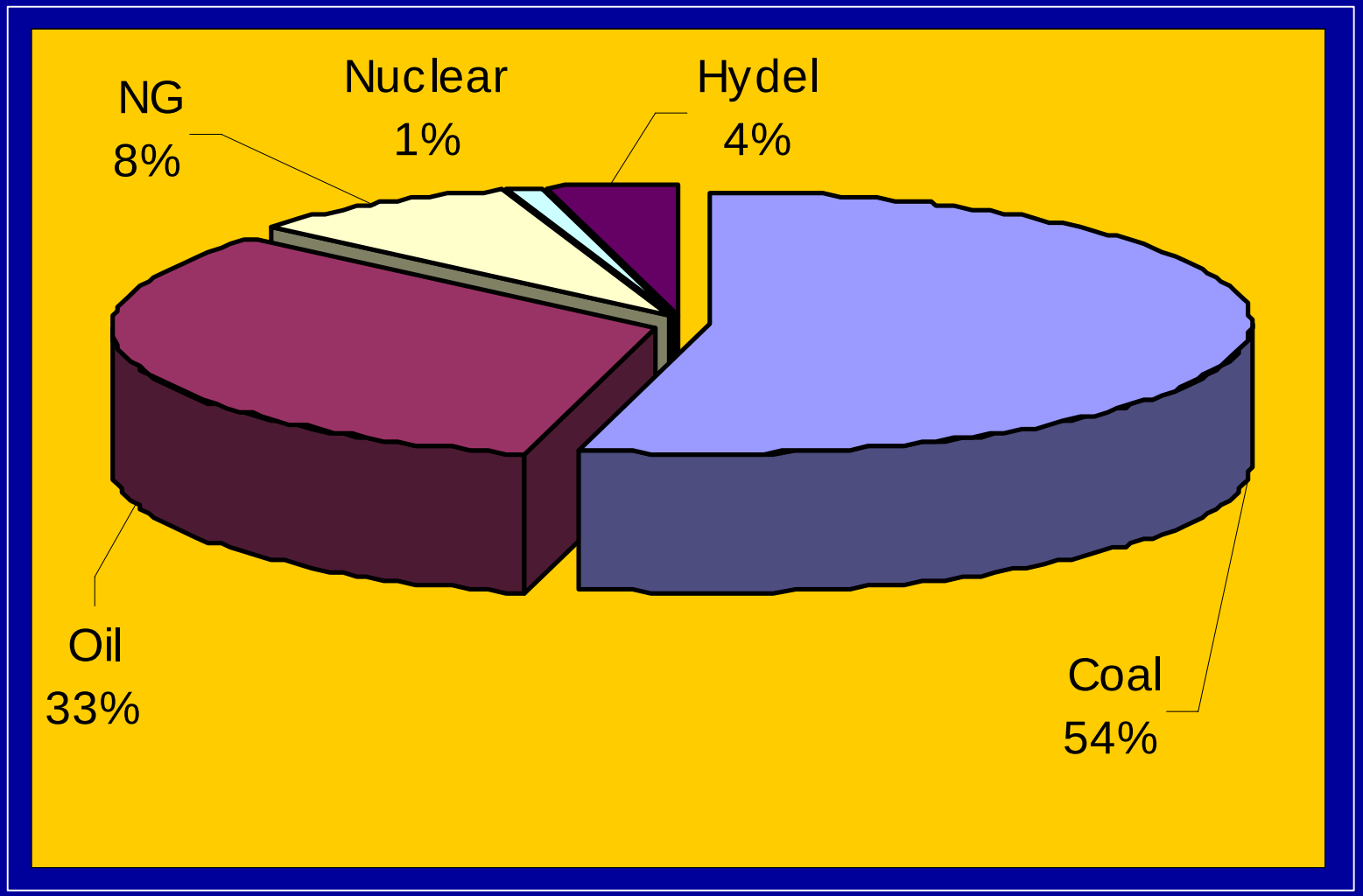




Historical energy growth rates in India

	Primary Commercial Energy	Non-Commercial Energy	Total Energy	GDP Growth
Decadal Growth(%)				
70-71 to 80-81	4.89 (1.55)	2.26 (0.72)	3.40 (1.08)	3.15
80-81 to 90-91	6.36 (1.13)	1.18 (0.21)	3.91 (0.70)	5.61
90-91 to 2001-02	5.33 (0.96)	1.30 (0.24)	3.86 (0.70)	5.53
Rolling Growth				
70-71 to 90-91	5.63 (1.28)	1.72 (0.39)	3.66 (0.84)	4.38
70-71 to 2001-02	5.35 (1.12)	1.53 (0.32)	3.60 (0.76)	4.76

Energy Consumption Matrix



Primary Energy Mix

Fuels	Actual 2001-02	Projections - 2020			
		India Vision 2020	IEA	HC- VISION Corrected	Planning Comm.
Oil	36.0	36.8	35.3	25	30
Natural Gas	8.9	11.0	13.1	20	12
Coal	51.2	41.7	46.5	50	50
Hydel	2.1	4.2	3	2	2.6
Nuclear	1.7	6.3	2	3	5.4
Total (MTOE)	298.64	530	563	826	679

Energy Efficiency

- Energy efficiency involves efficient utilization of resources, which is a key to sustainable development

- Improving energy efficiency increases productivity, significantly reduces the Green House Gas (GHG) emissions, reduces solid waste production and thermal pollution

Policies and programs used worldwide to improve efficiency

- Good house keeping practices
- Regulation and/or Standards
- Industrial cogeneration
- Fuel switching
- Fiscal policies like taxes, tax rebates, subsidies etc.
- Agreement/ Targets
- Benchmarking
- Energy audits
- Information dissemination and demonstration and
- Research and development.

Promoting Energy Efficiency - Role of Industry Associations

- Sector specific associations should develop the market by:
  - Sector specific bench marking
  - Technology development
  - Playing a voluntary role in implementing policy guidelines issued by BEE at the individual establishment level
  - Encouraging the development of the self - regulation process

Energy Efficiency - Indian Perspective

- **In India, though the potential and cost effectiveness of energy efficiency recognized by planners for more than a decade, the actual outlays have been sub-critical**
- **8th Five year plan made a provision of Rs. 1000 crores for energy efficiency to provide energy savings**
- **However this money was not explicitly spent for this purpose**

Energy Efficiency - Indian Perspective

- **10th Five Year plan proposes benchmarking of the hydrocarbon sector against the rest in the world.**
- **It also suggests demand side management specifically in the transport sector.**
- **The target for energy savings in the 10th plan is 95,000 Million Units, which is 13% of the estimated demand**

Energy Conservation Act

- **The Act provides**
  - **Strategic framework** for the formulation and development of energy conservation policies
  - Balance between **regulatory enforcement** & **voluntary participation** and between market driven methods & governmental mandates
  - Provision for creation of a **Central Energy Conservation Fund (ECF)**
  - Provision for creation of a **Bureau of Energy Efficiency (BEE)**
  - Powers to the central government, state governments to establish **energy standards** for buildings, industrial processes & equipment.

Bureau of Energy Efficiency (BEE)

- **The establishment of the BEE - the advisory body to the Central government, is seen as an important step in the formulation of a institutional and policy framework resulting in the planning and implementation of national energy efficiency**

Objectives of BEE

- To exert leadership
- To provide policy framework & direction towards Encon programme
- To interpret & execute Encon programme
- To coordinate policies & programmes among stakeholders
- To measure, monitor and verify Encon results
- To leverage multilateral, bilateral donor & private sector support
- To administer the delivery of energy efficiency services

Scope for Energy Conservation

- One unit of energy saved at consumption avoids nearly three units of fresh capacity addition
- Estimated potential of 20,000 MW through energy efficiency and Demand Side Management
- Saving potential of 30 - 35% each in industry & agriculture by retrofitting with efficient equipment / pump sets
- Saving potential of 25 - 30% in commercial / government establishments & residential houses

Recent Developments

- **BEE operationalized**
- **Voluntary energy saving targets of Rs. 400 Crs. Per year undertaken by industry**
- **Energy saving equivalent of 400 MW achieved totaling Rs. 2,300 Crs during last five years**
- **Energy audit of large government buildings; audit completed in nine buildings**

EE Market - India

- **Energy Efficiency Investment Market**
  - Generic Energy Efficiency Investments - 42 bn Rs
  - Process Specific Energy Efficiency Investments - 79 bn Rs
- **Return on Investment – Industry wise average**
  - Generic Energy Efficiency - 25% to 300%
  - Process Specific Energy Efficiency - 22% to 174%
- **Projects Segments for Generic Energy Efficiency Investments**
  - Less than 10 mn Rs Investments - 23%
  - 10 mn Rs to 50 mn Rs Investments- 45%
  - More than 50 mn Rs Investments - 32%
- **Investment in Energy Savings**
  - Generic EE Project : 1.23 Rs Crs/MW
  - Process EE Project : 2.05 Rs Crs/MW

Ref: Dutta Roy, 2004, BEE

Immediate Market Potential

Market Type	Investment Potential (Billion Rs)	Energy Savings (mn kWh)	Energy Savings (MW)
Industrial	121.00	49056	7000
Generic Energy Efficiency	42.00	23827	3400
Process Energy Efficiency	79.00	25229	3600
Commercial	5.69	739	247
Government Owned			
Offices	3.40	345	160
Hospitals	0.85	210	34
Private Owned			
Hotels	1.44	184	53
Municipal	13.00	3700	1688
Total	**140.00 bn Rs**	**53495 mn kWh**	**8935 MW**

Energy Efficiency Investment : 1.52 Rs Crs/MW

Ref: Dutta Roy, 2004, BEE

EE Consulting market

- At 10% of the investment, the market size is Rs 1400 Crs. excluding TA & Leasing segments
- Present market (Guestimation as accurate data not available)
  - Energy audit (Rs 10 to 15 Crs)
  - Performance contract (Rs 3 to 5 Crs)
  - Engineering consultancy (Rs 20 to 30 Crs)
  - TA consulting (Rs 25 to 50 Crs)

Ref: Dutta Roy, 2004, BEE

EE & CDM

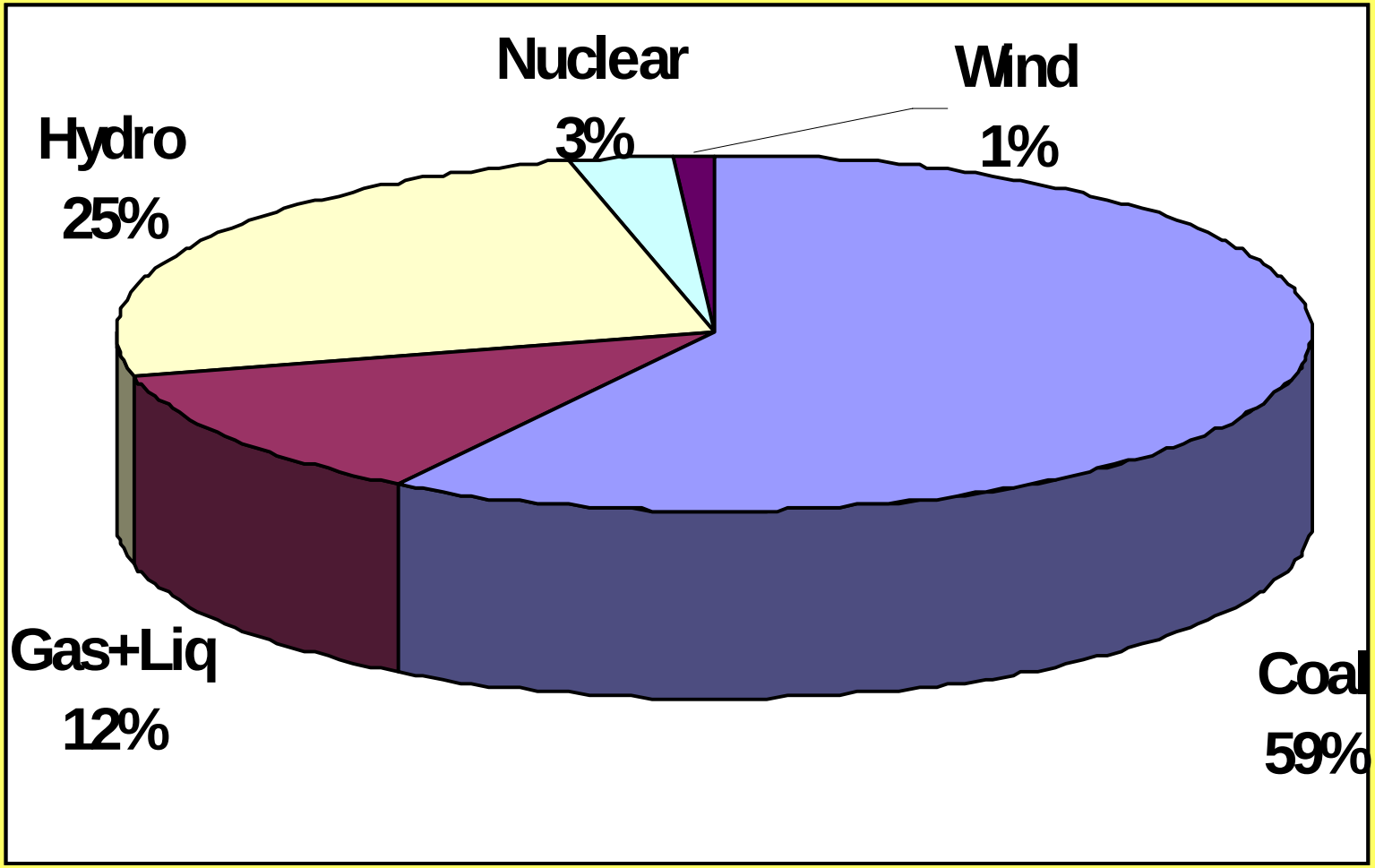
- **In India, a total of 34 (25% of the total CDM projects) energy efficiency projects approved through CDM route**

- **This can generate CERs of around 27,273,035 units (18% of total CERs from India) till 2012.**

Indian Power Sector

- All India installed capacity: 1,26,000 MW (2005-06).
- Length of the transmission lines: 2,00,000 ckm
- Energy Shortage is 7% (current estimate)
- Peak Load Shortage is 12 % per cent (current estimate)

Power Sector Profile in India



- Competitiveness and growth of Indian Industry affected by the present power situation
  - Power Shortages
  - Subsidy & cross-subsidy issues
- High T & D losses

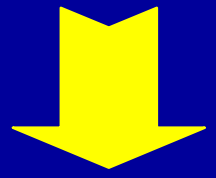
Projections for Electricity Requirement

Year	Billion kWhr		Installed Capacity (GW)	
	GDP Growth Rate		GDP Growth Rate	
	7%	8%	7%	8%
2003-04	633	633	131424	131424
2006-07	747	761	149806	152610
2011-12	1031	1097	206757	219992
2016-17	1377	1524	276143	305623
2021-22	1838	2118	368592	424744
2026-27	2397	2866	480694	574743
2031-32	3127	3880	627088	778095

Bankruptcy  Bankability

Certain Prerequisites...

- Operational efficiency of SEBs, Generation, Transmission and Distribution entities has to be improved.
- Time bound power sector reforms
- Tariff rationalisation.
- Increased competition in the sector.
- Improved quality of power supply to end users.

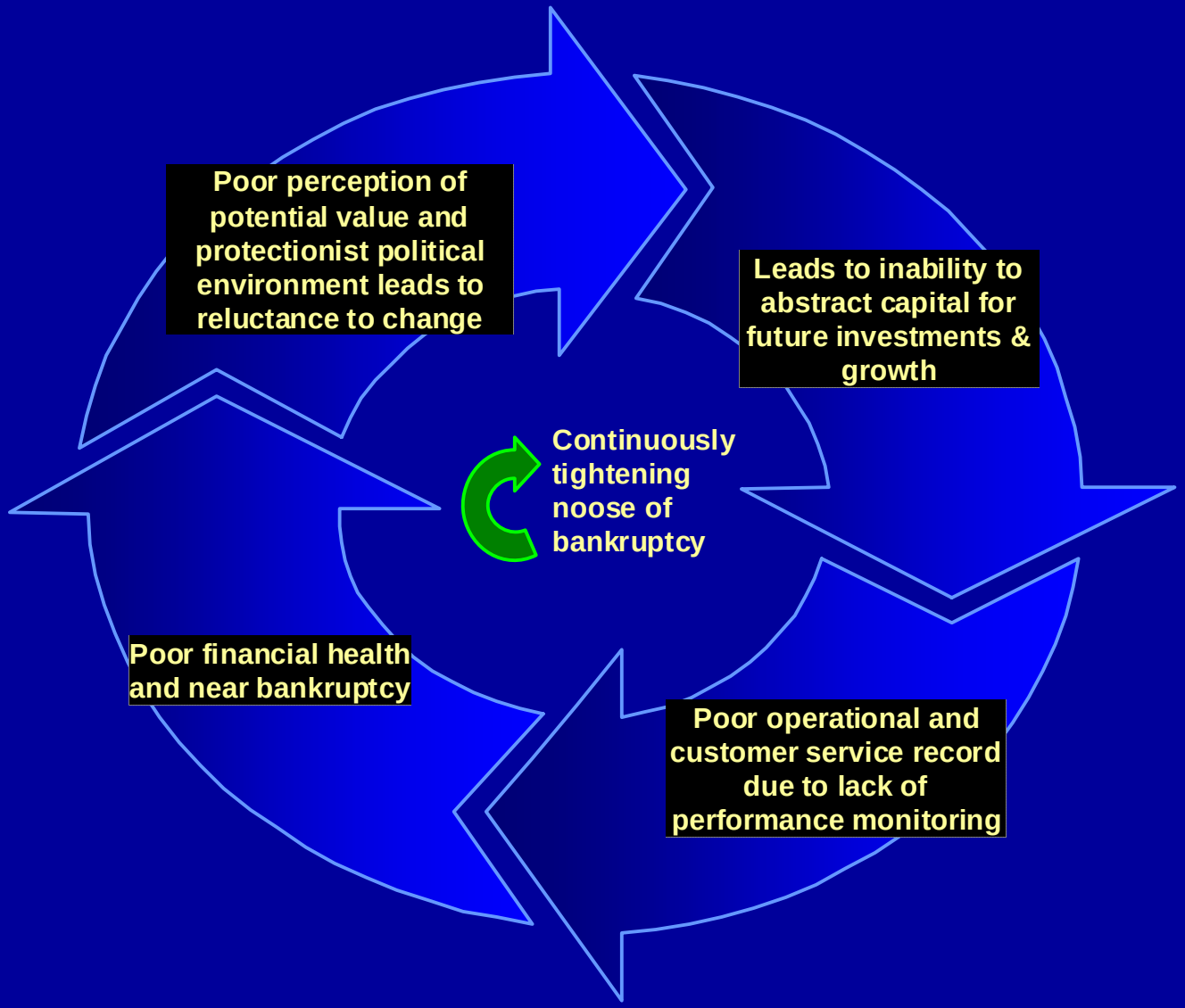


- Consumer's willingness to pay user charges.

Exhibit 3

SEBs ARE IN A VISCIOUS CYCLE OF UNDERPERFORMANCE

CONCEPTUAL

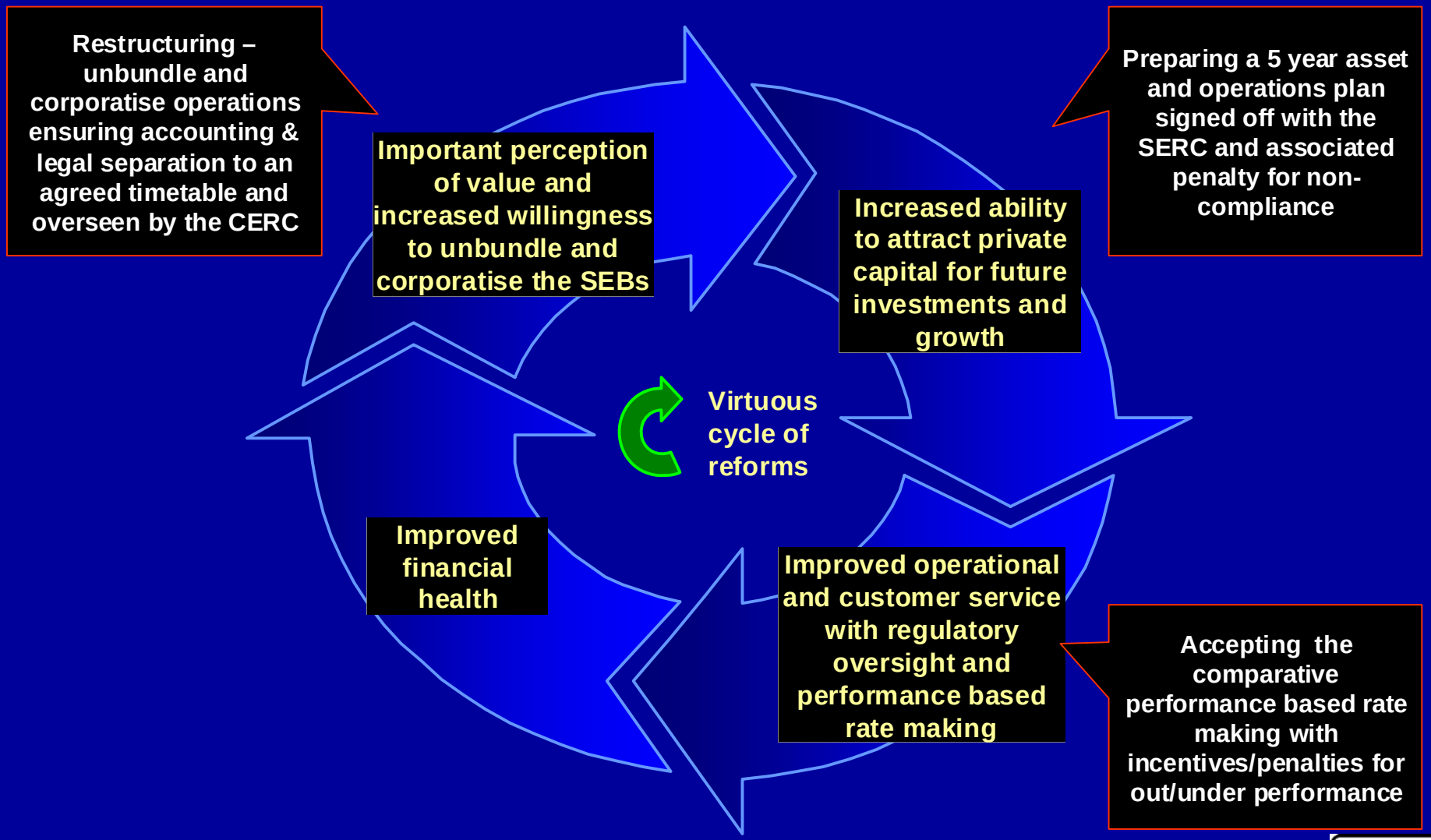


Source: Press searches and McKinsey analysis

Exhibit 4

SEBs NEED TO COMMIT THEMSELVES TO REFORMS

= *Required Commitments*

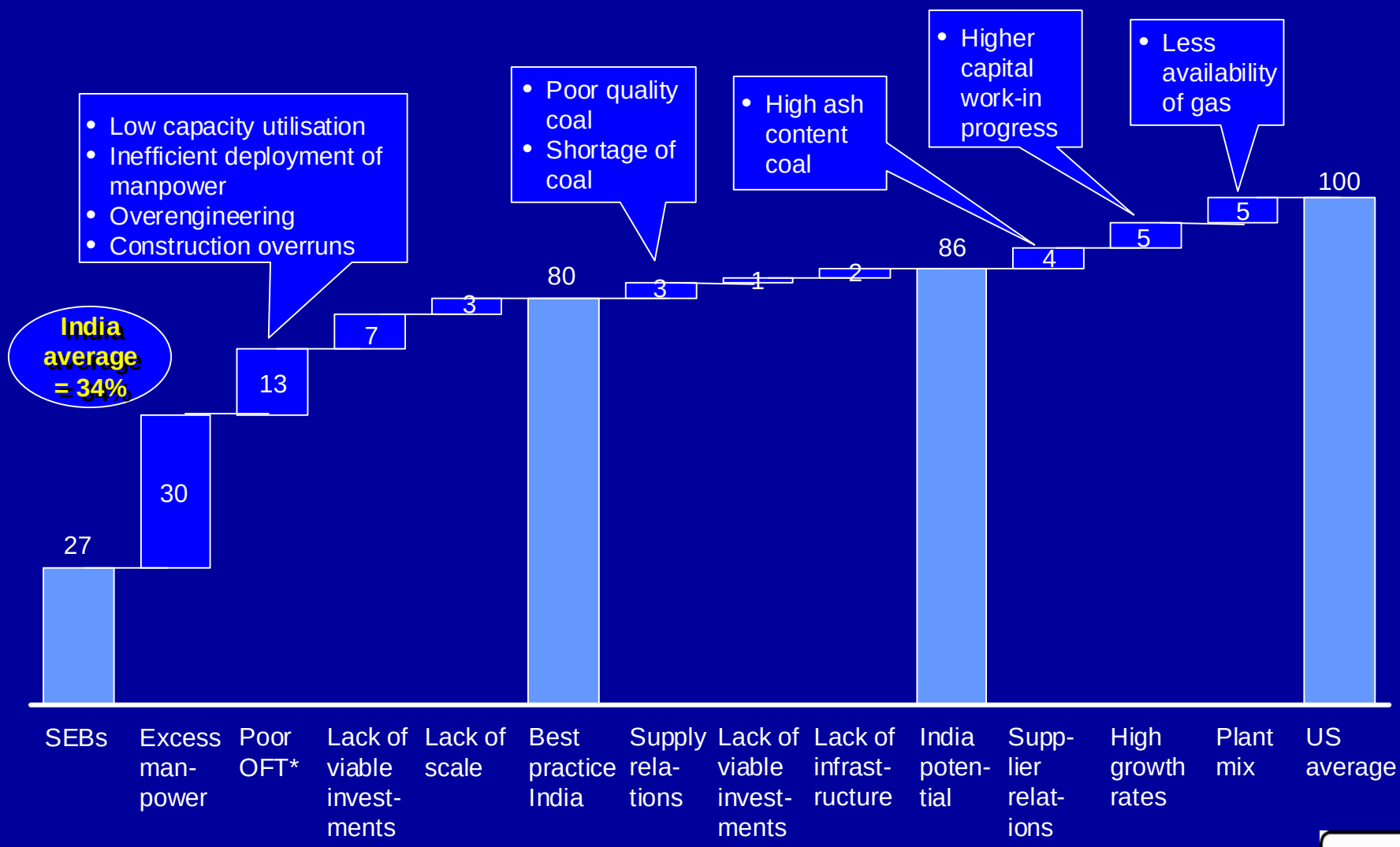


Source: McKinsey analysis

Exhibit 5

OPERATIONAL REASONS FOR PRODUCTIVITY GAP – GENERATION

Index :US = 100



* Organisation of functions and tasks

Source: Planning Commission; CEA; EIA; ASI; Interviews; McKinsey analysis

Exhibit 6

OPERATIONAL REASONS FOR PRODUCTION GAP – T&D

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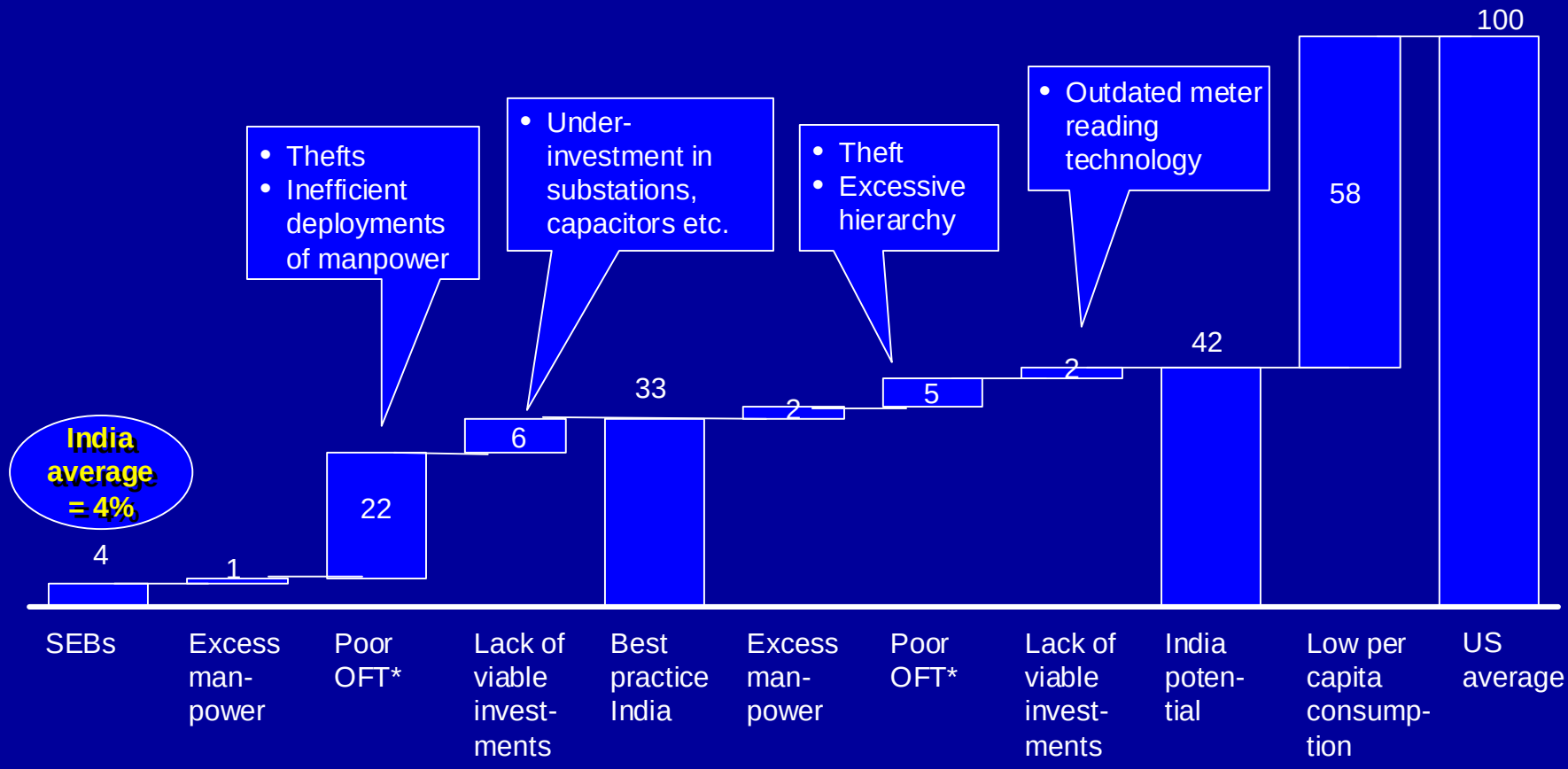

* Organisation of functions and tasks

Source: CEA; CMIE; ASI; Planning Commission; EIA; Interviews; McKinsey analysis

Demand Side Management (DSM)

- DSM is a viable tool in lowering electricity demand by minimizing wastage
- With the demand growth being experienced here, DSM is not an alternative to supply-side options, it is an additional method of keeping up with demand
- Every kW shaved or shifted....
  Is a kW available to meet other demands...
- Every kWh conserved...
  Is a kWh available to meet other needs...
- In many cases DSM requires the lowest capital Expenditure to meet a given segment of demand
- In many cases DSM has the lowest environmental impact

BENEFIT COST RATIOS FOR DSM

DSM Programme	Benefit cost ratio		
	Utility	Customer	Total resource
Energy efficient motors	1.06	4.59	9.83
Variable speed drives	0.78	2.66	3.47
Good house keeping measures	1.27	3.24	5.70
Waste heat VARS*	0.87	3.61	7.62
Improved electric arc furnace	1.01	12.16	13.20
Time of day tariffs	4.17	7.73	32.12
High pressure sodium vapor lamps	1.06	20.26	32.42
Compact fluorescent lamps	1.16	5.81	8.30
Electronic ballast	1.11	3.13	6.89
Efficient pumps and fans	1.07	3.62	6.94
Power factor correction	7.11	3.34	17.14
Co-generation	1.05	3.34	5.75

Source: Planning for demand side management in the electricity sector (1994)

DSM Potential & Programmes in India

- A survey-based analysis indicated that peak demand by HT industries in Maharashtra could be reduced by 9 percent in SR by adopting limited measures
- Saving potential in residential lighting in Delhi is around 35 percent or 294 MW
- Bombay efficient lighting large scale experiment envisaged leasing of 35,000 CFLs to residential consumers in a South Mumbai utility

DSM Potential & Programms in India

- Motor efficiency DSM project in Orissa envisaged saving of about 5.5 Mwwith 1/5 the of the cost of new capacity creation
- MSEB helped capacitors leasing to power loom consumers in Bhiwandi and observed reduction in transformer burning rate and improved service quality
- NPCL replaces old agricultural pumps with efficient ones of lower hp (with same water flow); thus acquired significant savings
- Karnataka Discom planning to implement DSM programms to promote CFL, efficient pumps etc

Industrial Sector

- Indian Industry consumes 52% of total commercial energy used in the country
- In India, energy intensive industries namely fertilizers, aluminum, textiles, cement, iron & steel, pulp & paper, and chlor- alkalis consume around 65 per cent of total industrial energy.
- Industrial sector in India, despite *Win-Win* situation, did not pay much attention to energy efficiency improvement program due to three main reasons:
  - Most of the manufacturing units still depend on old machinery
  - Relatively high cost of capital as compared to European/USA standards.
  - Uncertainty about the long-term growth of the particular industrial sector.

Comparison of specific energy use in select industries *in million kcal/ton*

Country	*Steel*	*Cement*	*Pulp & Paper*	*Fertiliser*
India	9.50	2.00	11.13	12.23
U K	6.07	1.30	7.62	11.25
USA	6.06	0.95	9.70	11.32
Japan	4.18	1.20	--	--
Sweden	5.02	1.40	7.56	

Ref: TERI, 2003

Energy Saving Potential

Industry	Energy Saving Potential
Iron & Steel	10%
Fertilizers	15%
Textiles	25%
Cement	15%
Chlor-alkali	15%
Pulp & Paper	25%
Aluminium	10%
Ferrous Foundry	20%
Petrochemicals	15%
Glass & Ceramics	20%
Refineries	10%

SUMMARY OF ENERGY SAVINGS ACHIEVED BY INDUSTRIAL UNITS

Year	No. of participating industrial units	Savings in million Rs.	Investment in million Rs.	Electrical Energy Saving		Furnace Oil Savings in 10^5 KL	Coal Savigs in 10^5 Metric tonnes	Gas savings in 10^5 cubic metres
				Million kWh	Equivalent Avoided capacity in MW			
2004	297	7630	13640	814	155	2.49	5.37	18585
2003	191	5390	10710	542	103	2.21	12.65	73181
2002	174	5940	6910	641	122	1.7	7.4	35588
2001	157	5870	6590	485	90	2.21	4.79	3929
2000	120	3660	6300	524	100	1.327	0.64	707
1999	123	2050	9400	205	45	1.62	2.15	2444
Total 6 years		**30540**	**53550**	**3211**	**615**	**11.557**	**33.00**	**134434**

Indian Cement Industry

- **The industry comprises of 125 large cement plants with an installed capacity of 148.28 million tonnes and more than 300 mini cement plants with an estimated capacity of 11.10 million tonnes per annum**

- **Indian cement industry is the fourth largest in the world after China, Japan and USA**

- **Cement industry has made tremendous strides in technological upgradation and assimilation of latest technology.**

Indian Cement Industry

- At present ninety three per cent of the total capacity in the industry is based on modern and environment-friendly dry process technology and only seven per cent of the capacity is based on old wet and semi-dry process technology.
- There is tremendous scope for waste heat recovery in cement plants and thereby reduction in emission level
- Significant improvement of thermal and electrical energy consumption trend of the dry process plants from 876 to 734 kcal/kg clinker and 120 to 89 kWh/t cement respectively from the year 1990 to 2001

Indian Cement Industry

- Older plants can be modernised/ expanded by technology upgradation and retrofitting with energy efficient equipment/systems.

- Some of the cement plants by their pioneering efforts have reduced energy consumption by 25-30% by incorporating /retrofitting energy efficient equipment/systems during the last 7-8 years

- Though the best of our industry matches quite well with world standards in terms of energy (thermal energy Kcal/kg of clinker – India 665 against 690 of Japan) and pollution norms (SPM of 40 in India against 20 of Japan) but the average performance of the Indian industry is lagging behind.

Energy Conservation Options	Investment Requirements	Possible Savings
Energy Efficient Technology and Equipment		
Gyratory crushers, mobile crushers and single stage crushers vertical roller mills		Upto 30% on electrical energy 15-30% compared to power consumption of ball mill
Roller press		4-8 kWh/t of cement in pregrinding system
High efficiency separators		Upto 30% on electrical energy
Variable speed AC drives		Upto 30% on power consumption of the drive
Solid state motor controllers and soft starters	Rs. 1.5 lakhs	Upto 2% on power consumption of the drive
Energy efficient motor	Upto Rs. 3 lakhs	Upto 5% on power consumption of the drive
Mechanical conveying systems over pneumatic conveying systems for dry raw meal and cement	Rs. 0.4-1.25 lakhs	Upto 5% on power consumption of the drive
High efficiency fans	Rs. 30-50 lakhs	10-30% on power consumption of the drive
Improved multi-channel burners		About 2% on heat consumption
5/6 – stage preheaters		30-40 kcal/kg clinker

Indian Steel Industry

- Installed capacity 34 MT of finished steel
- 42% of finished steel production in integrated steel sector
- 58% of installed production in secondary steel sector
- SEC ranges from 29.5 GJ/tcs to 41.8 GJ/tcs
- Average SEC of Indian industry (33 GJ/tcs compare to 26 GJ/tcs of US, 18 GJ/tcs of Japan
- Over the years, a number of energy conservation measures taken by each plant.

Energy Saving Measures in Steel Industry

Major energy saving measures	Investment (Rs. In lakhs)
Overhauling of BF gas holder	80
Recommissioning of gas mixing stations at rolling mills complex	15
Thermal insulation of bare heating surfaces of boiler & HP steam lines	6.6
Arresting steam leakages using online/conventional methods and by installation / replacement of steam traps and valves	3.5
Installation of capacitor banks at oxygen plants	10
Introduction of BF gas firing in boilers	400
Steam enhancement by providing extra heat in waste heat recovery boiler	27
Change of submerged arc furnace design from close to open type & improvement of charge distribution	43
SMS modification for long sequence casting	50
Use of washery rejects and chars in place of coal in boiler	-
Use of centrifuge to remove moisture from washed coal instead of oil fired boiler	20
Commissioning of stamp charging battery	19550
Improvement in combustion system of ignition furnaces at Sinter plant	1080
Centralised compressed air system	398
Top gas analysers for blast furnaces	70
Enhanced LD gas recovery	86
Installation of Ammonia incinerator with waste heat recovery	1075
Installation of gas fired boilers and cogeneration of power in boilers	12000

Indian Aluminum Industry

- Highly concentrated industry with only five primary plants in the country
- Bayer-Hall-Heroult technology used by all producers
- Electricity, coal and furnace oil are primary energy inputs
- All plants have their own captive power units for cheaper and un-interrupted power supply
- Energy cost is 40% of manufacturing cost for metal and 30% for rolled products
- Plants have set internal target of 1 – 2% reduction in specific energy consumption in the next 5 – 8 years

Energy Consumption, IACL, Hirakud

Description	Unit	2001-2002	2002-2003	2003-2004
Annual production	Tonne	30248	57200	60868
Total electrical energy consumption/annum	Million Kwh	499.8	649.4	1033.3
Specific energy consumption (electrical)	Kwh/tonne	15403	15375	15346
Total thermal energy consumption/annum	Mkcals	11329	11152	14987
Specific energy consumption (fuel)	Litres/tonne	41.07	32.96	27.00

Energy Efficient Measures in Aluminum Industry

- Installation data acquisition system
- Installation of energy efficient screw compressors
- Installation of PLC controlled burners in furnaces.
- Installation of de-super heaters for better heat transfer and steam saving in alumina refining
- Installation of liquid vapour hydro cyclone in evaporation feed flash tank to avoid caustic entrainment to the hotwell water and facilitates more flashing.
- Reduced compressor running hours by modifying pipe sizes, modifying the volumetric efficiencies, by providing air conservation ejector nozzles and regulating the pressure as per requirement.

Energy Efficient Measures in Aluminum Industry

- Installation of technologically upgraded recuperator in place of shell type in melting furnace.
- Reduction in oil consumption by installing fuel magnetizer and fused silica launders and reduction of furnace preparation time by using metal transfer trucks.
- Modification of digestion unit flash tank train by utilizing additional tank spared form slurry heater condensate flashing circuit.
- Installation of variable frequency drives.
- Utilization of energy efficient lighting system

Indian Transport Sector

- The progressive liberalisation of the norms for foreign investment and import of technology appear to have benefited the automobile sector with production of total vehicles increasing from 4.2 million in 1998-99 to 7.3 million in 2003-04

- Nearly every policy in the transport sector emphasises the link between transport and energy

- Liberalization of the licencing regime resulted in the introduction of a number of fuel efficient vehicles in the cars and two wheelers segment.

Indian Automobile Industry

- India is the 2nd largest two wheeler manufacturer in the world
- Second largest tractor manufacturer in the world
- 5th largest commercial manufacturer in the world
- 3rd largest car market in Asia, surpassing China in the process
- Performance:

Key Players	402
Investment	US $ 2.3 billion
Output	US $ 4 billion
Exports	US $ 417 million
Employment	250,000 persons

All-India and region-wise demand

(in '000)

Automobile type	South		West		East		North &Central		All India	
	2002-03	2011-12	2002-03	2011-12	2002-03	2011-12	2002-03	2011-12	2002-03	2011-12
Passenger car	158	296 (7.2)	151	331 (9.1)	47	76 (5.4)	257	524 (8.2)	613	1227 (8.0)
Motor cycle	950	2835 (12.9)	1070	4327 (16.8)	343	883 (11.1)	907	2624 (12.5)	3270	10669 (14.0)
Scooter	160	203 (2.6)	161	219 (3.5)	83	99 (2.0)	471	602 (2.8)	876	1124 (2.8)
MUV	29	62 (8.6)	48	111 (9.7)	12	22 (7.4)	41	87 (8.6)	130	282 (9.0)

Note: The figures in parenthesis indicate the Compounded Annual Growth Rate (CAGR) for the period 2002-03 to 2011-12

Energy Consumption - M & M Ltd., Kandivli, Mumbai

Description	Unit	2001-2002	2002-2003	2003-2004
Annual eq. Vehicle production	**Nos**	**37148**	**42508**	**52184**
Total electrical energy consumption/annum	**Lakhs/ Kwh**	**255**	**269**	**310**
Specific energy consumption (electrical)	**Uits/Eq Vehicle**	**687**	**632**	**594**
Total thermal energy consumption/annum	**Mkcals**	**16420**	**17784**	**20592**
Specific energy consumption – thermal (fuel)	Mkcals/ eq. vehicle	0.44	0.42	0.39

Energy Efficiency - Barriers

- Price distortions in the energy market.
- Lack of incentive-based energy conservation and efficiency improvement programs
- The risks associated with the adoption of new techniques or equipment
- Lack of information on performance, reliability and economies of new equipment
- Relative weakness of energy conservation schemes compared to energy supply augmentation projects
- Lack of awareness or documentation of energy conservation schemes

ESCOs

- International experience suggests that energy efficiency / DSM can be promoted by the existence of active ESCOs
- The ESCO business in India not doing well and even some established companies have sold off their ESCO businesses
- Large and professionally managed energy intensive industries are not interested in hiring an ESCO to reduce energy costs because they have the equity, the know-how and engineering divisions to implement recommendations on their own
- Smaller firms, with little know-how and no access to finances and capability to implement recommendations would greatly benefit from an ESCO, even at higher costs.

Financing Issues

- Financially sound prime borrowers are not in need of finances
- Project financing needed for entities with weak balance sheet
- Normally interest rates are higher for such borrower
- Financial institutions such as IREDA charges higher interest rates for energy efficiency financing
- The higher discount rates of consumers often result in consumers not investing in DSM options that are viable from the society / utility viewpoint

Policies to Promote Energy Efficiency

- Efforts should be made to increase the energy efficiency of end-use sectors through the adoption of “Top Runner” system, like those adopted in Japan
- Economic and rational pricing of energy
- Relative prices of fuels based on calorific value, conversion efficiency, storage, transportation and pollution potential
- Rationalisation of tax and duty structure
- promoting energy efficiency in the entire energy value chain

- Cost compatibility of energy-efficient products with inefficient ones
- Labeling & benchmarking of appliances
- consumer awareness about the long-term benefits of efficient energy
- Supply of beneficiated/blended coal to the power plants
- Energy efficient transformers
- Strong anti-theft legislation
- Supply of quality & reliable power to the consumers
- Time of day metering
- Electronic metering and efficient billing
- Subsidy to well-targeted marginal consumers

- **The transport sector offers significant potential for energy efficiency improvement. The following needs to be promoted:**
  - **Multi-modal transport system**
  - **Strengthening Urban Public Transport / Mass Transit Systems**
    - **Facilitating Ticketing between different modes – e.g. A person landing at an airport should be able to purchase a ticket that enables him to take a bus / local train / bus to reach his destination**
    - **Information about routes / timings – display at stops / terminals.**
    - **Analysis of energy efficiency kJ/passenger km.**
    - **Congestion tax / Disincentives for private vehicles in rush hour.**

- Increasing Freight Traffic by Railways
- Staggering office / school timings in Urban areas to balance traffic loads.
- Better road management
- High occupancy vehicles
- Traffic signal synchronization
- Renewed emphasis on inland waterways and coastal shipping

The Future for India

- **Role of Technologies**
- **Standards**
- **Monitoring and Targetting**
- **Education and Training**
- **Institutional Arrangements**
- **Indices for sub-sectors on Energy Efficiency**
- **Harnessing CDM Opportunity**
  - In India, a total of 34 (25% of total CDM projects) CDM energy efficiency projects have been approved
  - Can generate 27,273,035 units of CERs.

India and US

- US- Indian business groups with academic and government linkages for PPP in technology to be discussed.
- US- India Energy Co-operation, an umbrella agreement in this regard.
- India and US both party to Asia Pacific Partnership (APP): aims to develop new technologies in
  - cleaner fossil fuel energy
  - power generation and transmission
  - aluminum, steel, cement, buildings, appliances & mining
    - India co-chairing Task Forces on steel and mining

India: Beating Energy Bottlenecks

Power Capacity addition lower than planned ⟷ GDP Growth rate higher than projected

Oil prices at historically high level ⟷ Industrial growth rate, profitability continuously increasing

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ISN'T THERE PRODUCTIVITY & EFFICIENCY GAIN

Blueprint for Energy Efficiency

- Dr. Jayant Sathaye's backgrounder for the Indo-US conference on 2nd/3rd May 2006 has the contents
- How to fine tune and go forward?

Thank You