# Green Development of India: Need of the Hour

Kanhaiya Singh
(NCAER, New Delhi)

## ASIA'S GROWTH AND DEVELOPMENT CHALLENGES AFTER THE GLOBAL FINANCIAL CRISIS

Promoting Green Development Initiatives

**ADB and The Earth Institute Columbia University**

**ADB Auditorium, ADB Headquarters**

**Manila**

**August 3-4, 2015**

# Key Theme: Need for Green Development in India

## Major constraint to sustainability of Indian Economy

### Energy:

- Coal has finite reserve
- High Dependency on import of Oil, Gas, and even coal (about 30 per cent of total energy consumption)
- There are Environmental concerns of hydro power: Floods and disasters (like Himalayan Outburst)
- Initiatives in Renewable Development is already delayed

### Water

- Per Capita Water Availability in India is low (one fifth of world average) and reducing
- Water Resources of India are inadequately managed
- Rain water is underutilized and wasted
- River system is under stress due to excessive withdrawal and disposals of sewage and industrial affluent causing pollution of major river systems (Ganga Basin itself affects one third population of India)
- Increasing threat of diseases, contaminated food and loss of aquatic life

## Challenging Socio-political system

- Increasing Population Pressure
- Unsystematic Urbanization
- Increasing number of Urban Poor
- Urban aspirations of Rural India
- Democratic constraints, which do not allow even most obvious economic decisions for petty politics

All this and more requires assessing and internalizing Green Economics to present a research based blue print

**Focus of this presentation is however, ENERGY**

# Structure

- Ancient Wisdom
- Global Perspective and Some reflection on the Future picture
- Remedial Measures and Need for Green accounting
- Initiative underway

# Philosophy of Ancient Wisdom

Since time immemorial, Sanskrit literature has preserved the philosophy and wisdom of Love for Nature and maintain harmony with it

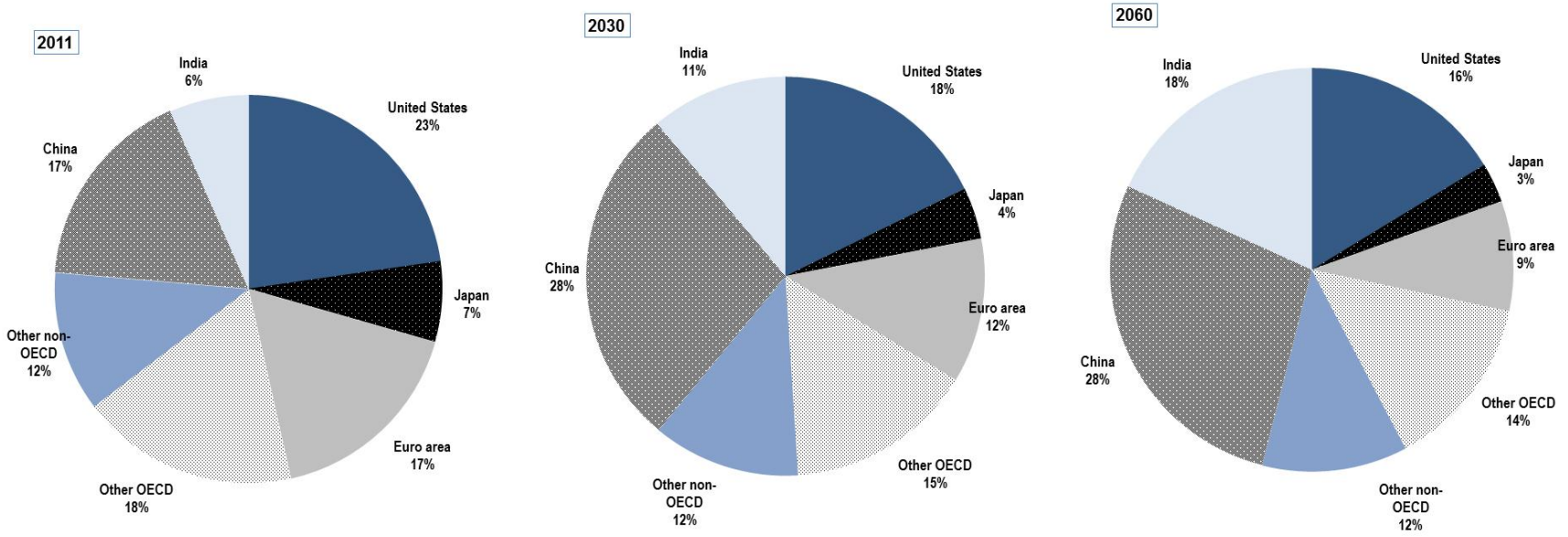
- Sun
- Air
- Trees
- Rivers
- Animals
- Mountains and
- Soil and Earth itself, all are worshiped with great respect in India

- But, for material reasons we destroyed forests, polluted rivers, abused mountains and exploited soil with inadequate effort towards replenishment.
- However the ancient wisdom for harmony with nature must have evolved out of rich experience and NEED, which we seem to forget
  - Need is the mother of all changes while
  - Abundance is the mother of all wastages
- Very soon India would find green development as most desired instrument for survival and it has already sensed its importance. But, the progress has been slower thus far. Possibly due to constraints in terms of monetary resources and compulsion of poverty eradication:
- Individually wise but collectively unapologetic. We have to come out of that.

# Understanding the Future:
# Changing Income Map of the World

Major changes Predicted in the composition of global GDP (2005 PPP)

Source: OECD Economic Policy Paper No. 3: Looking to 2060: A global vision of long-term Growth - © OECD 2012

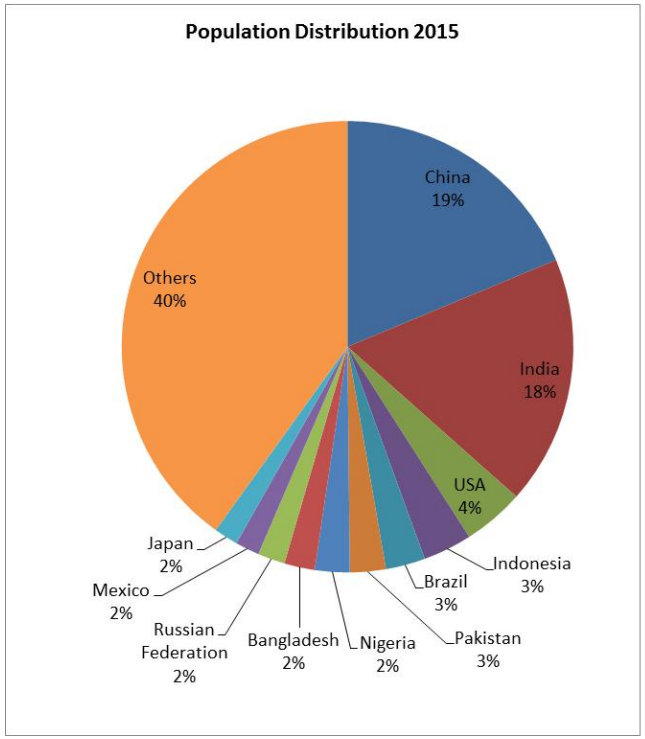


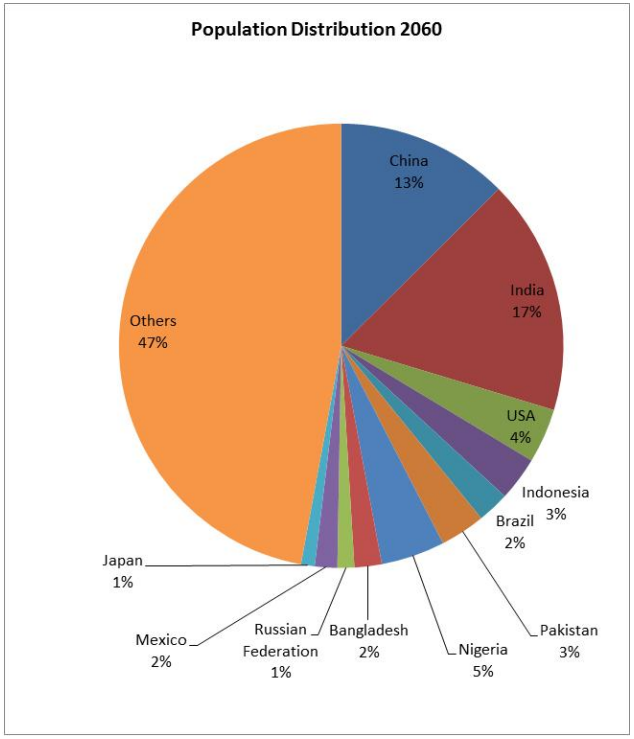

So, 60 years down the line India may be a big country but possibly not so rich country

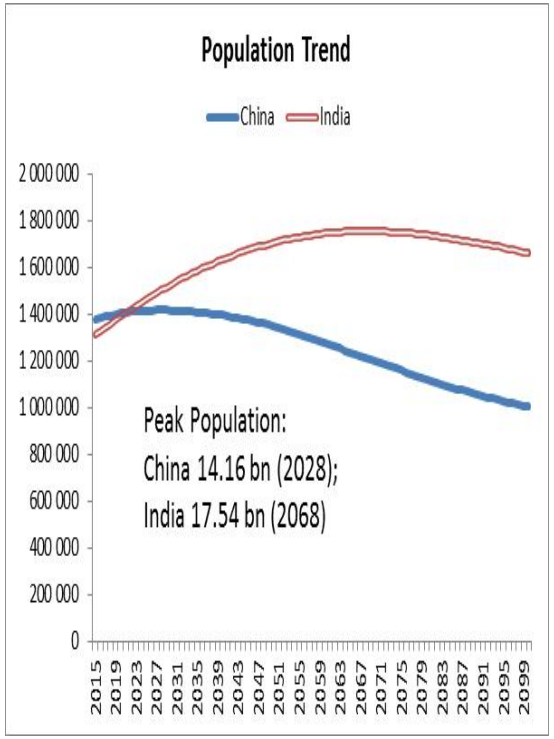
# Understanding the Future: Population

India would still be carrying the one sixth of world population. However:

- Population may be on decline
- Rural Population would still be almost 50 per cent
- Population density might have almost doubled in urban centers
- Pressure on Water bodies and Energy resources would have increased manifolds
- people would be more demanding and aspirational as individual income might be as high as one third of that USA compared to one twentieth at present
- Political compulsions might have increased/decreased
- Challenge of Skill Development and Job creation might take new dimensions



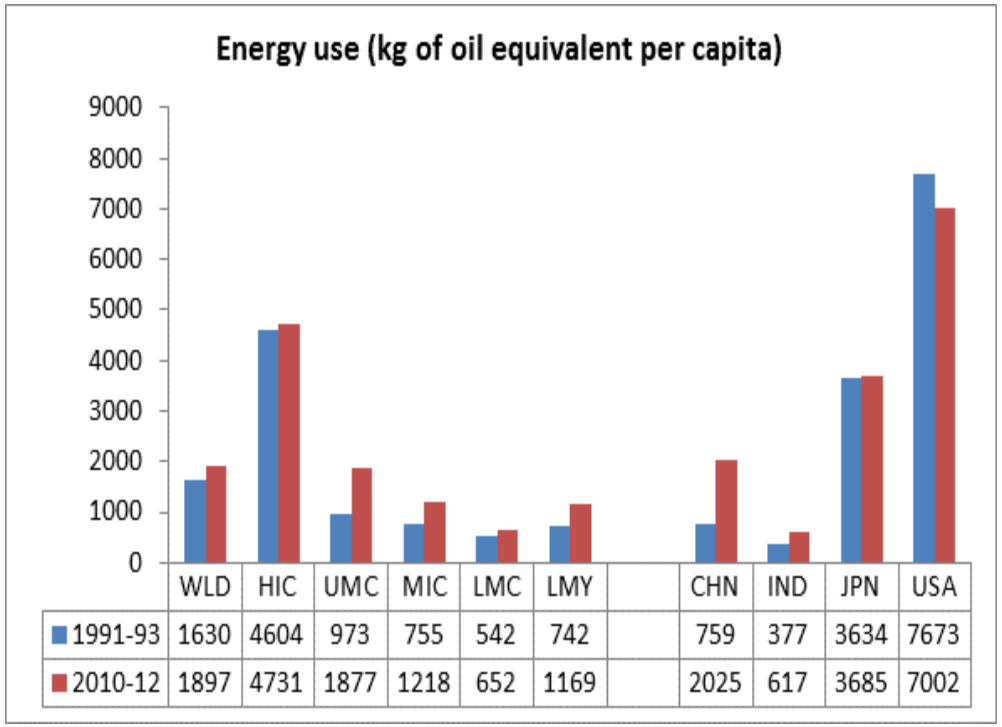



# Understanding the Future: Energy Intensity

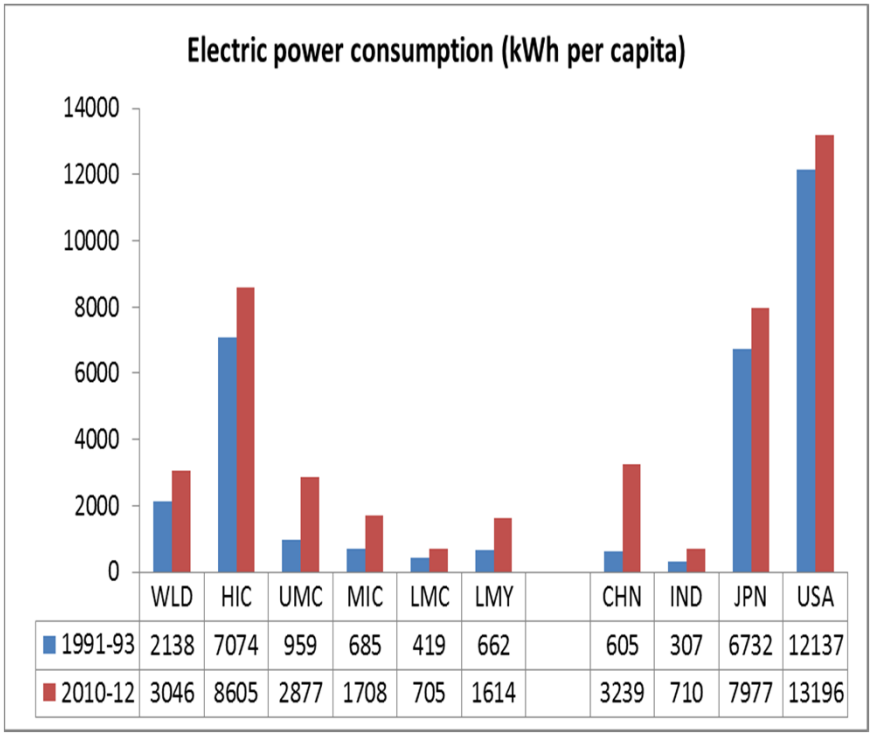
Total energy use in per capita terms is increasing globally but Japan appears to have stabilized, which can be a bench mark for others

However India and China are still far behind and therefore, accelerated growth of total energy demand is inevitable

Growth of Energy in terms of electricity is much more than the growth of total energy, which can be a good trend provided additional electricity is generated through clean technologies, but it seems to be less likely.




| | WLD | HIC | UMC | MIC | LMC | LMY | | CHN | IND | JPN | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991-93 | 1630 | 4604 | 973 | 755 | 542 | 742 | | 759 | 377 | 3634 | 7673 |
| 2010-12 | 1897 | 4731 | 1877 | 1218 | 652 | 1169 | | 2025 | 617 | 3685 | 7002 |

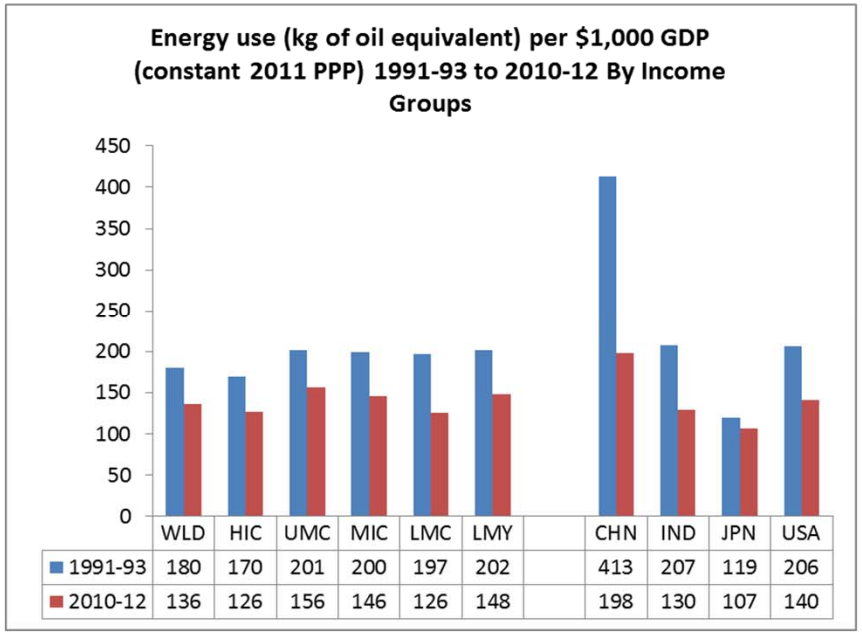


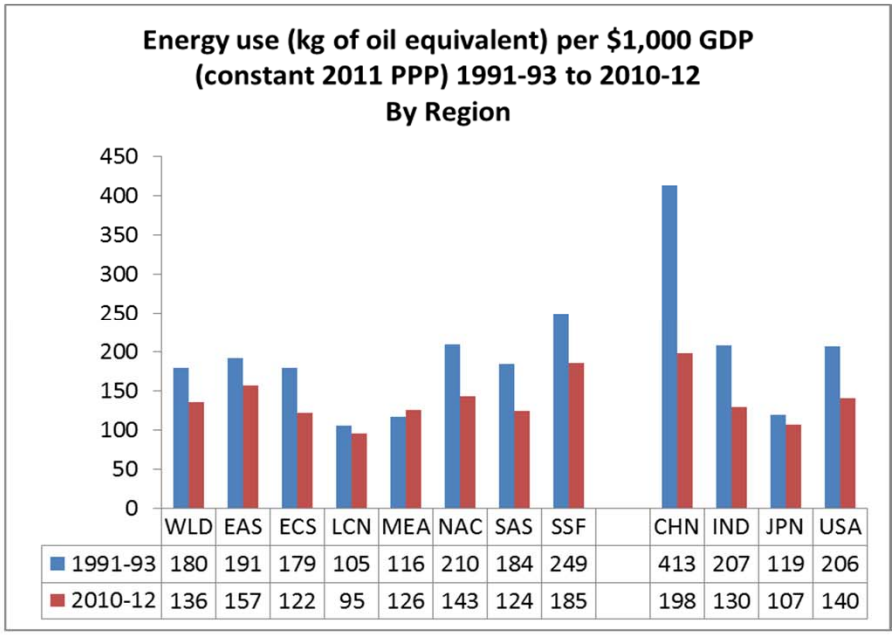

| | WLD | HIC | UMC | MIC | LMC | LMY | | CHN | IND | JPN | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991-93 | 2138 | 7074 | 959 | 685 | 419 | 662 | | 605 | 307 | 6732 | 12137 |
| 2010-12 | 3046 | 8605 | 2877 | 1708 | 705 | 1614 | | 3239 | 710 | 7977 | 13196 |

# Understanding the Future: Energy Efficiency

Energy efficiency has increased globally (regionally as well income category wise) with Japan appearing to have acquired the bench mark Status
India can do still better by adopting efficient demand side management like:

- High speed mass transport system
- Improved roads and reduced road congestion
- Reduced transmission and distribution losses
- Automatic power saving systems
- Emphasis of on LED lights
- Fuel/ energy efficient vehicles and equipment



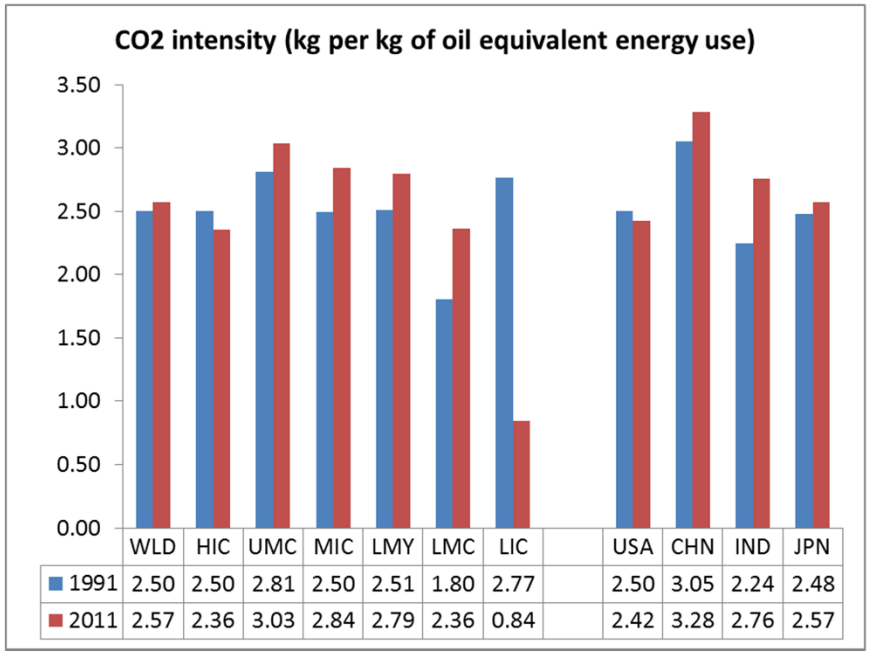



# Understanding the Future: CO2 Intensity

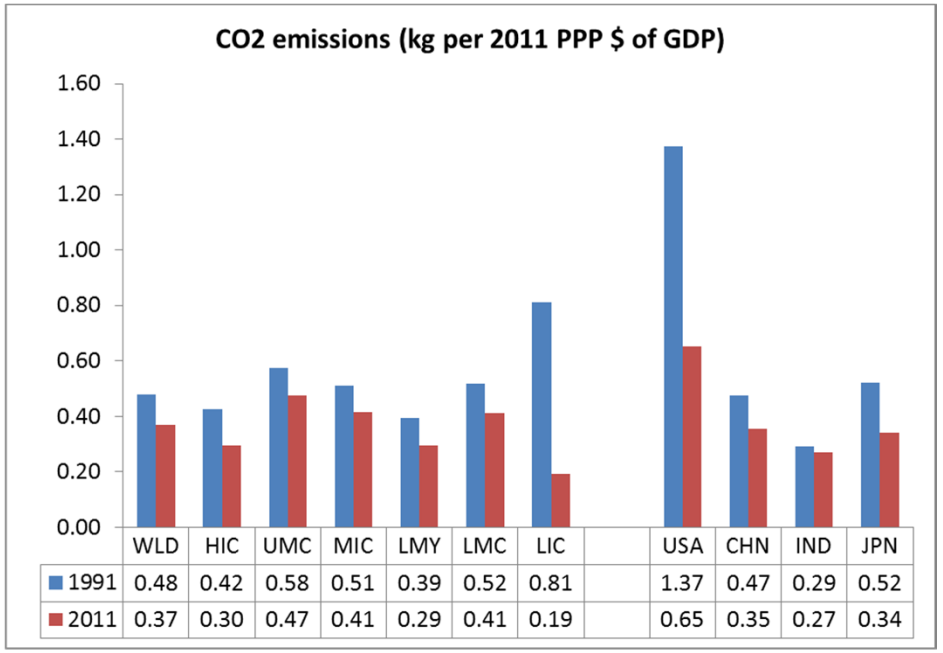
Although the energy intensity of production process has improved there is deterioration in CO2 emission per kg of oil used.

**<u>This put a question mark on the success and scale of clean technology missions</u>**

Improvement in terms of per unit GDP appears to be on account of lowering of share of energy consumption in manufacturing, construction and some other sectors.



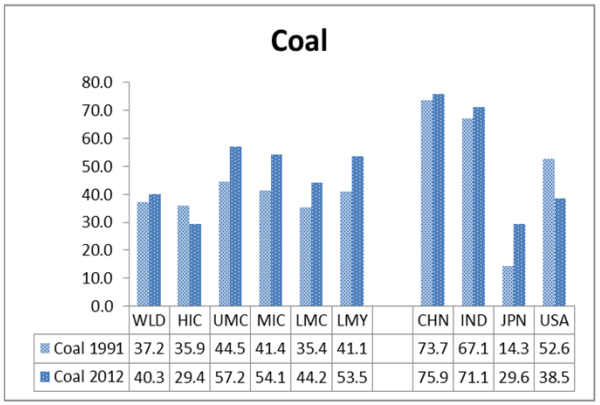

| | WLD | HIC | UMC | MIC | LMY | LMC | LIC | | USA | CHN | IND | JPN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | 2.50 | 2.50 | 2.81 | 2.50 | 2.51 | 1.80 | 2.77 | | 2.50 | 3.05 | 2.24 | 2.48 |
| 2011 | 2.57 | 2.36 | 3.03 | 2.84 | 2.79 | 2.36 | 0.84 | | 2.42 | 3.28 | 2.76 | 2.57 |



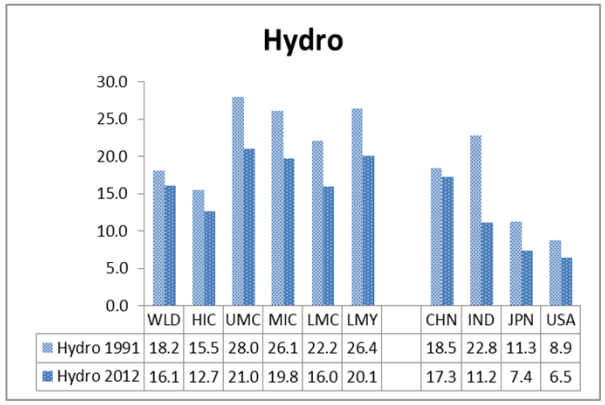

| | WLD | HIC | UMC | MIC | LMY | LMC | LIC | | USA | CHN | IND | JPN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | 0.48 | 0.42 | 0.58 | 0.51 | 0.39 | 0.52 | 0.81 | | 1.37 | 0.47 | 0.29 | 0.52 |
| 2011 | 0.37 | 0.30 | 0.47 | 0.41 | 0.29 | 0.41 | 0.19 | | 0.65 | 0.35 | 0.27 | 0.34 |

# Understanding the Future: Source of Electricity

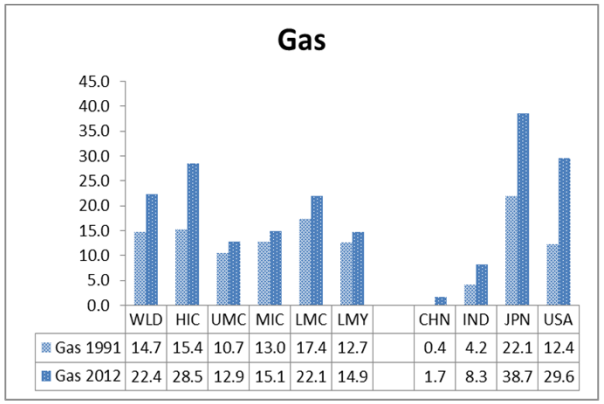
- Coal Remains the leading source of generating electricity in India
- Hydro has limited potential
- Nuclear remain in the domain of high income groups
- Oil is giving way
- Renewable resource based generation is growing everywhere
- It appears the world has discovered its destiny in terms of energy resource but realization is far less



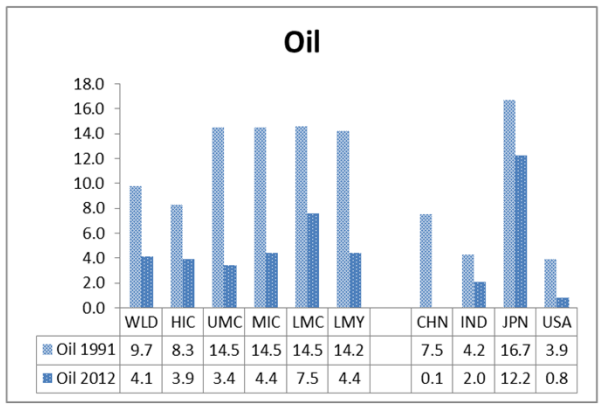

| | WLD | HIC | UMC | MIC | LMC | LMY | | CHN | IND | JPN | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Coal 1991 | 37.2 | 35.9 | 44.5 | 41.4 | 35.4 | 41.1 | | 73.7 | 67.1 | 14.3 | 52.6 |
| Coal 2012 | 40.3 | 29.4 | 57.2 | 54.1 | 44.2 | 53.5 | | 75.9 | 71.1 | 29.6 | 38.5 |



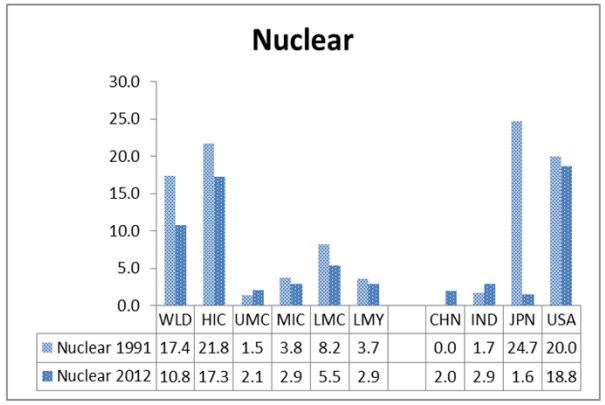

| | WLD | HIC | UMC | MIC | LMC | LMY | | CHN | IND | JPN | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydro 1991 | 18.2 | 15.5 | 28.0 | 26.1 | 22.2 | 26.4 | | 18.5 | 22.8 | 11.3 | 8.9 |
| Hydro 2012 | 16.1 | 12.7 | 21.0 | 19.8 | 16.0 | 20.1 | | 17.3 | 11.2 | 7.4 | 6.5 |



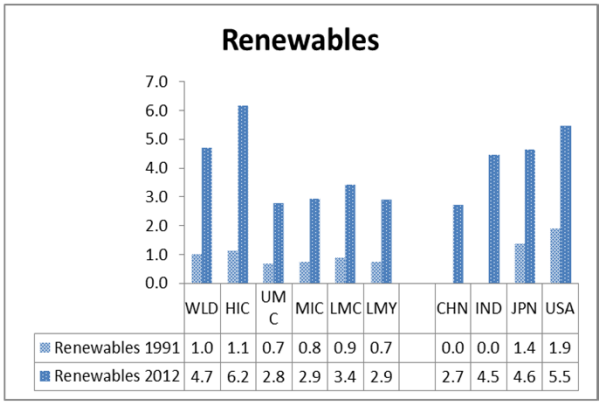

| | WLD | HIC | UMC | MIC | LMC | LMY | | CHN | IND | JPN | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Gas 1991 | 14.7 | 15.4 | 10.7 | 13.0 | 17.4 | 12.7 | | 0.4 | 4.2 | 22.1 | 12.4 |
| Gas 2012 | 22.4 | 28.5 | 12.9 | 15.1 | 22.1 | 14.9 | | 1.7 | 8.3 | 38.7 | 29.6 |




| | WLD | HIC | UMC | MIC | LMC | LMY | | CHN | IND | JPN | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Oil 1991 | 9.7 | 8.3 | 14.5 | 14.5 | 14.5 | 14.2 | | 7.5 | 4.2 | 16.7 | 3.9 |
| Oil 2012 | 4.1 | 3.9 | 3.4 | 4.4 | 7.5 | 4.4 | | 0.1 | 2.0 | 12.2 | 0.8 |




| | WLD | HIC | UMC | MIC | LMC | LMY | | CHN | IND | JPN | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nuclear 1991 | 17.4 | 21.8 | 1.5 | 3.8 | 8.2 | 3.7 | | 0.0 | 1.7 | 24.7 | 20.0 |
| Nuclear 2012 | 10.8 | 17.3 | 2.1 | 2.9 | 5.5 | 2.9 | | 2.0 | 2.9 | 1.6 | 18.8 |

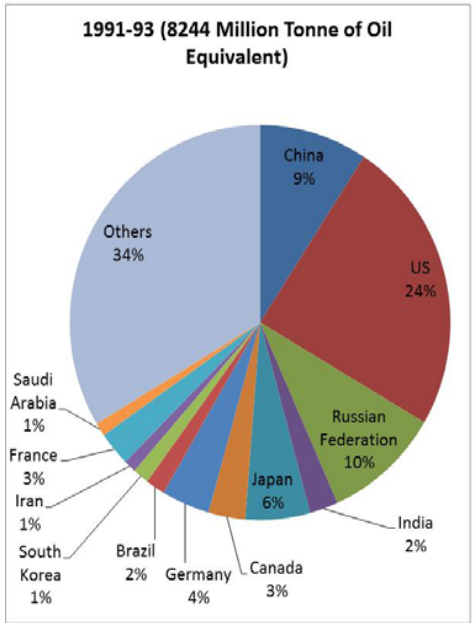


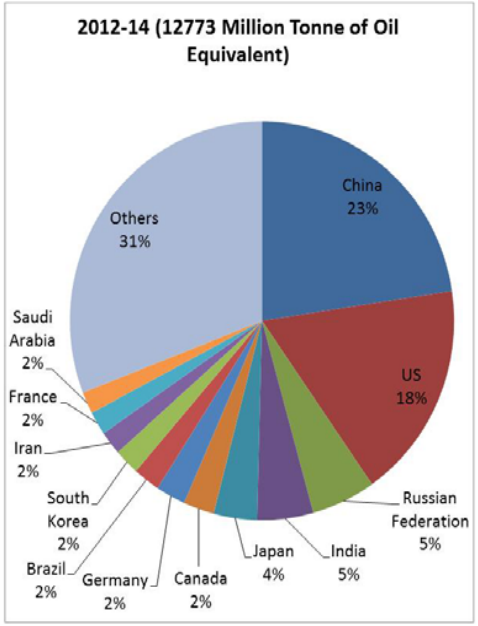

| | WLD | HIC | UMC | MIC | LMC | LMY | | CHN | IND | JPN | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Renewables 1991 | 1.0 | 1.1 | 0.7 | 0.8 | 0.9 | 0.7 | | 0.0 | 0.0 | 1.4 | 1.9 |
| Renewables 2012 | 4.7 | 6.2 | 2.8 | 2.9 | 3.4 | 2.9 | | 2.7 | 4.5 | 4.6 | 5.5 |

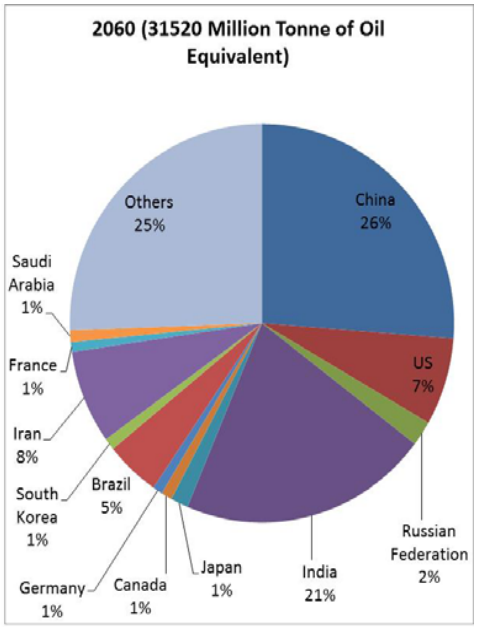
# Understanding the Future: Energy Demand

While energy demand in countries like USA and Japan appear to be stabilized, India is likely to increase its energy demand by almost ten times of current need and it would be contributing to one fifth of world energy demand next only to China.

- India's per capita energy consumption would still be much below the leading countries
- But volume effect is too dominant



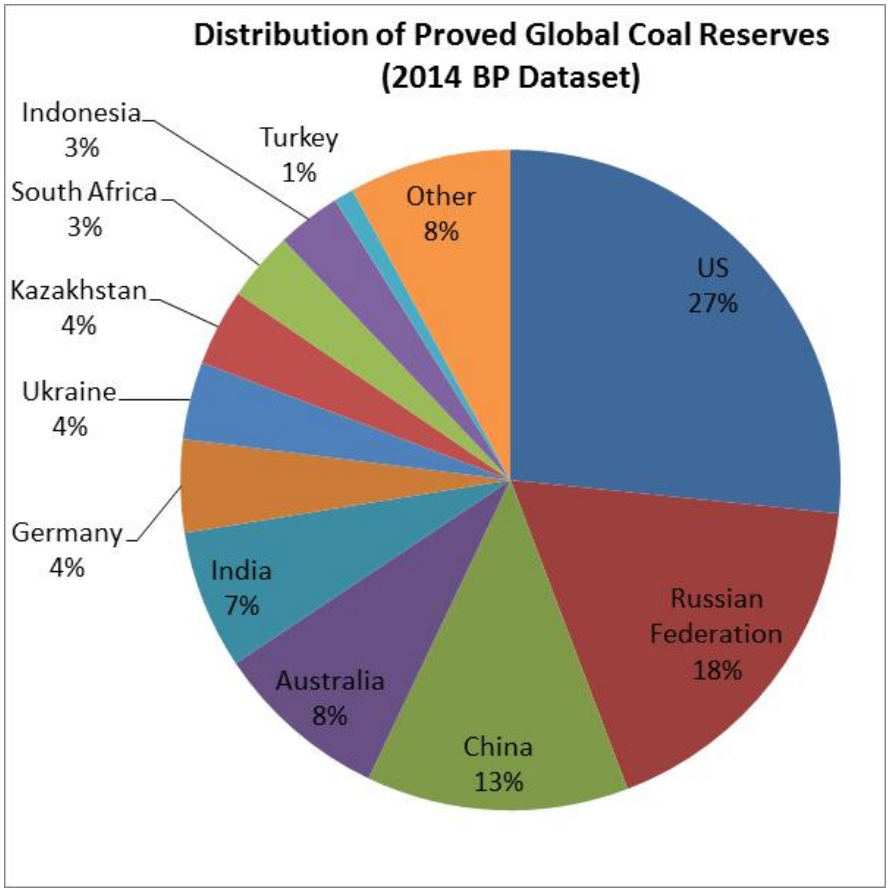




| Per Capita Energy (Oil Equivalent) Tonne/Year based on long term trend with upper ceiling | |
|---|---|
| China | 7.0 |
| US | 6.0 |
| Russian Federation | 5.5 |
| India | 4.1 |
| Japan | 5.0 |
| Canada | 7.0 |
| Germany | 3.9 |
| Brazil | 6.6 |
| South Korea | 7.0 |
| Iran | 7.0 |
| France | 3.7 |
| Saudi Arabia | 7.0 |
| Others | 1.5 |

# Understanding the Future: Potential of COAL

How long coal can serve India if its production were to increase by ten times or even up to the level of China?: Hardly couple of decades.
Therefore, coal has to give way not because of carbon emission but more because it may not be available and affordable (it would have either exhausted or costly to recover)
Even if the proved resource is doubled, the production may peak much before 2060 and then decline anyways




| Country | Coal Reserves Million Tonne | | Coal Prod 2014 Million Tonne | **R/P ratio** |
|---|---|---|---|---|
| | Total | Share | | |
| US | 237295 | 26.62 | 907 | **262** |
| Russian Federation | 157010 | 17.61 | 356 | **441** |
| China | 114500 | 12.84 | 3874 | **30** |
| Australia | 76400 | 8.57 | 491 | **155** |
| **India** | **60600** | **6.80** | **644** | **94** |
| Germany | 40548 | 4.55 | 186 | **218** |
| Ukraine | 33873 | 3.80 | 61 | **>500** |
| Kazakhstan | 33600 | 3.77 | 109 | **309** |
| South Africa | 30156 | 3.38 | 261 | **116** |
| Indonesia | 28017 | 3.14 | 458 | **61** |
| Turkey | 8702 | 0.98 | 70 | **125** |
| Other | 70830 | 7.94 | | |
| World | 891531 | 100.00 | | |

# Way Out: Need for Green Energy

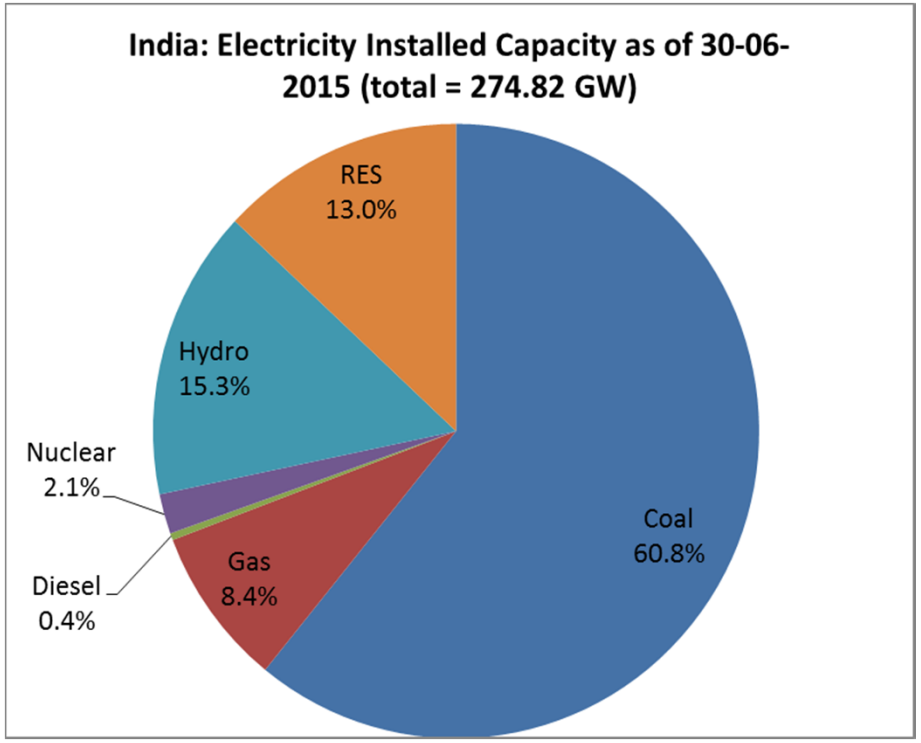
- Change of energy composition is must in favor of Renewables
- Research and development to reduce cost of renewables based electricity generation
- Participation in Development of Fusion Technology as it offers the prospect of an almost inexhaustible source of energy
- Conducting green Analysis and Estimate Green GDP for appraisal and better understanding of economic and environmental activities

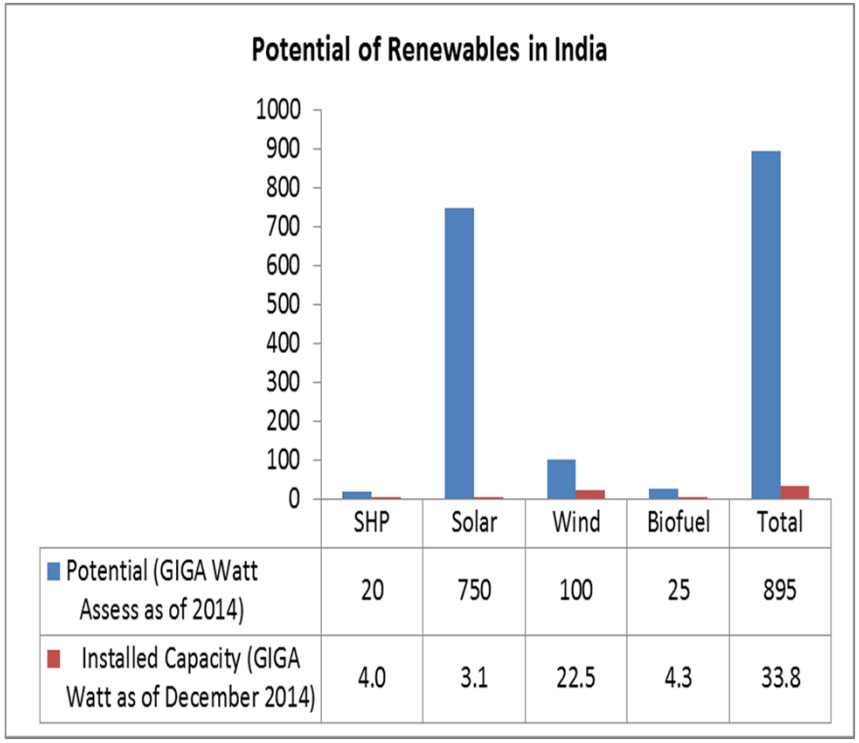
# Potential of Renewable Energy as Source of Electricity Generation

India has large potential of renewable energy resource but it would not be enough to replace coal and other fossil fuel based energy

Taking ten times increase in electricity generation, the entire potential of renewable energy would be able to replace less than half of the requirement

Therefore, Leaning towards nuclear power would be inevitable and that requires development of fusion technology as early as possible

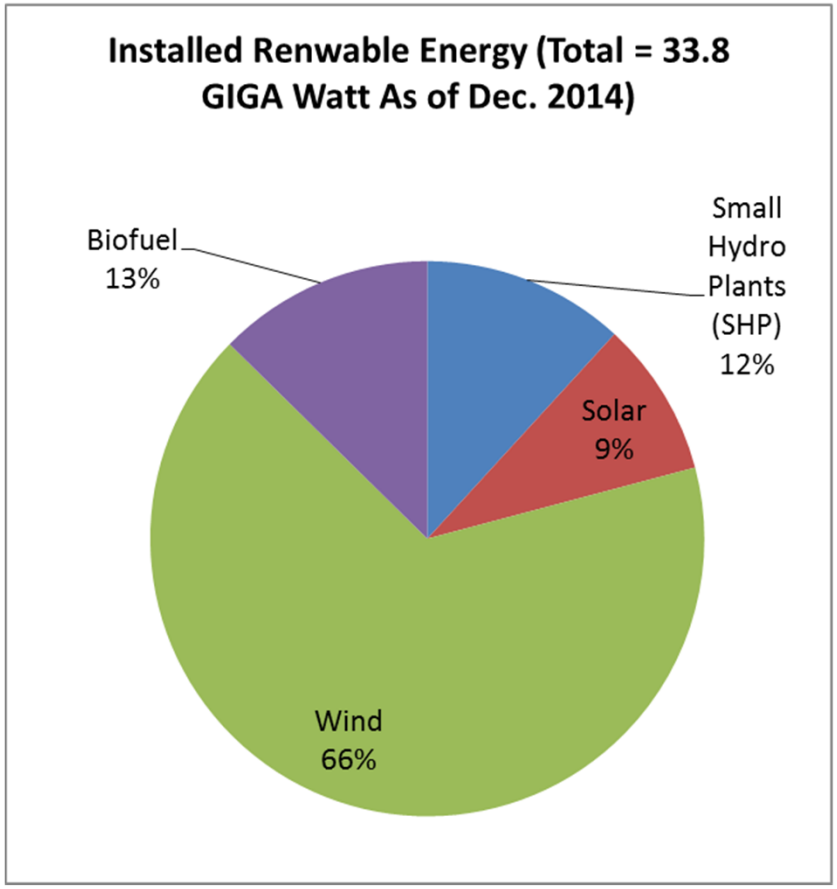


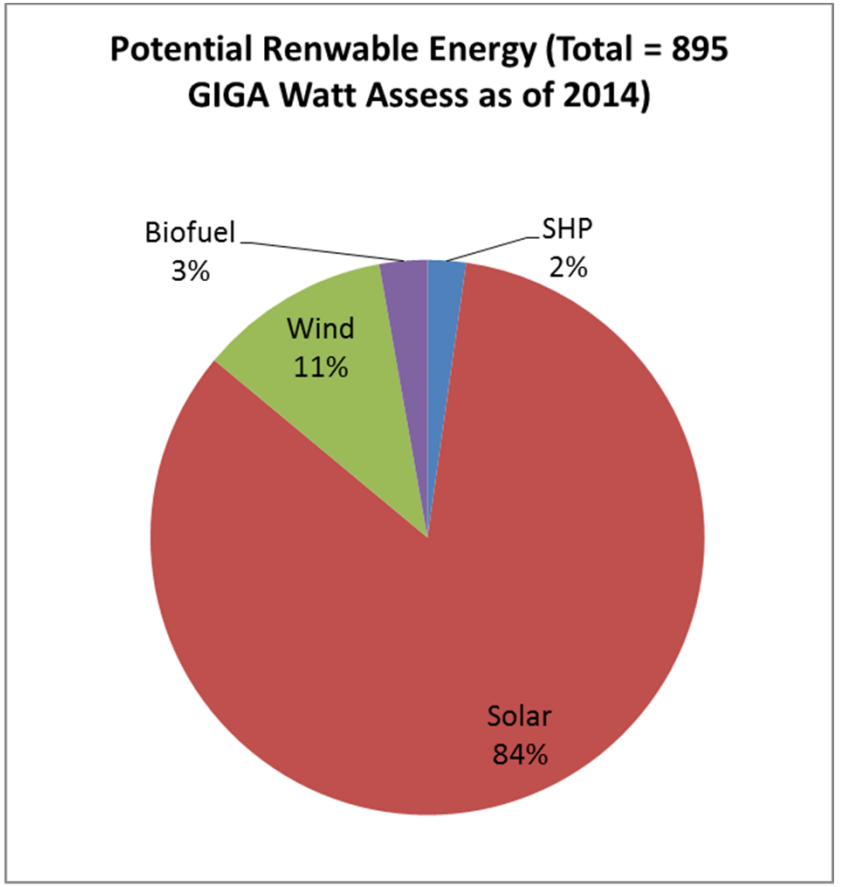




| | SHP | Solar | Wind | Biofuel | Total |
|---|---|---|---|---|---|
| Potential (GIGA Watt Assess as of 2014) | 20 | 750 | 100 | 25 | 895 |
| Installed Capacity (GIGA Watt as of December 2014) | 4.0 | 3.1 | 22.5 | 4.3 | 33.8 |

# Installed and Potential of Renewable Energy as Source of Electricity Generation

Solar energy is likely to increase its share from 9 per cent to 84 per cent of total renewable energy



# Government initiatives

- Ambitious target of 100 GW (more than one third of current electricity demand) by 2022
- Prioritizing nuclear energy
- Emphasis on more crop per drop of water: efficient irrigation project
- Digital drive: distant learning with quality, communication of knowledge and awareness, work from home
- Namami Gange: New Ministry for cleaning of rivers and river linking
- Sanitation drive to reduce health related cost
- Mass transit system for urban transport:  for reduced congestion and saving fuel
- Infrastructure drive to increase speed and scale
- Skill development for productivity improvement

# Government Initiatives: Promoting Renewables

- India has developed institutions and extensive data bases for renewable energy resource in the country
  - Wind Atlas of India and Solar Radiation Resource Assessment: National Institute of Wind Energy (NIWE)
  - State wise solar potential: National Institute of Solar Energy
  - Biomass Atlas of India: The Indian Institute of Science, Bengaluru
  - Small Hydro potential: IIT Rurkee
- Domestic manufacturing base already created with
  - Fiscal incentives
  - tax holidays
  - Depreciation allowance
  - Remunerative returns for the power fed into the grid
  - 100 per cent foreign direct investment
- Bilateral and multilateral cooperation frameworks have been established with 42 countries

# Government Initiatives

However, Still a long way to go

**Ernst & Young LLP's Renewable Energy Country Attractiveness Index (RECAI)**

| Rank | Country | All renewables | Wind index | Solar index |
|---|---|---|---|---|
| 1 | US | 75.4 | 68.8 | 78.0 |
| 2 | China | 71.9 | 76.7 | 79.6 |
| 2 | Germany | 69.6 | 58.4 | 59.6 |
| 4 | UK | 62.1 | 58.8 | 38.9 |
| 5 | Japan | 61.8 | 43.7 | 56.8 |
| 6 | Australia | 61.3 | 46.2 | 57.2 |
| 7 | Canada | 59.3 | 52.5 | 46.1 |
| 8 | France | 56.9 | 47.3 | 48.3 |
| **9** | **India** | **56.2** | **50.5** | **60.6** |
| 10 | Italy | 54.4 | 37.3 | 50.3 |
| 11 | Belgium | 53.0 | 42.5 | 35.7 |
| 12 | South Korea | 52.2 | 39.9 | 41.7 |
| 13 | Spain | 51.7 | 36.0 | 45.5 |
| 14 | Denmark | 51.3 | 46.0 | 24.9 |
| 15 | Brazil | 50.9 | 47.4 | 46.9 |

Source: Ernst & Young LLP's renewable energy country attractiveness index, August 2013

Thank You for listening