

"Low-Carbon Multiple Benefits for Sustainable Development, Human Health and Ecosystem Services"

LCS-Ret - ICLCS Inaugural Round table. Pathways toward a Paradigm of Low Carbon Societies: Priority areas for Innovative and Transformational Research, Education and Training

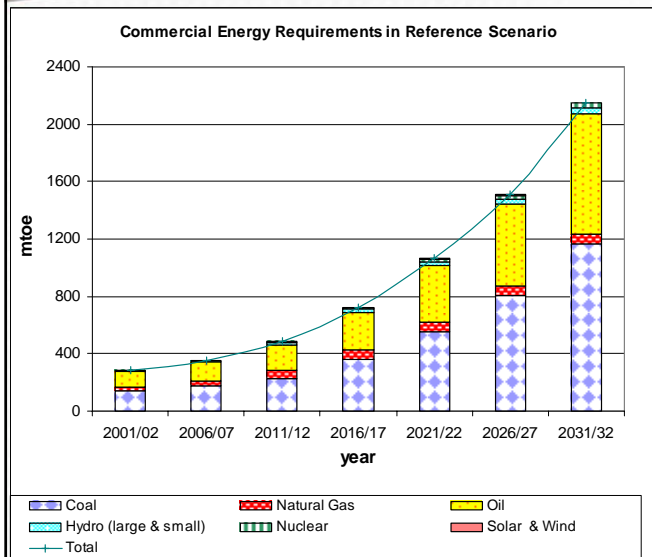
**Ritu Mathur,
TERI, INDIA**

June 27, 2009

Current Energy Status

- Installed generating capacity ~ 150,000 MW
 - Per capita consumption of electricity of 650 units
 - Suffering from huge shortages (2007/08) of
 - ~ 10% in energy terms
 - ~ 17% in peak energy
- Energy and peak shortages in 2003-04 were 7.1 % and 11.2 % respectively.
- Shortages increasing rapidly due to inability to meet more than 40-50% of the targeted capacity addition requirements in the last 3 five year plan periods.
 - Over 50% of India's rural population does not have access to electricity!
 - 90% of rural India dependent on traditional fuels for cooking

Reference Energy Demand Projections



Concerns of:

- Energy security
- Climate Change

- What are the options & what are the implications of adopting alternative choices to fuel the country's energy needs?

→ Scenario based analysis

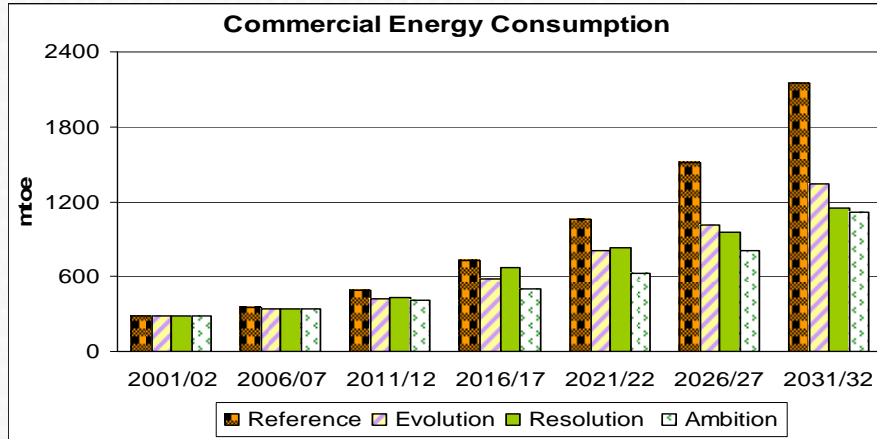


So What Shape Can The Future Take?

Scenario names	Storyline
Reference	Life continues pretty much as we know it with autonomous efficiency improvements taking place where feasible. Increase in use of renewable energy carries on at the same pace. Defined policy priorities are implemented with no real sense of urgency
Evolution	A determined effort is provided for efficiency improvements both on the supply and demand sides. Considers an accelerated push for renewable energy, nuclear and new technologies such as CTL (Coal to liquids) and GTL (Gas to liquids). Energy Security concerns are paramount in this scenario.
Resolution	This scenario honors the Prime Minister of India's commitment that <i>India's per capita carbon emissions would never exceed those of the developed world</i> and it is optimistically assumed here that the developed world would be able to bring down its emissions to a level of 2 tonnes/capita.
Ambition	This scenario considers that India conditionally sets aside its legitimate arguments on "common but differentiated responsibilities" & equitable per capita rights, and takes on even more stringent emission reduction targets



Energy Consumption across Scenarios

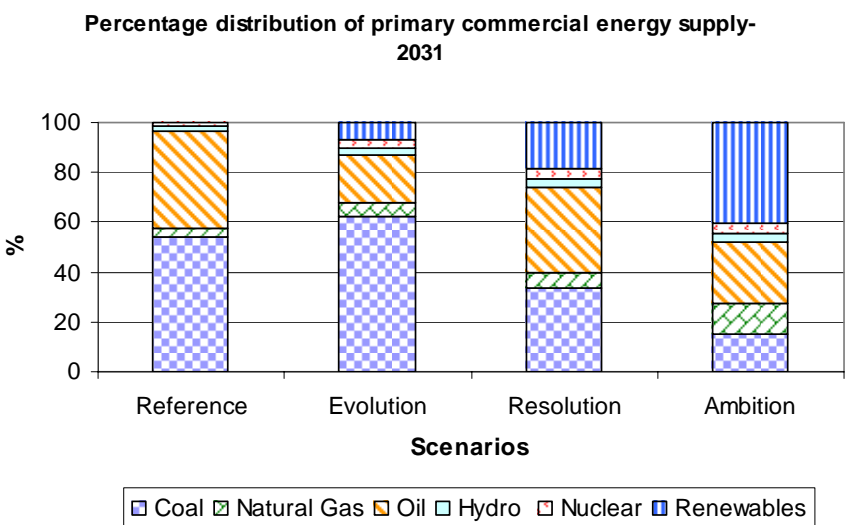


Page • 5

CONFIDENTIAL - NOT TO BE CIRCULATED



Energy Mix Under Alternative Scenarios



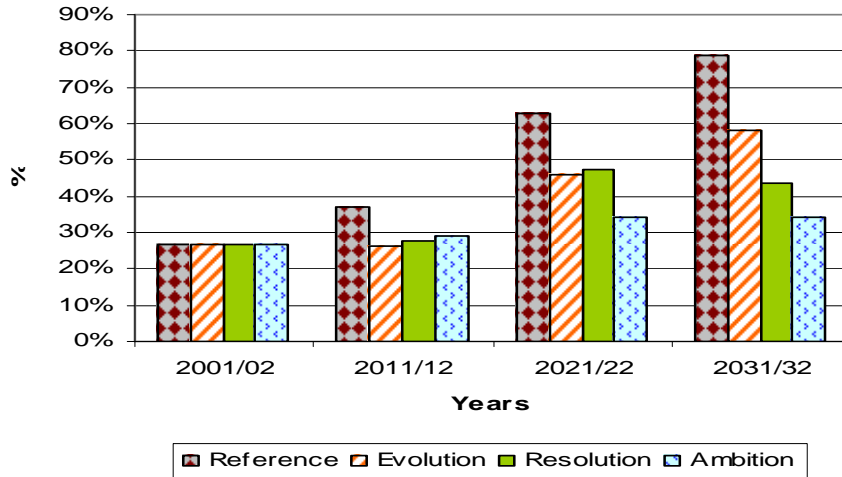
Page • 6

CONFIDENTIAL - NOT TO BE CIRCULATED



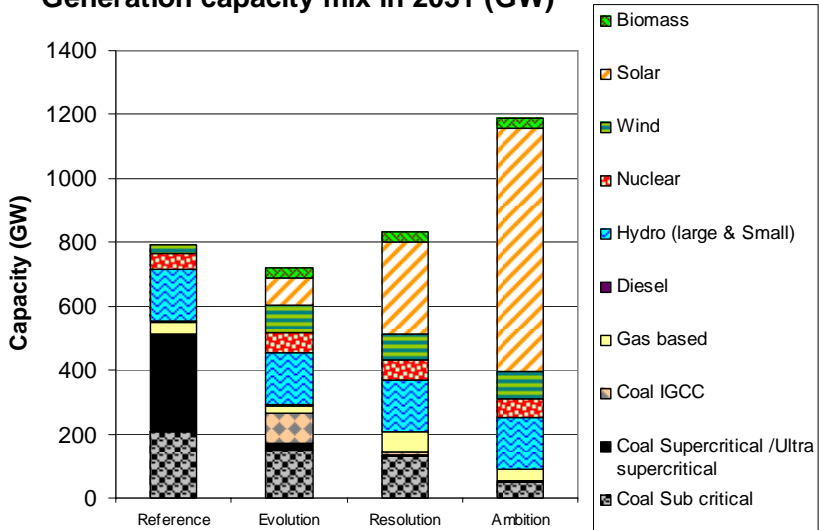
Energy Security.....

Fossil import dependency across scenarios

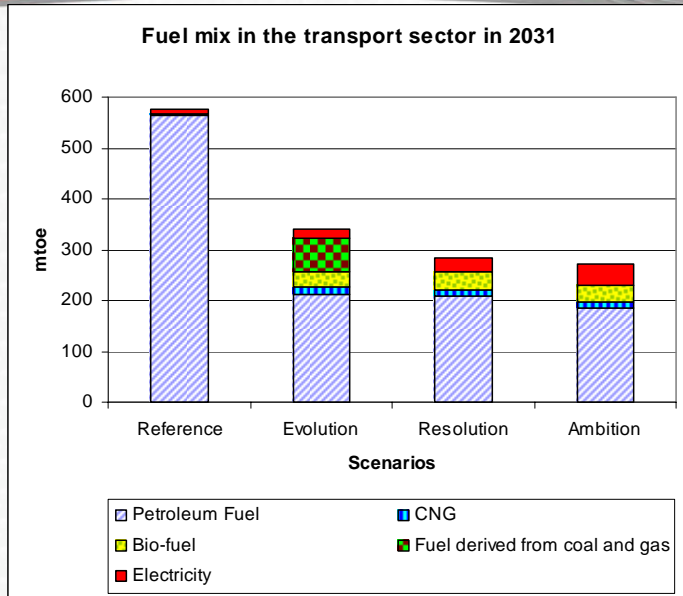


Power Generation Technology Deployment...

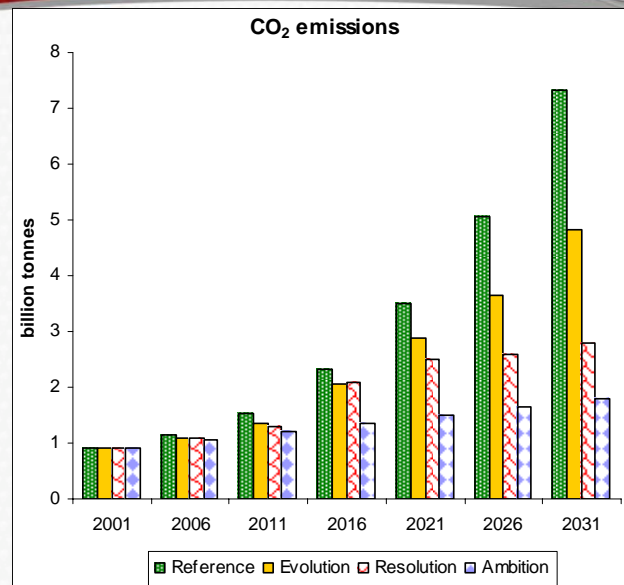
Generation capacity mix in 2031 (GW)



Transport Energy....

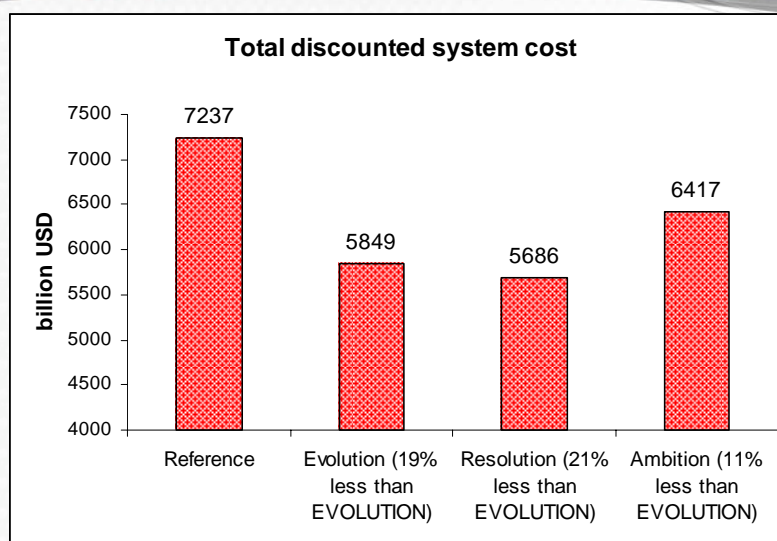


And.....CO₂ Emissions!!!!



- Drop in CO₂ emissions dramatic with emissions in the Ambition scenario in 2031/32 only doubling from the 2001/02 levels against a nearly 8 fold increase in the Evolution Scenario.
- In per capita terms, in the year 2031/32, India would have a CO₂ emission level of ~ 2 tonnes in the Resolution Scenario versus 1.3 tonnes in the Ambition Scenario!

Makes Economic Sense?*



Key Modelling Results

- Resolution scenario brings with it the highest level of savings, entails investment that pays off over the lifetime of options, is likely to lead to lower level of fuel import dependency, and simultaneously prepares for de-carbonising the economy.
- However, achieving a feasible solution to this scenario itself needed relaxations in several boundary conditions.
- CTL/GTL important for India's energy security but may not be the most optimal choices when more stringent carbon targets are set.

Page • 13

CONFIDENTIAL - NOT TO BE DISSEMINATED



Way Forward Strategies

Energy Efficiency and DSM

- Developed countries must facilitate/provide the best available technologies either by setting their manufacturing units or by licensing of their technology for manufacture in the country.
- A large scale program, supported by multilateral organizations, and well-designed market mechanisms could further accelerate deployment of energy efficient technologies.

Prudent planning for supply and investment in fossil fuels

- Should India use up its domestic coal resources faster rather than invest in import infrastructure?
- Refinery technologies for production of advanced cleaner fuels to meet transport emissions beyond Euro IV norms should be made available
- Need greater investment in domestic gas development – imports of natural gas should be limited

Biofuels an attractive option.

- the productivity of bio-diesel plantations and the overall use efficiency of the product, including by-products, needs to be enhanced
- Efficiency of second generation technologies needs to be increased and such technologies made available at the earliest

Moving to cleaner transport

- massive shifts need to take place to the use of electrically driven public transport systems and to the use cleaner personal vehicles based on hybrid technology and/or advanced batteries
- Compensatory mechanism for industry may be needed
- The JNNURM and railway track electrification programmes need to be re-defined
- City governments should be encouraged to leverage central government support and local resources to garner international technological and financial support to ensure an *accelerated* development of efficient city transport options.
- The well-established method of competitive discovery of viability gap funding required could be the agreed basis for international financial support.



Way Forward Strategies

▪ Accelerated Renewable Energy Use

- Technology transfer in manufacture of wind turbines to suit India's wind profile and large capacity wind turbines of over 5 MW needed
- India's off-shore wind energy potential is completely untapped. To map and exploit this potential technology transfer will be needed.
- India's also needs accelerate the tapping of its hydro power potential of 160 GW. Its current installed capacity is only 36 GW.
- Decentralised provision of energy must be the 'mantra'

▪ With ~ 80% of its capacity needs to be added between now and 2031/32 and 60% between 2017/18 and 2031/32, India's electricity sector lends itself well to clean interventions. Renewable energy technologies of solar, wind and biomass and nuclear power plants most desirable

▪ Need to move towards solar thermal with storage to meet the base load requirements.

▪ Need cost reductions and International Financial Support

Page • 15



Thank you !

Page • 16

CONFIDENTIAL NOT TO BE QUOTED

