# Report of Group # 9






# Problem

Design a new energy policy which will enable economic growth, development and environmental protection whilst considering the needs of both urban and rural communities

# Plan of the talk

- Indian perspectives
- Zimbabwe perspectives
- UK perspective

# Options

(1) Decentralized power for rural electrification and during load shading

- Installation cost = ₹400000/- ( £5750/- ) for 5kW unit
- At present per unit electricity cost: ₹ 7/- (£ 0.1)
- Payback period = 1 and ½ years

(2) Location specific Renewable Installations (Wind in Gujarat, biomass in NE states, Solar in Gujarat, Maharashtra and Tamil Nadu)

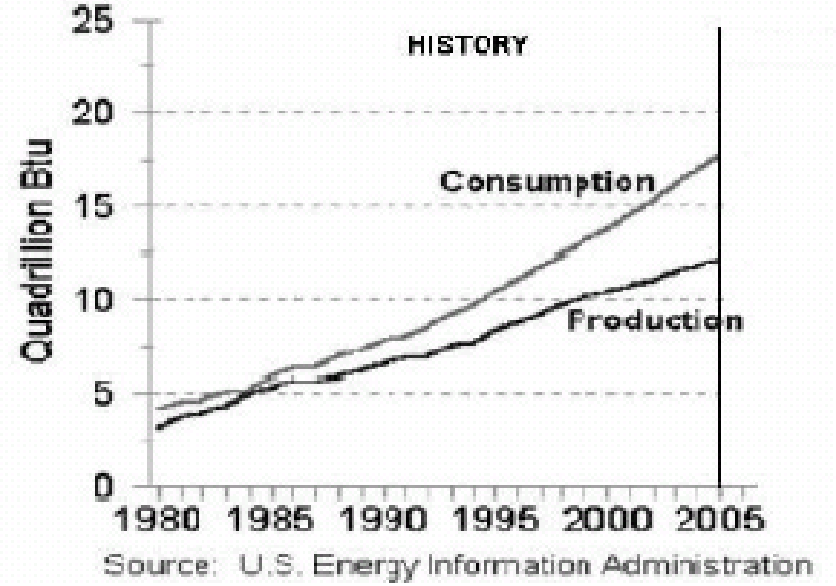
(3) Mini and micro hydro power plant for NE part of India (mega dam is not feasible as this region is earthquake prone - Zone#5)

(4) Efficient Building design (ECBC code) to reduce energy consumption in Air Conditioning (~30% and 45% energy is consumed in summer at IITG and IITB respectively)

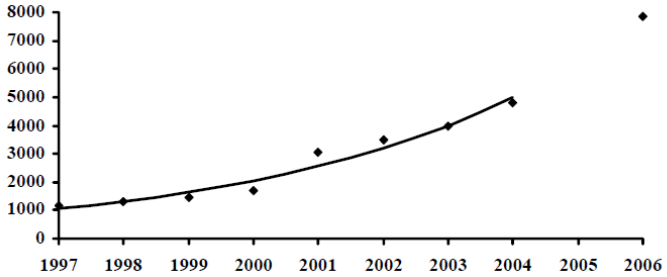
(5) Proper planning for road traffic to minimize energy consumption and emission.

# Why biomass energy?

- Installed electric power generation capacity is 100 GW with a gross generation of 480 billion kWh - far insufficient
- Fossil fuels are fast depleting
- **Gap between supply and demand increasing**
- Green house gas emissions steadily increasing and causing concern




*Renewable Potential-50GW,* Biomass-20GW




**Biomass is a renewable source and available in abundance**

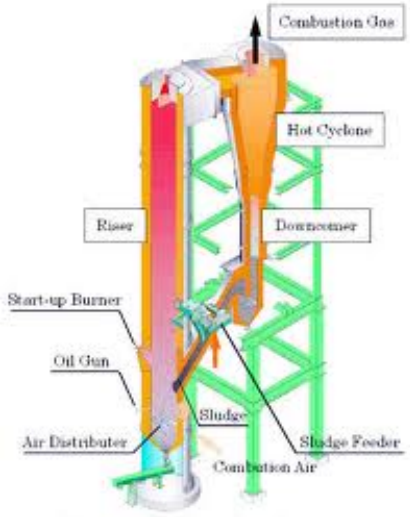
# Gasification-India, Zimbabwe and UK

- Popular downdraft: 5-500 kW
- CFB: Large Scale (MW level)

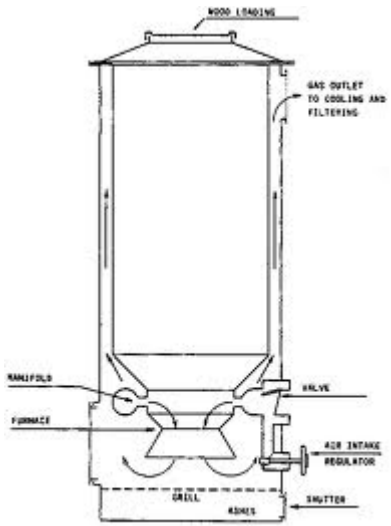
- Utilization of rice husk and rice straw (both raw and briquette form)

Raw rice husk – CFB Gasifier

Briquette – Downdraft Gasifier




**Collection---pellet---transport**




By product utilization: Si for solar PV

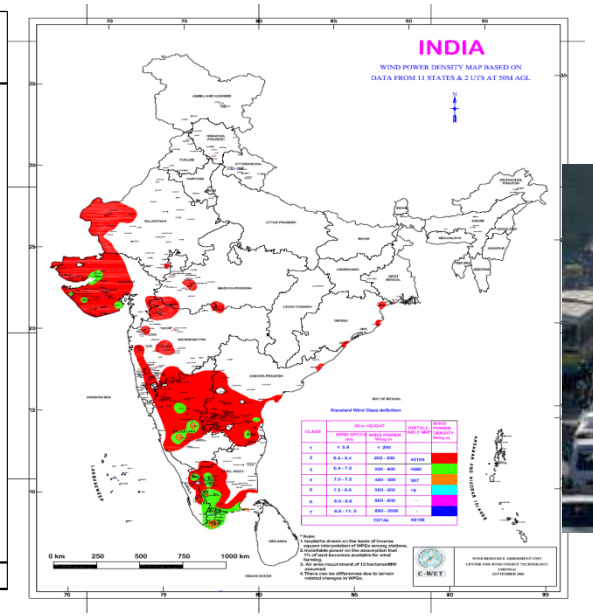
NOx, SOx reduces significantly

# Biogas and Wind

- **Public Acceptance**
- **Community Basis**
- **Entrepreneur development - SS**
- **Portable/mobile plastic biogas digester-Urban**

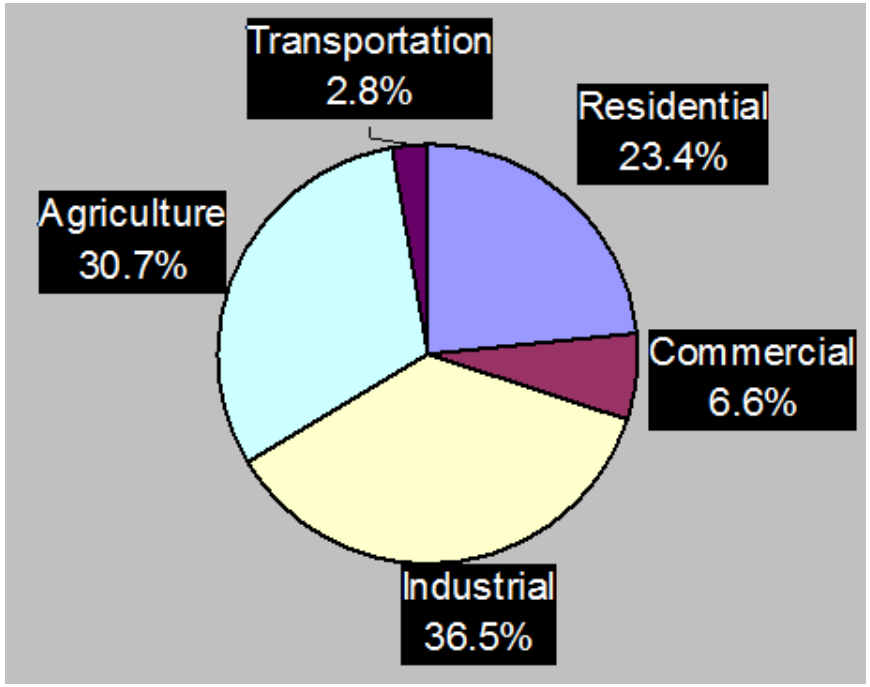
Wind: Location specific

| Sl. No. | State | Gross Potential * (MW) | Technical Potential # (MW) |
|---|---|---|---|
| 1. | Andhra Pradesh | 8275 | 1920 |
| 2. | Gujarat | 9675 | 1780 |
| 3. | Karnataka | 6620 | 1180 |
| 4. | Kerala | 875 | 605 |
| 5. | Madhya Pradesh | 5500 | 845 |
| 6. | Maharashtra | 3650 | 3040 |
| 7. | Orissa | 1700 | 780 |
| 8. | Rajasthan | 5400 | 910 |
| 9. | Tamil Nadu | 3050 | 1880 |
| 10. | West Bengal | 450 | 450 |
| | **Total** | **45195** | **13390** |




# ECBC-Urban

- Energy savings are of the order of 50%
- Initial cost increases by 10 to 15%, but payback is obtained in 5 to 7 years



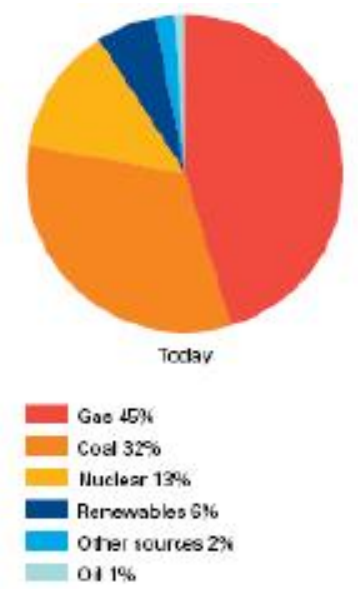

✓ The most cost effective way to meet the ECBC requirement is to design buildings with appropriate regard to climate and sun

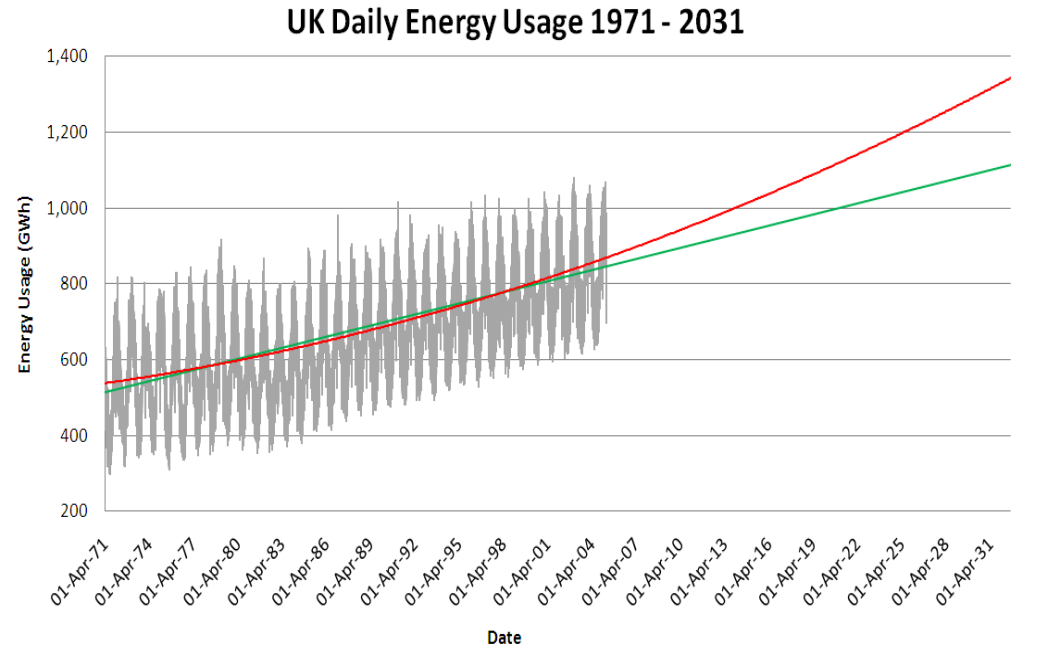
# Steps to full fill/ policy framework

- Motivation to the public for acceptance of technology
- Community biogas – UK (Farm), India, Zimbabwe
- Local entrepreneurship development for successful implementation of technology
- Government initiative / subsidy for the installation of demonstration projects on renewable energy technologies.
- Finance from other sources
- Development of mechanism/methodology for community based RETs for proper functioning

(everybody's business is nobody's business)

# UK Power Generation - Demand




78% Reliance on fossil fuels for electricity production!

46% Gas

32% Coal

- The energy demand is increasing in both India and the UK.
- India already experiences an energy gap whilst the UK is set to with the expected demand growth and limited planned new generation

# Current Problems with UK Energy

Future supply

- LCP Directive – Emissions based closures
- End of Life
- New nuclear not planned before 2020

Energy transmission

- Distance from suitable sites to peak demand areas

GHG Emissions

Rising fuel Price

Loss of efficiency due to CCS tech

Energy consumption – very high per capita figures

Energy poverty

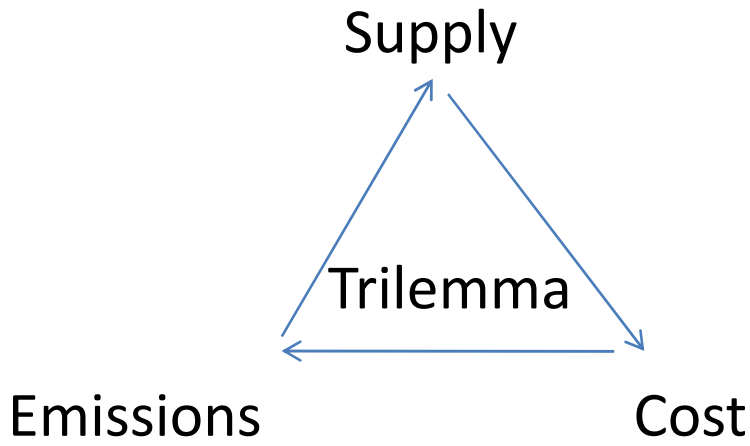
# UK Policy 1

The 2008 Climate Change Act

- Cut UK carbon emissions by 34% by 2020
- 80% by 2050.

Continuing pressure to reduce NOx, SO2 and particulates emissions.

Decarbonise the economy.



# UK Policy 2

RO and Carbon Trading - ROC (Renewable Obligation Certificate)

Renewable sources

Targets started at 3% in 2002/03, 11.1% for 2010/11 rising to 15.4% in 2015/16)

NERP – National Emission Reduction Plan – 2007

Minimum limits for emissions of $SO_2$, NOx and dust from (large combustion plants) LCPs with a thermal rating equal to or greater than 50 MW.

Allow "existing" LCP's (those first licensed before 1 July 1987) to trade their annual allowances for sulphur dioxide (SO2), nitrogen oxides (NOx) and dust (particulates) with other LCPs within the Scheme. Scheme will result in some plant closures by 2015.

# UK Policy 3

Feed in tariffs – Now limited to 50kW - The scheme provides a fixed payment for the electricity you generate, called the “generation tariff”. It also pays for any unused electricity that you export to the grid, the “export tariff”. A further benefit is that you won’t have to pay for the electricity that you generate and use yourself.

Past scrappage schemes – e.g Central heating boiler replacement scheme was a success, reached 125,00 target in March 2010

Carbon Off-setting

## Clean Energy Development Requirements

Increased us of renewables

Movement towards low carbon fossil fuels

New plants to meet current (India) and future (Uk) energy gaps

Clean energy but cost effective to produce and affordable to the consumer

# Potential UK Solutions

Balanced Portfolio

Greater renewable use and with increased offshore wind capacity

Network links – Coast DC-AC transformers (offshore wind)

Increasing use of Biomass

Increase in biomass co-firing

Conversion of LCP directive causality coal plants

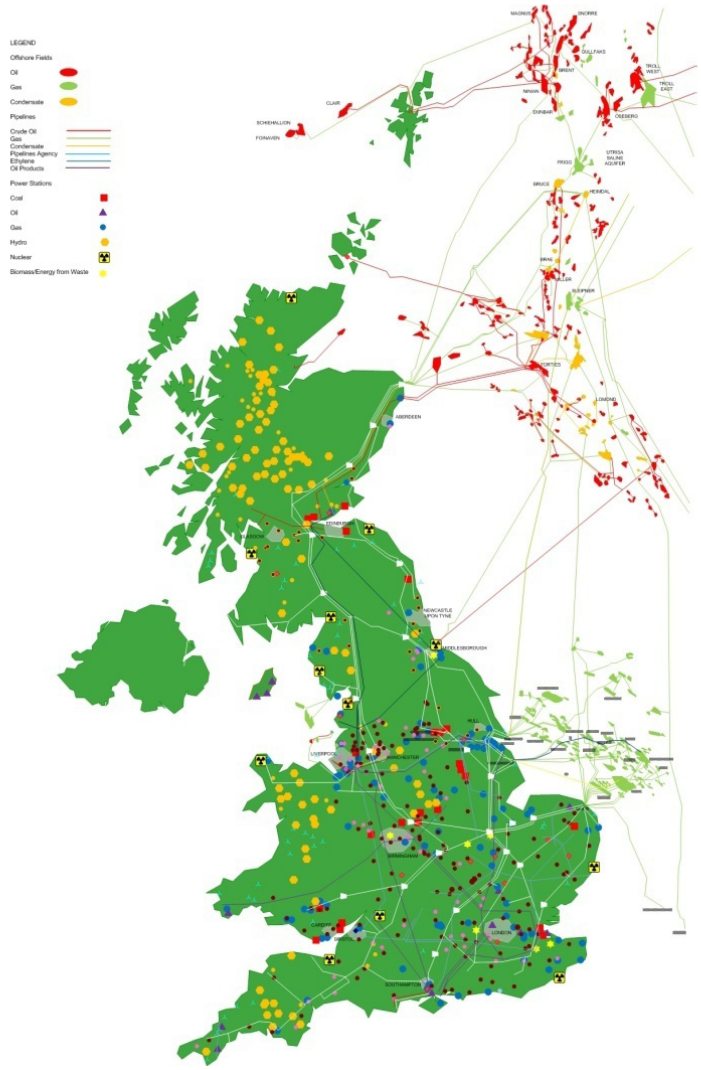
Increased power plant efficiency requirement due to CCS implementation

**Nuclear plans** – (base load) will renewables be able to provide

# Geographic Suitability and Transport

North East Midlands and South East Yorkshire geography and transport infrastructure ideal for a number of development technologies

UK – 2008, Power Assets and Infrastructure



Well developed North Sea Oil + Gas Industry and pipeline Infrastructure

Clear routes to midlands power stations for $C0_2$ transport

Large Offshore $CO_2$ storage

Good network routes for potential offshore power generation transfer to grid

# Biogas in Rural UK

Farmers in the UK  can utilise methane rich gas from their maize and grass and animal waste to produce their own electricity by burning it in a generator

The biogas created is used to fuel a combined heat and power unit to produce electricity which is then exported to the National Grid.

The end product of anaerobic digestion technology is a balanced, fibrous natural fertiliser called ‘digestate’ – which can be spread on land to provide a major proportion of yearly crop nutrient requirements

# Nuclear Power in the United Kingdom

The UK has 18 reactors generating about 18% of its electricity and all but one of these will be retired by 2023.

At present new nuclear power stations are expected to be built in the UK to replace them although the Japanese earthquake disaster may have an effect on public acceptance

# Drivers for Change and Public Perception

Drivers for change from both public pressure groups and government

Public perception is very important. Support from the general public has to be gained for technological success – therefore public education is vital in the UK

'Not in my backyard' mentality and media scares have been a problem in the past

Energy usage per capita is much greater in the UK than India, therefore personal consumption variation has a much bigger impact. 'Turn the lights off, to keep the lights on'

# Thank you

# Energy policies of India

- Increasing energy deficit largely effects the energy policy of a country
- Current Fuel demand 3-4 times
- generation of electricity  5-6times should be done in the upcoming years
    - coal  is responsible for 70% power generation
    - It is going to be the primary in the future (~2030)
    - But if it goes like this, pollution will be more
- we should look for energy efficient technologies and alter native energies
- India mainly concentrated in Nuclear, solar, and wind
- Energy conservation has emerged the effective energy policy of India.
- Rural electrification is the major issue to establish in the country
- Rural Electrification board provides the  facilities to power the rural
    - Encouraging private companies, providing incentives, subsidies,

# Energy policies of India

- Solar in theoretical has a excellent opportunity for electricity generation
- But the initial total cost is high for generation and storage(research is on for cheap solar materials and, storage systems)
- But the installation of solar has to be done.
- India looking at 700 to 2,100GW installation of Solar in Thar desert
- Present installed one less than 1 %
- Electricity cost 3-5% more than the conventional , land scarcity and slow progress
- Future applications, rural, agriculture, solar heating
- Encourage of private companies, providing subsidy 30-70% for installation of solar plants

- In wind India is the fifth largest one to generate electricity
- Drawbacks are initial cost is more than the commercial ones, and the noise problems
- 13000MW installations, it adds 1.6% of the total electricity in India

# Energy Conservation in Buildings

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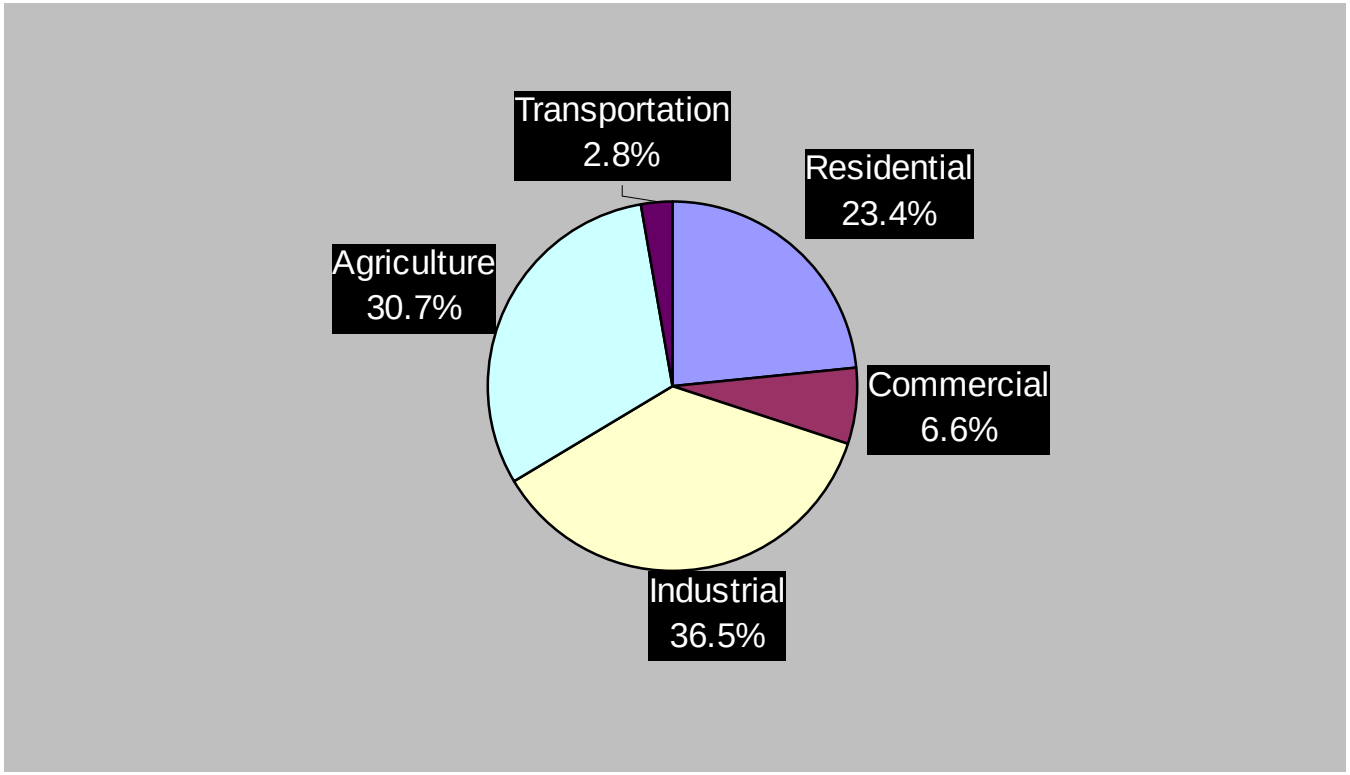
- BEE was set up in March 2002 under the provisions of Energy Conservation Act of 2001 to provide a legal framework for the government's energy efficiency initiatives in the country.
- The Bureau's mission is to develop policies and strategies with a thrust on self regulation and market principles with the primary objective of reducing energy intensity of the Indian economy.
- 40-60% can be reduced in green energy buildings compare to the conventional

- BEE (Bureau of Energy Efficiency)

# Sector wise Energy Consumption

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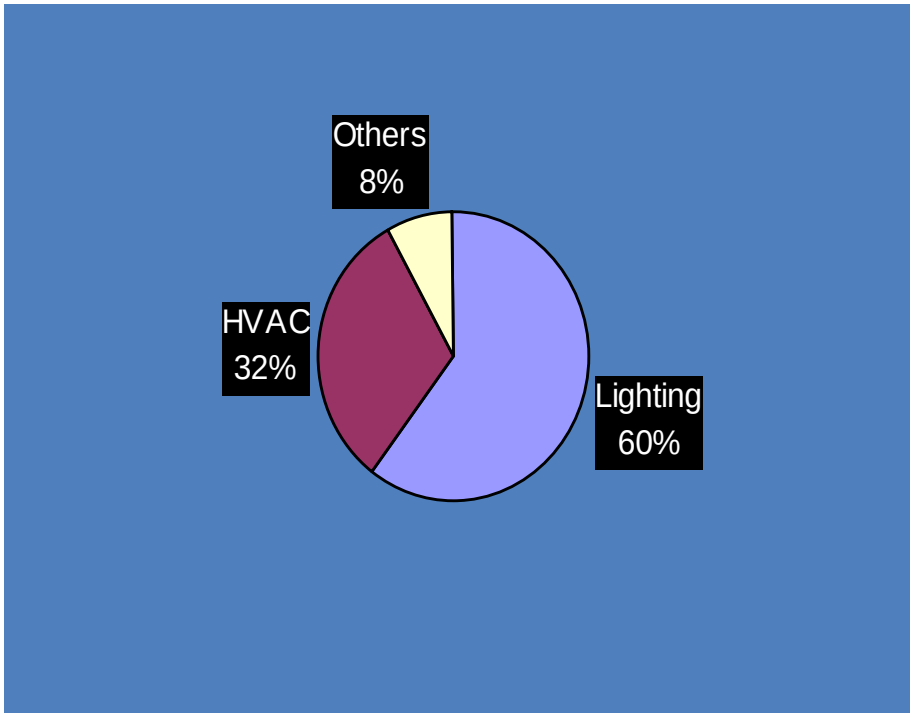
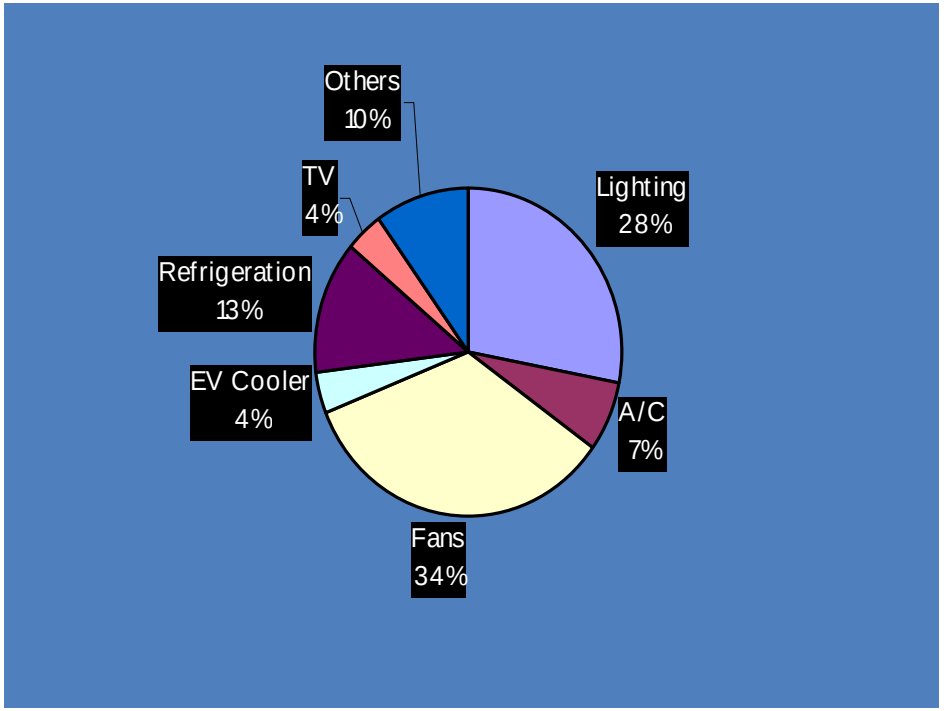
# Energy Consumption in Commercial and Residential Buildings

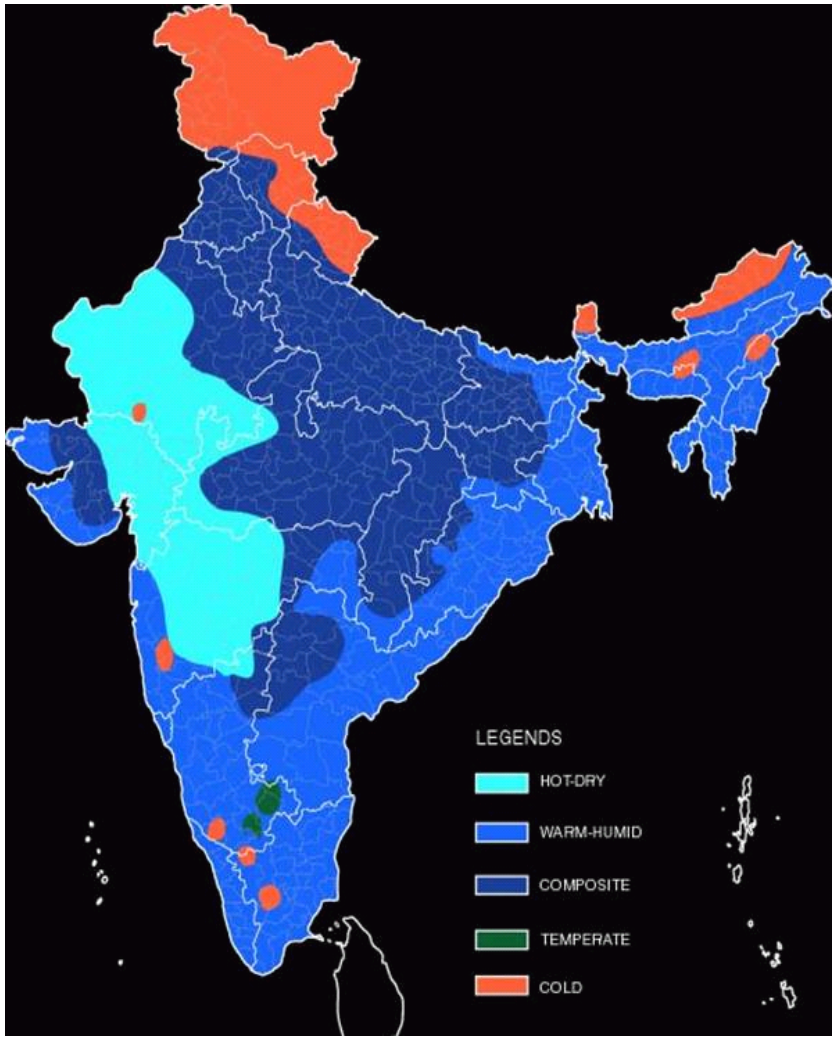



**Commercial buildings**
**33 billion units**

**Residential buildings**
**116 billion units**

# Climatic zones in India




## Five climate zones

1. Composite (not any below for 6months or more) (Delhi)
2. Hot Dry(>30°C, < 55% RH) (Ahmadabad)
3. Hot Humid (>30°C, > 55% RH) (Kolkata),
4. Moderate (25-30°C, < 55% RH) (Bangalore)
5. Cold (< 30°C, < 55% RH) (Shillong)

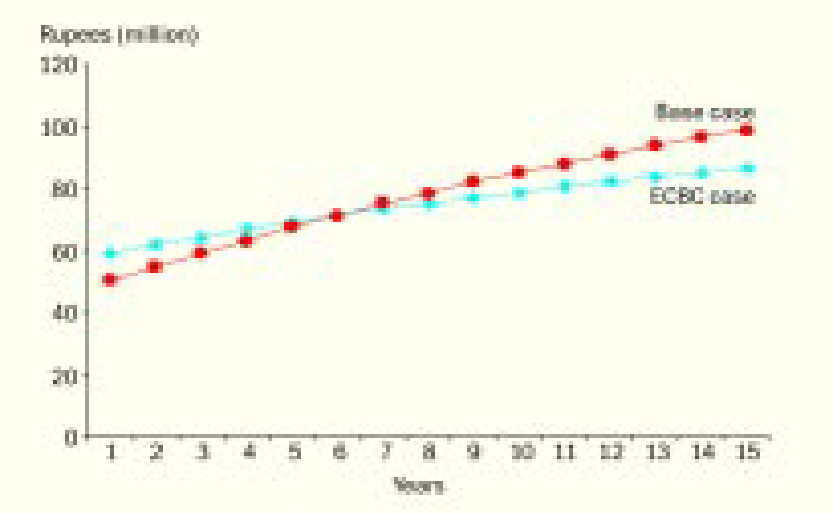
# What should we need?

- An extensive data collection was carried out for construction types and materials, glass types, insulation materials, lighting and HVAC equipment
- Base case simulation models were developed
- The stringency analysis was done through detailed energy and life cycle cost analysis.

# Building components

- Building components included
  - Building Envelope (Walls, Roofs, Windows)
  - Lighting (Indoor and Outdoor)
  - Heating Ventilation and Air Conditioning (HVAC) System
  - Solar Water Heating and Pumping
  - Electrical Systems (Power Factor, Transformers)

# Case studies




- Case study 1
- IIT Kanpur,  CESE Building
- Case study 2:
- Fortis Hospital
- For lightening system
- 33% reduction in Lightening burden
- More than 35 projects were developed and
- The Reserve Bank of India's buildings in Delhi and Bhubaneswar in Orissa have already been rated 4 star and 5 star respectively.
- CII-IGBC is planning  a building design for residential first time in the world at Mumbai, with platinum rated and
- Aliens -Space Station 1 and Space station 2 -Residential project gold rated

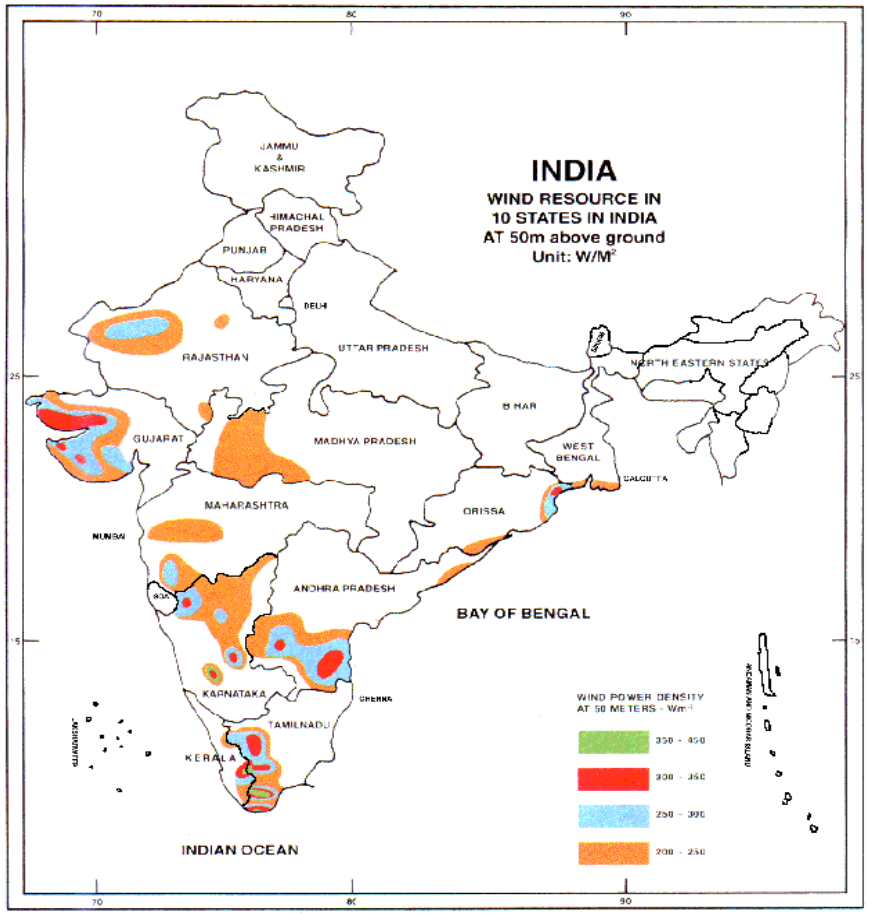
- Energy savings are of the order of 50%
- Initial cost increases by 10 to 15%, but payback is obtained in 5 to 7 years
- The most cost effective way to meet the ECBC requirement is to design buildings with appropriate regard to climate and sun.
- A design not sensitive to sun and climate will have to invest more to meet the minimum ECBC standard

More are under study , to reduce 5-15 % reduction in energy consumption

India's largest photovoltaic (PV) power plants

| Name of Plant | DC Peak Power (MW) | GW·h /year[10] | Capacity factor | Notes |
|---|---|---|---|---|
| Sivaganga Photovoltaic Plant[11] | 5 | | | Completed December 2010 |
| Kolar Photovoltaic Plant[12] | 3 | | | Completed May 2010 |
| Itnal Photovoltaic Plant, Belgaum[13] | 3 | | | Completed April 2010 |
| Azure Power - Photovoltaic Plant[14] | 2 | | | 2009 |
| Jamuria Photovoltaic Plant[15] | 2 | | | 2009 |
| NDPC Photovoltaic Plant[16] | 1 | | | 2010 |
| Thyagaraj stadium Plant-Delhi[17] | 1 | | | April, 2010 |
| Gandhinagar Solar Plant[18] | 1 | | | January 21, 2011 |
| Tata - Mulshi, Maharashtra[19] | 3 | | | Commissioned April 2011 |
| Azure Power - Sabarkantha, Gujarat[20] | 5 | | | Commissioned June 2011 |
| Moser Baer - Patan, Gujarat[21] | 30 | | | To Be Commissioned July 2011 |

# Wind power India




Map not strictly according to scale