India’s Energy Challenge: Lessons from Japan

Japan – India Symposium

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Key Messages

- India and China will define future global energy challenges
- Japan & India: Roughly same aggregate energy consumption: India’s quantity & Japan’s quality
  - Japan: Universal access to modern energy (equity), highly efficient (economically and ecologically)
  - India: Half the population without access to modern energy (inequitable); inefficient (economically & ecologically)
- Regional cooperation & integration need to rely on or work in accordance with global rules and standards
  - Japan’s coping strategy (portfolio approach & efficiency): With almost 100 percent energy import dependence Japan is more energy secure than India which imports only 33 of its primary energy
    - Market mechanism for pricing, penalty for environmental degradation & carbon emission
    - Self reliance principles inapplicable in the energy sector

The appeal is not to our moral sentiments or animal spirits but to our own self-interest
India: Primary Energy Demand: Dominated by Fossil fuels

2010: 691 mtoe

- Coal: 41%
- Oil: 24%
- Gas: 8%
- Nuclear: 1%
- Hydro: 1%
- Biomass: 25%

2035: 1680 mtoe

- Coal: 52%
- Oil: 24%
- Gas: 8%
- Nuclear: 3%
- Hydro: 1%
- Biomass: 12%

3 fold increase in energy demand; fossil fuel share increases from 73% to 84%
The ‘Chindia’ Energy Challenge

By 2020 India will
- Match China in population numbers & overtake China as the world’s fastest growing energy region
- Overtake Japan/China/EU to become the largest coal importer

By 2030-35 India will
- Occupy coal space vacated by China (China’s coal imports expected to peak in 2015)
- Overtake USA to become the 2nd largest energy consumer
- Overtake oil & gas import bill of Japan initially and later USA

By 2035 India & China will occupy oil space vacated by USA & EU
- Together import 19.2 mbpd of oil
- OECD imports will fall to 12.5 mbpd
- China will off-set entire savings in EU
- India will off-set savings realized by USA

But even by 2035 India’s energy demand will only be 57% of China’s
- Per capita energy consumption in India will hit 1 toe only in 2035
Natural Gas Demand Growth

- Natural gas demand & growth 2010-2035
  - Japan: CAGR 0.7% 130 BCM
  - India: CAGR 4.2% 170 BCM

Oil demand growth

- Japan: Declines from 4.3 mbpd to 3.1 mbpd
- India: Increases from 2.5 mbpd to 6.9 mbpd
Quality Vs Quantity

- Energy Consumption per 1000 USD GDP (2010-2035)
  - Japan: Fall from 0.08 toe to 0.06 toe
  - India: Fall from 0.44 toe to 0.22 toe
- Energy consumption per capita (2010-2035)
  - Japan: 4 toe to 3.8 toe
  - India: 0.6 toe to 1 toe

- Cumulative carbon emissions 1900-2035
  - Japan: 80 GT
  - India: 100 GT

- A USD 45,000 per capita country and an USD 1400 per capita country have roughly the same cumulative emissions
  - Quality - Japan: Technology & Efficiency
  - Quantity - India: Energy poverty, inequality & inefficiency
Energy Security: Japan’s coping strategy

• 2011: Year of energy supply disruptions and high prices
  – Political upheavals in hydrocarbon producing regions reduced hydrocarbon supply by 1.3 %
  – Natural disasters (tsunami) and its reverberations reduced world nuclear power by 7 %
  – Annual average price of oil was highest ever above USD 100/bbl
  – Floods in Australia reduced global coal availability

• All fossil fuel disruptions were substituted by fossil fuels through the market mechanism
  – Increase in OPEC oil production (Arabian peninsula and Iraq)
  – Increase in coal and gas based electricity in Japan
  – Increased coal supply from USA, Russia, Columbia and Indonesia

• Gas supplies to Japan and China increased as they had open liquid markets
  – Follow a portfolio approach to energy security

Source: BP, Brian Dodson at ORF-IEF conference
Oil Import Cost – Highest for India

- Relative risk of exposure to high oil prices increasing for India and decreasing for all OECD countries
  - All except USA are importing less oil and exporting more goods & services
  - USA is decreasing imports on account of domestic production
- Japan imports almost all its energy and spends less than 3% of GDP on oil imports
- India imports 33% of energy and spends more than 6% of GDP on imports (7.5% last year)
Challenge: Reducing Carbon Emissions from Coal Combustion

Domestic coal reserves: not as abundant as originally assumed?
- Out of an inventory of 200 BT only 50 BT is thought to be economically extractible
- Even if all coal reserves in India are used for power generation, Indian emissions are unlikely to exceed 4.5 GT or 3 tonnes per capita
- Increasing the efficiency of sub-critical Pulverised Coal power plants by 1 percent will decrease coal use by 3 percent
  - Reduction in annual coal consumption by ~100 Million Tonnes
  - Will lead to a reduction in annual CO2 Emissions >170 Million Tonnes (equal to the total emissions of Netherlands)
  - Japan has one of the most efficient coal based power generation fleets in the world
Japan’s Contribution

• Training activities aimed at transferring Clean Coal Technology (CCT) have continued since 2001
  – 136 Indians have been trained in Japan until 2011
• A successful model project was carried out by Japan’s NEDO to reduce ash content in Indian coal on a commercial scale
  – New technology is expected to be introduced on a larger scale in 2012
An undesired similarity?

• Privatisation progressing faster than market transformation
  – Fukushima? A lesson for India in a hurry to privatise and accelerate nuclear energy production?
  – Privatisation of profits and socialization of losses?

• India’s nuclear Targets
  – Before 1974 (first nuclear device tested): 43 GW by 2000 (33 GW from breeder reactors)
  – After 1984: 10 GW by 2000 (no breeder reactors)
  – After 1998 (second nuclear device tested): 20 GW by 2020 (3.5 GW breeder reactors)

• Long term projections:
  – Pre-NSG waiver: 275 GW by 2050
  – Post NSG waiver: 455 GW by 2050 (35 % of 1300 GW total generation) out of which 95 % to come from breeder reactors

• Questions
  – Capacity developed in 60 years: 4.1 GW
  – Capacity expected in next 40 years: 455 GW
  – 100 fold increase in 40 years?

Ambitious even to the uninitiated?
Impact of Economic Crisis - Creating clean energy or promoting industries (jobs)?

• Climate Change & RE Policy: Mother of all Trade Wars?
  – **e.g. Crystalline Solar PV modules**: Glut in the market on account of overcapacity (50% in China) and slower demand from Europe (reduction in subsidies)
  – **USA**: Punitive duty of 250% on Chinese crystalline solar modules
  – **China**: Considering anti-dumping case against US dumping of poly-silicon
  – **Germany**: Hesitant on tariff barriers on Chinese modules as they are made on German machines!

• **What does all this mean for India’s JNNSM? 20 GW solar by 2020**
  – Capital cost of solar PV fell by 30% in 2011 on account of imported modules
    • Second round of Phase I bidding quoted prices pushed down to Rs 7.46/kwh!
  – Domestic content requirement circumvented
    • Shift towards less expensive thin film as domestic content requirement does not apply
    • US imports of thin film with low cost financing!

Bankability of solar projects questioned, Domestic PV manufacturing under strain
Over 300 million Indians do not have access to electricity 700 million use biomass as fuel for cooking

Without enabling the shift from Carbohydrates to Hydrocarbons, generation of surplus energy (essential for material progress) cannot be facilitated

- Carbohydrate – Hydrocarbon = Net energy deficit (gender bias!)

Unaccounted energy derived from the poor (women) and the migrant labourer and their net negative energy consumption subsidizes energy consumption by the rich
- Reduces per capita energy consumption figures, reduces overall carbon emission figure
- Underwrite India’s sustainability!

These are India’s ‘green’ poor and the main sustainability challenge – If they become rich (energy consumers) they will no longer be ‘green’ but if they remain poor they may become ‘red’?