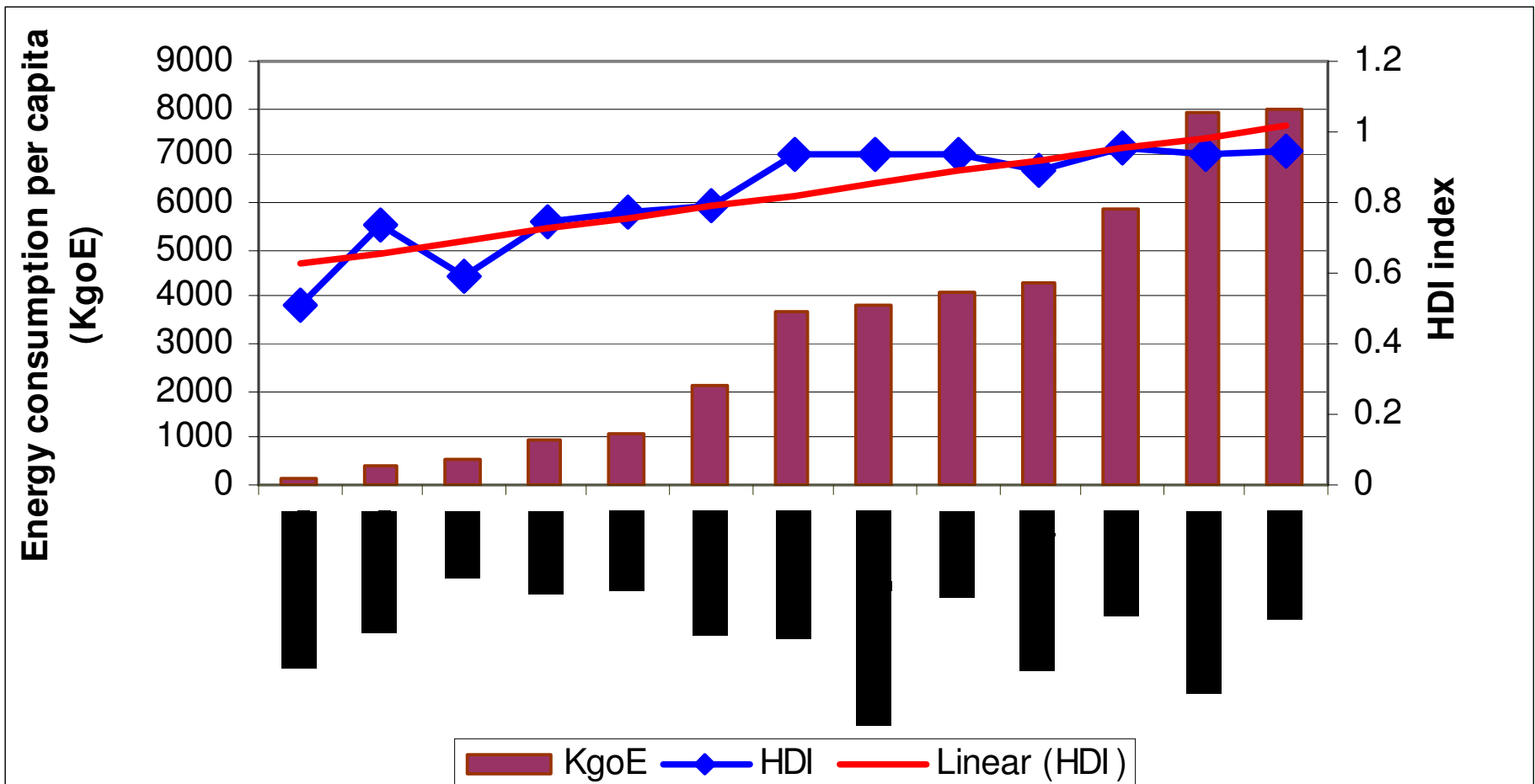


# **Climate Change Dialogue India Country Presentation**

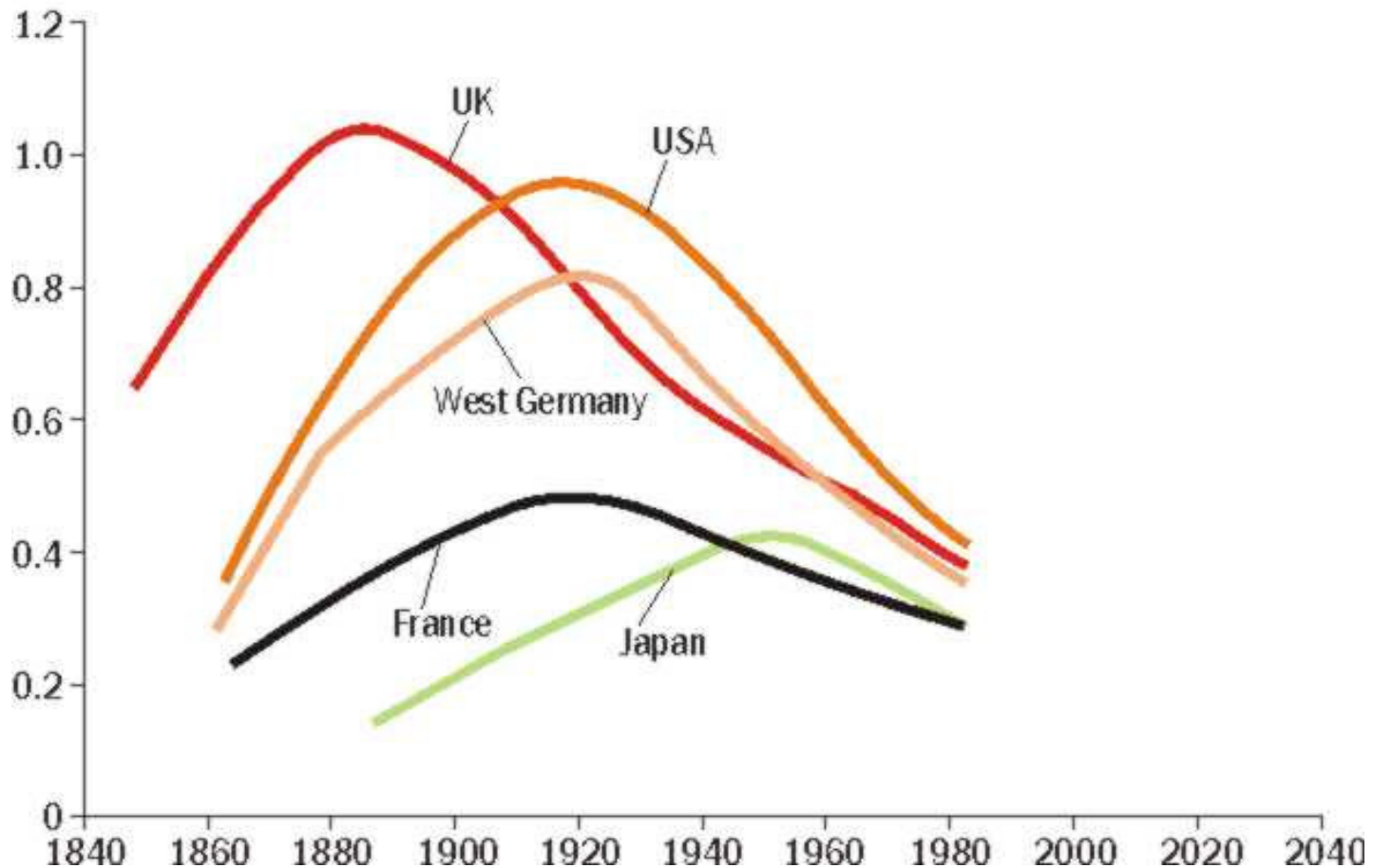
**Surya P. Sethi  
Adviser, Energy  
Planning Commission, India  
May 2006**

# India Needs More Energy for its Development

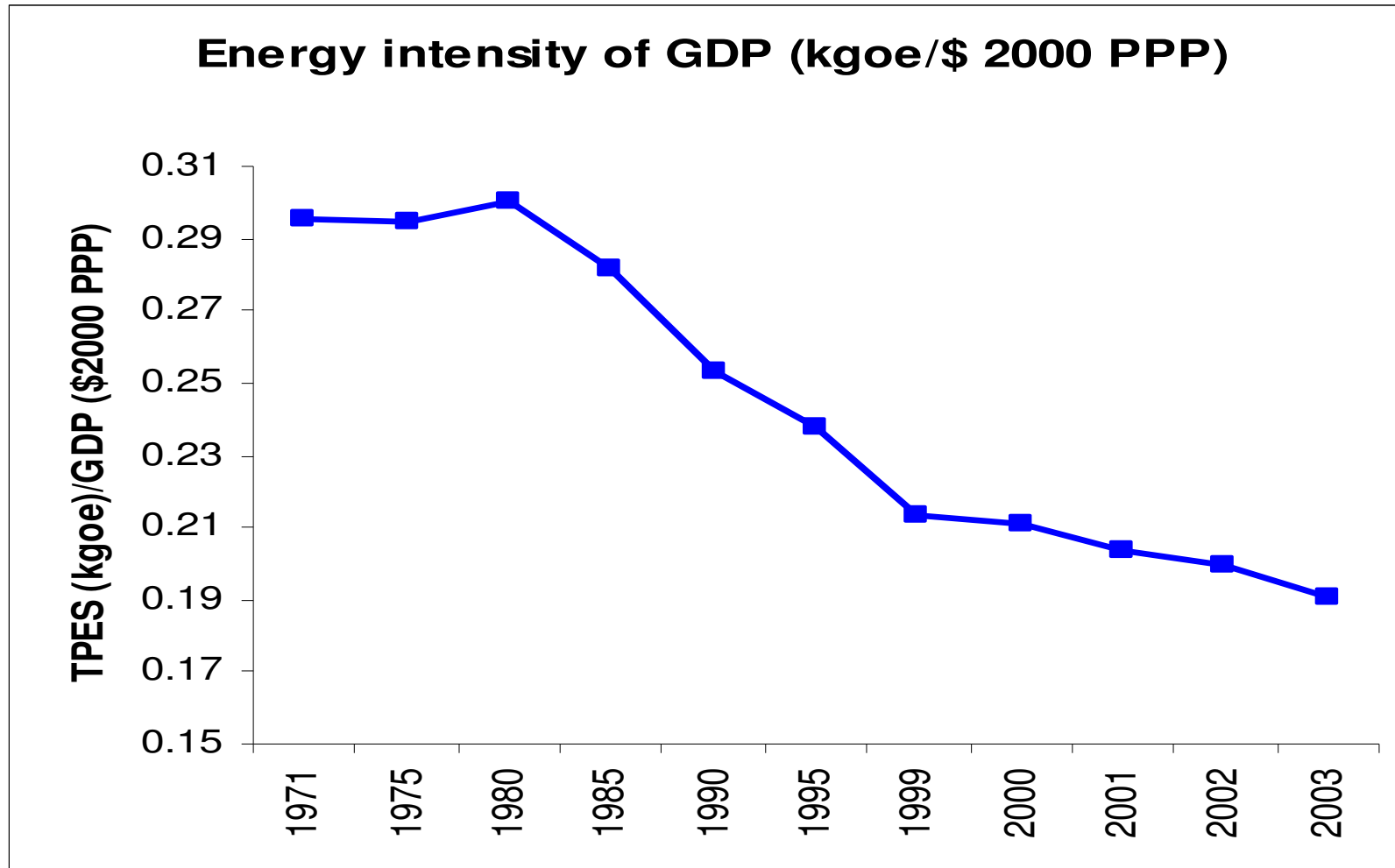


# India is NOT Following the Fuelish Path of Industrialized Countries

Energy intensity expressed as the amount of energy (in equivalent metric tonnes of petroleum) consumed to yield 1000 dollars of GDP



# Decreasing Energy Intensity Behind India's Sustainable Development



# India's Development Goals

1. Reducing the poverty ratio by 5 percentage points by 2007 and by 15 percentage points by 2012
2. Providing gainful and high-quality employment to the labor force
3. All children in school by 2003; all children to complete 5 years of schooling by 2007
4. Reducing gender gaps in literacy and wage rates by at least 50 % by 2007
  - Raising the literacy rate to 75% within the 10<sup>th</sup> Plan
6. Reducing the decadal rate of population growth between 2001-2011 to 16.2%

**The goals in blue are more ambitious than corresponding MDGs**

# India's Developmental Goals...

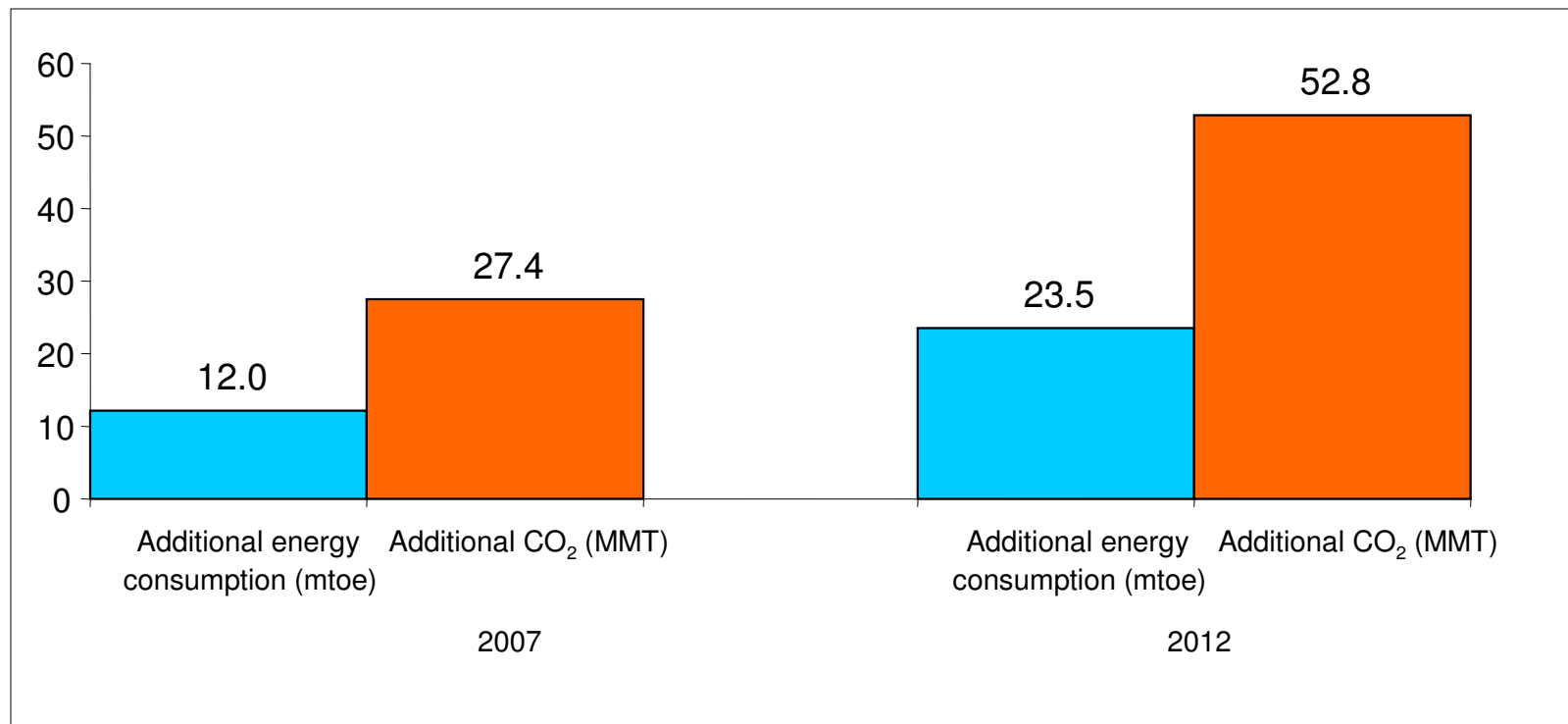
- 7. Reducing the Infant Mortality Rate (IMR) to 45 per 1000 live births by 2007 and to 28 by 2012**
- 8. Reducing the Maternal Mortality Ratio (MMR) to 2 per 1000 live births by 2007 and to 1 by 2012**
- 9. Increasing the forest and tree cover to 25 % by 2007 and 33 % by 2007**
- 10. All villages to have sustained access to potable drinking water by 2007**
- 11. Electricity for all by 2012**
- 12. Cleaning of all major polluted rivers by 2007 and other notified stretches by 2012**

# **Energy Implications of India's Development Goals**

# 1. Reducing the poverty ratio by 5 percentage points by 2007 and by 15 percentage points by 2012

- About 26% of India's population below poverty line in 2001 (Govt. estimate)
- National poverty line: 2100 calories/capita (urban); 2400 calories/capita (rural)
- 35% of Indian population < US \$1/day; 80% < US \$2/day (UNDP estimate)

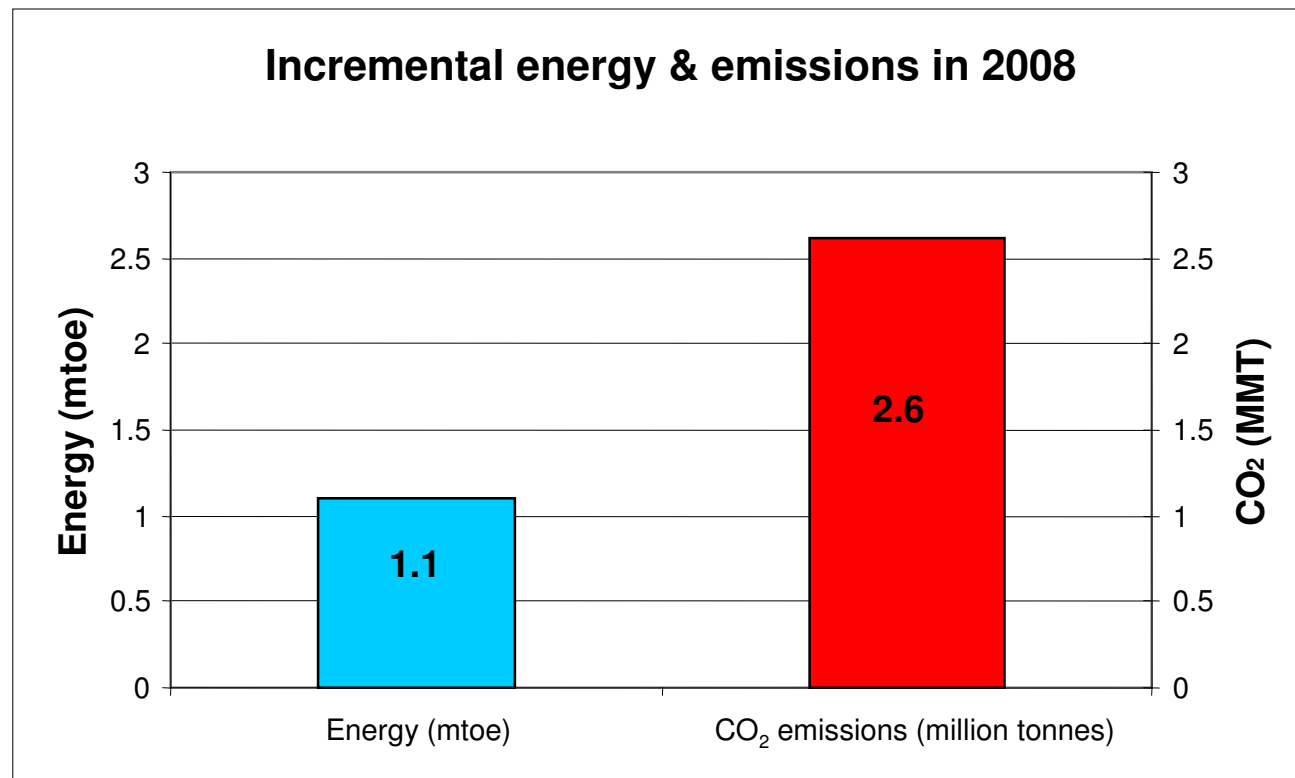
Annual incremental energy consumption & associated CO<sub>2</sub> emissions for reducing poverty ratios with 2001 as base year



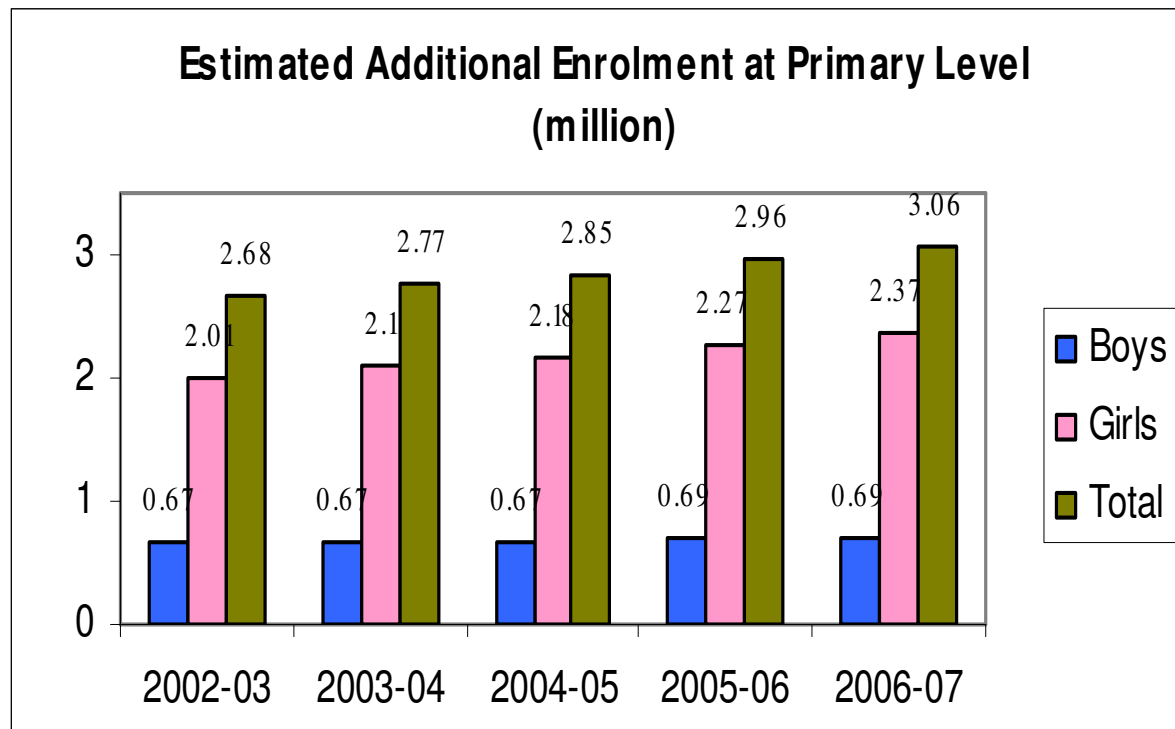


## 2. Providing gainful and high-quality employment to the labor force

- Estimated addition to labor force during 2002-2007: ~35 million
- Assumed that basic energy consumption patterns of the newly employed population changes from Below poverty line to Above poverty line



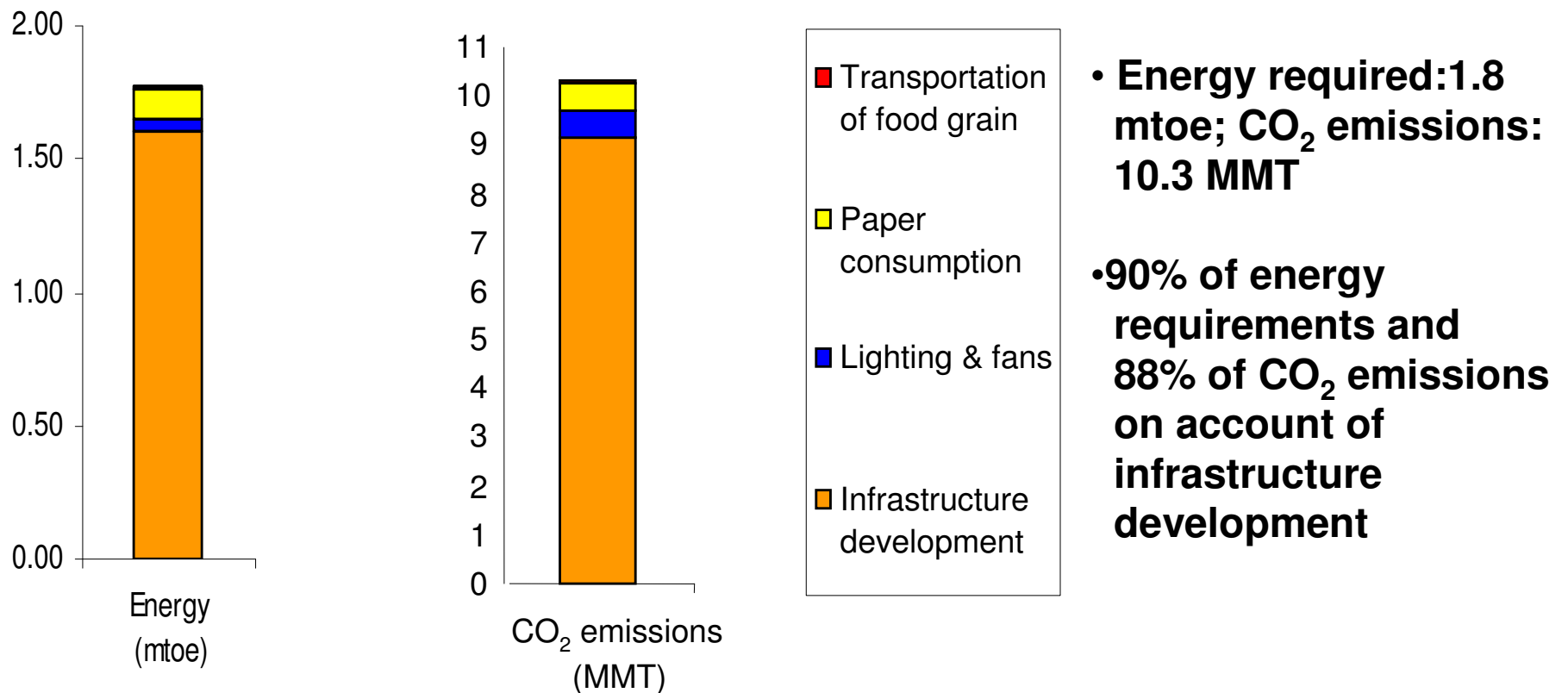
### 3. All children to complete 5 years of schooling; Increase in literacy rate to 75%; Reduction in gender gaps in literacy by at least 50% - by 2007



#### •Two major programmes of Government of India:

- **Sarva Shiksha Abhiyan (SSA)** – to achieve universal elementary education
- **National Literacy Mission: ~100 million persons (in age group 15-35 yrs) to be made literate through NLM scheme**

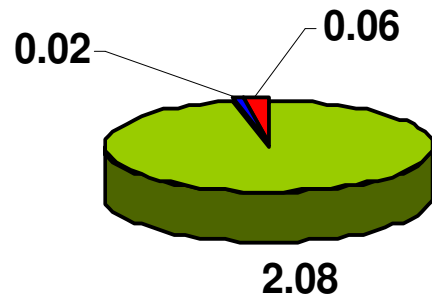
### 3. All children to complete 5 years of schooling; Increase in literacy rate to 75%; Reduction in gender gaps in literacy by at least 50% - by 2007



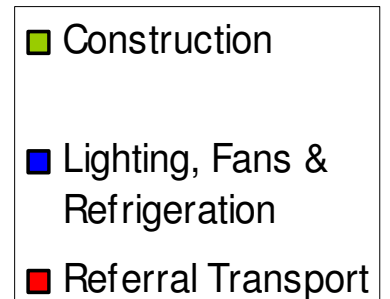
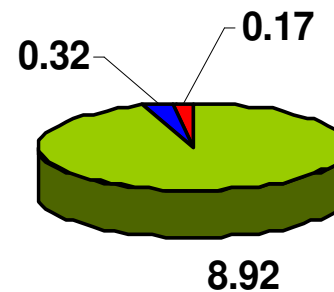
## 4. Health related targets

- Reduction in decadal growth rate of population during 2001-11 to 16.2%
- Reduction in Infant Mortality Rate to 45 per 1,000 live births by 2007 and 28 per 1,000 live births by 2012
- Reduction in Maternal Mortality Ratio to 2 per 1,000 live births by 2007 & 1 per 1,000 live births by 2012.

Energy Consumption (mtoe)



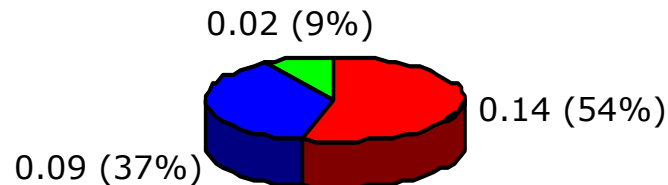
CO<sub>2</sub> emissions (MMT)



**Estimated increase in energy consumption & emissions due to additional infrastructure & services**

## 5. All villages to have sustained access to potable drinking water by 2007

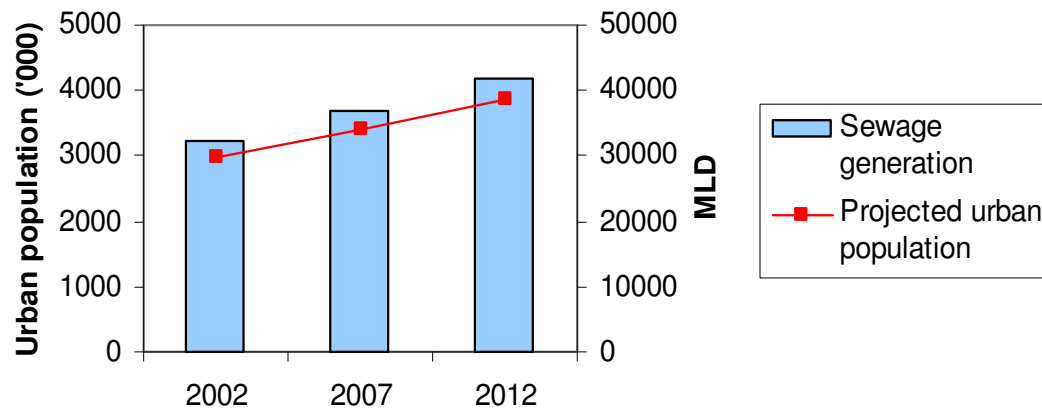
Energy Requirement for supply of clean drinking water to rural community (mtoe)



- Water extraction and distribution
- Water treatment
- Material requirement

- **2 GoI Programs:**
  - **Rajiv Gandhi drinking water mission**
  - **Swajaldhara (community led participatory program to provide drinking water in rural areas )**
- **15% of rural population not covered by safe drinking water → 1 million bore-wells needed (0.3 m motorized)**
- **5.6 million acre-foot of water to be treated**
- **30,000 tons of steel required for GI pipes**
- **0.26 mtoe energy requirement**
- **3.45 MMT CO<sub>2</sub> emissions**

## 6. Cleaning of all major polluted rivers by 2007 and other notified stretches by 2012



- Current sewage generation ~ 33,000 MLD; Treatment capacity 7,000 MLD
- Treatment capacity to be created → 26,000 MLD at national level + 1300 MLD under National River Conservation Plan (NRCP)
- Industrial effluent generation ~ 15,000 MLD; treatment capacity 9,000 MLD → 6,000 MLD discharged untreated by Small Industries
- Capacity requirement: 10 KW/MLD (STP); 12 KW/MLD (ETP)

- Energy required to meet target: 0.31 mtoe /year (till 2007)
- CO<sub>2</sub> emissions resulting from additional energy requirement: 4.2 MMT/year

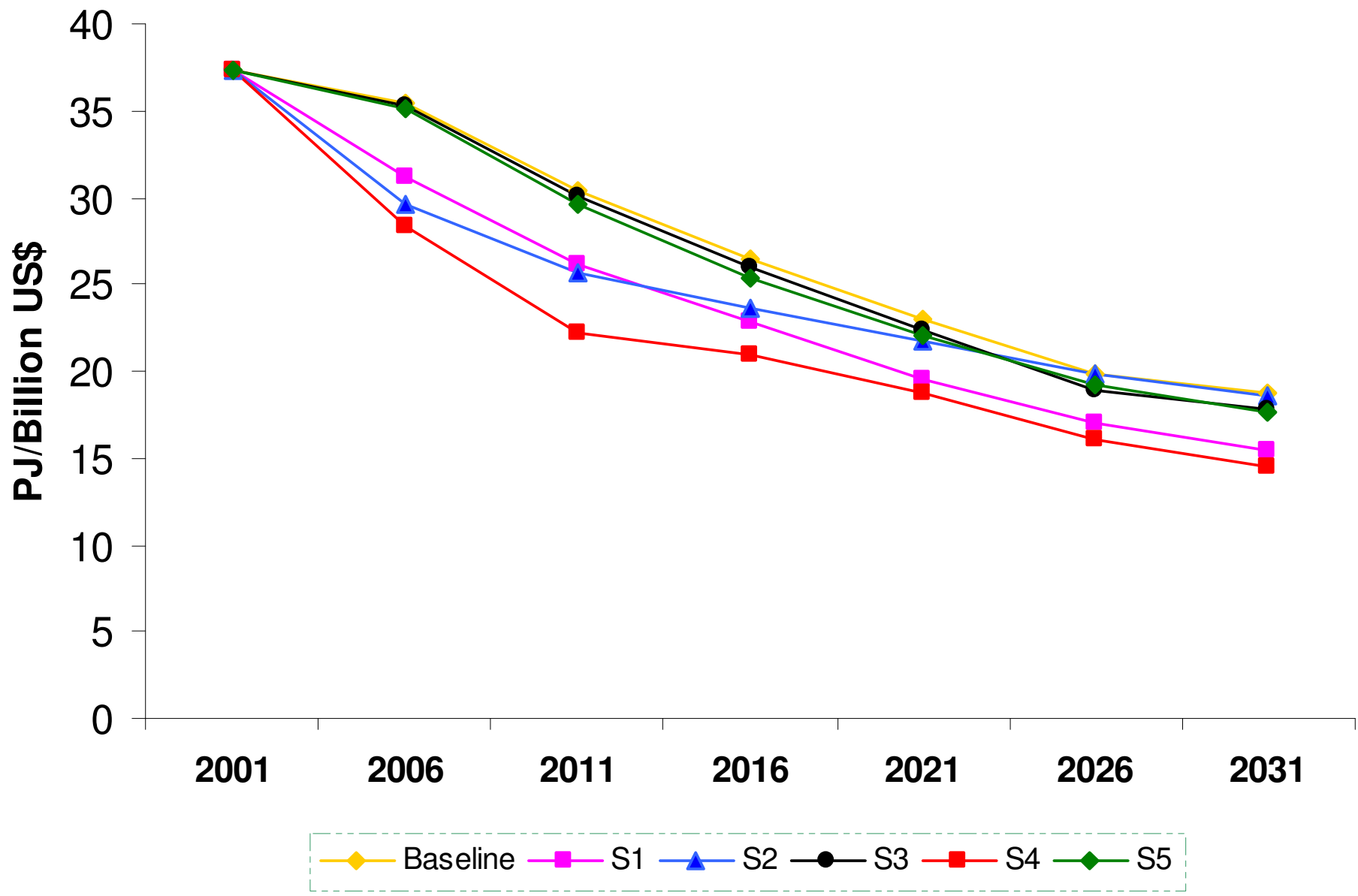
# **India's Policies For Sustainable Growth**

# India's Energy Policies: Scenarios Simulated by MARKAL (2001-2031)

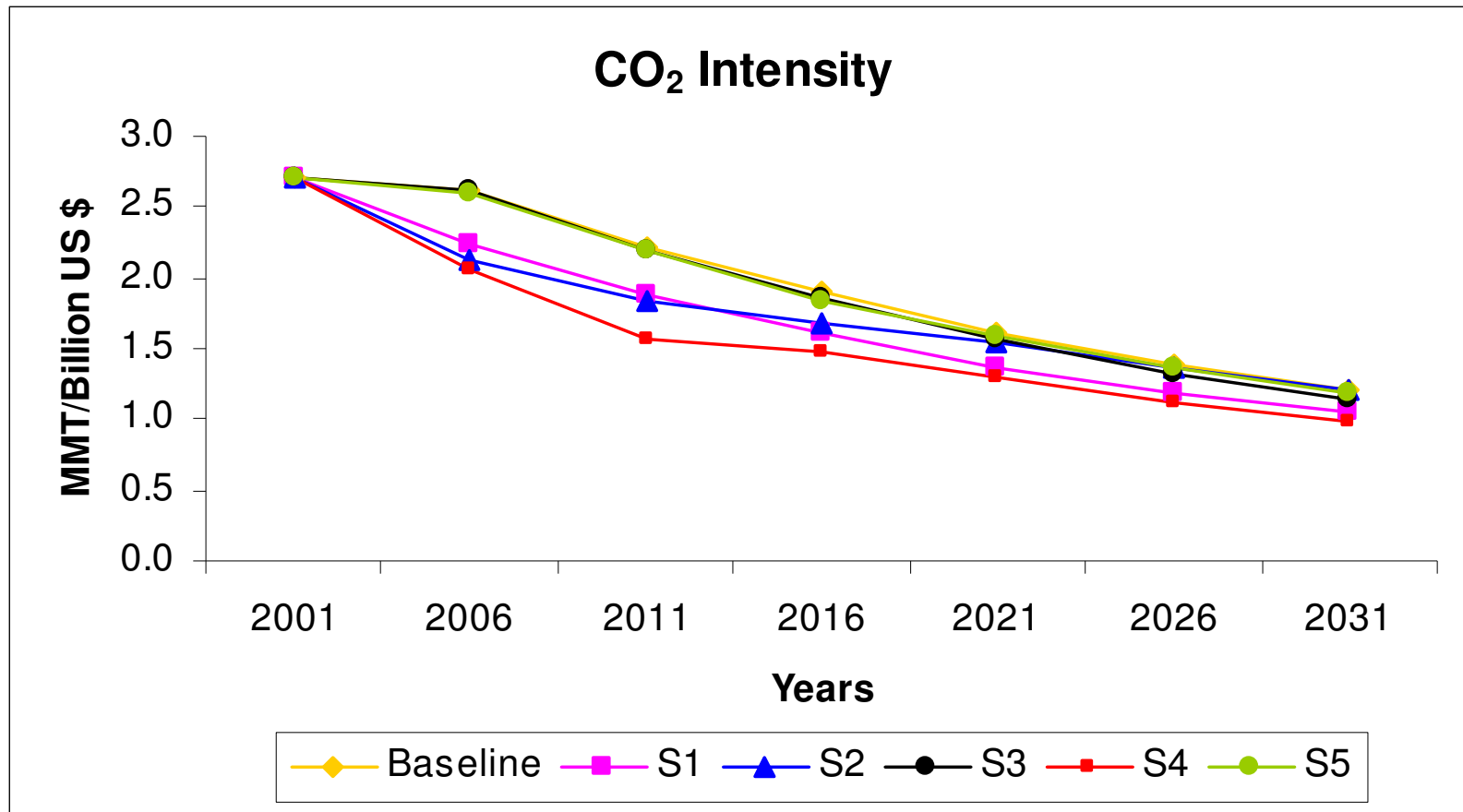
- **Baseline:** Base year 2001  
GDP growth 8%  
Official demographic projections  
IPCC emissions factors  
8% discount rate
- **S1:** Cleaner fuels for power generation
- **S2:** Electricity for all by 2012  
decentralized renewable options  
efficient cook stoves
- **S3:** 20% increase in share of public road transport  
Greater use of CNG in buses, taxis, 3-W vehicles
- **S4:** S1+S2+S3
- **S5:** Average annual GDP growth rate 6.7%



# Comparison of Energy Supply Intensity



# Change in India's CO<sub>2</sub> intensity as a result of Government policy initiatives



# India's per capita energy consumption remains low

	TPES/Capita (kgoe)
<b>India 2003</b>	<b>304</b>
<b>India 2003 (8% growth rate, BAU base case)</b>	<b>1240</b>
<b>India 2032 (8% growth rate, EE Scenario)</b>	<b>1042</b>
<b>World Average 2003</b>	<b>1688</b>
<b>OECD 2003</b>	<b>4668</b>
<b>USA 2003</b>	<b>7840</b>
<b>China 2003</b>	<b>1090</b>
<b>South Korea 2003</b>	<b>4272</b>
<b>Japan 2003</b>	<b>4056</b>

# **India's Technology Needs For Sustainability**

# Issues in Technology

- **Principles relating to technology transfer**
- **Country-specific circumstances**
- **Technology for sustainable development to be placed in limited public domain for developing countries**
- **Collaborative R&D to replace conventional technology transfer**

# India's Technology Priorities

- **Futuristic Technologies: Technologies at an early stage of R&D:**

## **(a) Next generation solar:**

- **Organic and polymer solar cells**
- **New material based thin film solar (telluride & indium thin film cells)**
- **Solar based regenerative fuel cells**

# **Futuristic Technologies for India...**

## **(b) Next generation biomass:**

- **Microbial fuel cells**
- **Microbial production of hydrogen from biomass**
- **Bioreactors for hydrogen production**

# **Futuristic Technologies for India...**

## **(c) Next generation coal:**

- **Liquefaction of coal to produce fuel oil**

## **(d) Next generation energy storage**

- **Advanced ultra-capacitors/super-capacitors**
- **Carbon nanotubes and glass micro spheres for hydrogen storage**
- **High density storage batteries**



# **Technologies to be adopted to Indian conditions:**

## **(a) Solar energy**

- **Tandem cells**
- **Low cost concentrator with PV**
- **Solar thermal sterling cycle**

## **(b) Biomass**

- **Enzymatic degradation of ligno cellulosic biomass for bio-ethanol and bio-methanol**
- **High yielding germ plasms for TBO plants**
- **MCFC / SOFC integrated with biomass gasifiers & gas turbines for power generation**

# **Technologies to be adopted to Indian conditions...**

## **(c) Coal**

- **Integrated gasification combined cycle (IGCC)**
- **In-situ coal gasification (UCG)**
- **Ultra-critical & supercritical coal combustion**

## **(d) End-use technologies**

- **Metal hydride based hydrogen storage**
- **Solar passive architecture**
- **Light emitting diodes**
- **Integrated hybrid PV water heating systems**

# **Technologies Requiring Removal of Barriers Specifically Cost Barrier**

## **(a) Solar energy**

- **Hybrid solar systems**
- **Solar concentrators**
- **Solar passive systems**

## **(b) Biomass**

- **Biomass gasifiers for power generation**
- **Thermal application of biomass gasifiers (process heat)**
- **Bio-oil from biomass by flash pyrolysis**

# **Technologies Requiring Removal of Barriers Specifically Cost Barrier**

## **(c) Coal**

- **Beneficiation of coal**
- **Higher conversion efficiency in existing plants**

## **(d) End use technologies**

- **Green building architecture**
- **Efficient appliances/processes currently in use**
- **Absorption refrigeration**
- **Solar thermal for residential / commercial and low-grade industrial**

# Issues On Adaptation

# Issues in Adaptation

## Principles for action on adaptation

- **The full ‘additional’ cost of adaptation should be financed and not just the incremental cost**
- **A simplified modality for predictable and flexible cost-sharing should be developed**
- **Adequacy and predictability of resources for financing adaptation should be ensured**

# **Adaptation issues...**

## **Principles for disbursing and managing funds available for adaptation**

- **Flexibility in decision making and processing**
- **Mechanism should enable wider access to resources in the pool- include regional and specialized agencies as implementing agencies**
- **A portfolio based approach that leads to:**
  - **Mainstreaming Adaptation in ongoing development programs**
  - **Technology development, diffusion and transfer**
  - **Insurance to enhance adaptive capacity**

# Adaptation issues...

## Way Forward on Adaptation:

- **Streamlining portfolio for programming adaptation interventions**
- **Studies for identifying specific interventions in Insurance --GEF to research current options and potential interventions**
- **Above Issues to be reflected in the Five-year Programme of Work on Adaptation being undertaken by SBSTA**