**Introducing Green Technology in Developing Nations:
A case of Indian Railways**

SLIDES PRESENTATION

Introducing Green Technology in Developing Nations – A Case of Indian Railways

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Agenda for Today

- Sustainability Issues in India
- Electricity – A Major GHG Contributor
- A Case Study of Indian Railways
- Session Opens for Discussion
- Key Learning

Learning Objectives

- Does Current Procurement Policy support introduction of green technology? If not, what changes are required?
- Can Clean Development Mechanism be used for financing introduction of green technology?

Sustainability Issue- What lies ahead?

- GDP growing at >7% per year during last two decades.
- India's GHG emission - 1.7 tons/person against global average
- of 4.3 tons/person.
- GHG emission !ed from 1.2 billion tons CO2 in 1994 to 1.7 billion tons CO2 in 2007.
- India stands 5th in aggregate GHG emissions in the world. Why?
- By 2031, India's energy needs is estimated to be about seven times that of 2001 levels.
- By 2050, 55 % of India's population will be living in urban areas, amounting to 900 million people.

Electricity – A Major Source of GHG!

- A power deficit of 12000 MW during the peak hours.
- By 2045, total electricity demand 5000 billion kWh
- By 2020, IR will have a projected energy demand of 37,500 million kWh.
- The gap in electricity demand and supply increasing.
- Most Employee of IR using low efficiency Incandescent Bulb in houses.

Indian Railways

- **Third Largest Network**
- **63,974 route Kms**
- **12,000 Passenger Trains per day**
- **7,000 Freight Trains per day**
- **23 million passenger every day**
- **2.65 million tons of freight traffic every day**
- **1.34 million employee**
- **Annual revenue base of Rs.1,06,000 crores**

Energy Cost of ICLs

Parameters

Wattage: 60 W 100 W

Lumen: 620 1240

Cost: Rs. 10-15

Life: 1000-1500 Hrs

Energy Cost* (per annum): Rs. 380 Rs. 640

*** Assuming average usage of 3.5 hours daily and energy cost of Rs. 5 per Unit**

Environmental Impacts of ICLs

Parameters

Primary Energy Demand Use: 3290 kWh
Global Warming Potential: 564 kg CO2-eqv.
Acidification Potential: 3.5 kg SO2 – eqv.
Eutrophication Potential: 0.137 kg PO4 – eqv.
Human Toxicity Potential: 48.5 kg DCB-Eq.
Mercury Emission: 10* mg

Source: Life Cycle Assessment of Illuminants Siemens Corporate Technology, 2009

*** Mercury emission from coal power plant over five years**

Current Procurement Policy

- Based on Codes, Manuals and Guidelines
- Award Criteria - Lowest technically suitable offer
- No scope for integrating environmental and social criteria
- Scope for Judicial Review in case of arbitrariness
- India a signatory to Kyoto Protocol

Barriers for Introducing Green Technology in India

- First Cost barrier of Green Technology
- Lack of Consumers Awareness & Bias
- Lack of Consistent Quality & Standards
  -Short Life Span, Poor Light Quality, Market flooded with non-standard products
- Non-availability of Green Tech. in Rural Areas
- Doubt about promised benefits of Green Tech.
  – Hurt Consumer Confidence
- Unsustainable Institutional Framework

Who should bear the high Initial cost of green technology?

Project Developer ?
or
Power Utility ?
or
Government ?
or
Consumers ?

Does adopting Green Technology always Cost more?

A Case Study of Indian Railways

Challenges for Project Team

- Reduce peak lighting load in housing Colonies by adoption of green technology by employees .
- Boundary Condition

  The proposed solution should not invite any additional cost either to organization or to its employees.

Available Solutions

- Providing direct subsidy to households to meet the high initial cost of green technology by the government .
- Providing free supply of green technology to consumer by
- Distribution Company/Indian Railways and recover the amount in
- monthly installment from consumers.
- • Reducing subsidy to electricity consumption currently provided by
- the government to consumers in order to make energy efficient
- products attractive.
- • Reducing cost of green products by providing subsidy to
- manufactures in India.
- NONE OF THE ABOVE SOLUTION IS ANSWER!

The Kyoto Protocol

Clean Development Mechanism

- The Clean Development Mechanism (CDM) an important part to the Kyoto
- Allows to take advantage of the lower abatement costs in Non---Annex I countries
- Instrument to increase the cost-efficiency
- Shall contribute to the sustainable development of the host countries
- Three Criteria for Project Based Credits:
- Emission reductions must be real and measurable.
- The project must be based on voluntary participation of all parties involved.
- Additionally, size, leakage...keyinthe assessment of project feasibility

Distribution of CDM Projects

- **Total CDM Projects - 2344 till 2012**
- **China, India, Brazil, Mexico & Malaysia contribute 78% of all CDM projects and 80% of all CERs generated.**

Outcome of the Project

- Economic Benefits
- – Direct Energy Saving – 112 Giga Unit per annum
- – Saving in Energy Bill per Households – Rs. 1280 per annum
- – Total Saving in Energy Bill - Rs.44.8 Crores ($ 8.96 Million) per
- Annum
- Environmental Benefits
- – Reduction of 90,000 tones of CO2 emission per annum
- Social Benefits
- – Approx. 0.4 million households directly benefitted
- – Created awarness among consumers about energy conservation
- – Further create employment for recycling/ disposal industry

Discussion Question- 1

You are one of the members of project team in Indian Railways. Based on your experiences, what changes you would suggest in current procurement policy of Indian Railways to demonstrate the benefits of buying green solution to the stakeholder, despite its high initial economic cost?

Sustainable public procurement?

"….a process whereby organization meets their needs for goods, services and works in a way that achieves value for money on a whole life basis in terms of generating benefits not only to organisation, but also to society and the economy, whilst minimising damage to the environment".

Source: Government of South Australia

Life Cycle Costing & SPP

Life-cycle costing is the best way to see why SPP makes sense.

Comparison of ICLs vs CFLs

Parameters

- ***Wattage 60 W 100 W***
- ***Lumen 620 1240***
- ***Cost Rs. 10-15***
- ***Life 1000-1500 Hrs***
- ***Energy Cost* (per annum) Rs. 380 Rs. 640***

Parameters

- ***Wattage 14 W 20/23 W***
- ***Lumen 620 1240***
- ***Cost Rs. 80-130***
- ***Life 6000- 10000 Hrs***
- ***Energy Cost*(per annum) Rs. 90 Rs. 140***

Assuming average usage of 3.5 hours daily and energy cost of Rs. 5 per Unit

Comparison of ICLs vs CFLs

Parameters

- ***Primary Energy Demand Use 3290 kWh***
- ***Global Warming Potential 564 kg CO2-eqv.***
- ***Acidification Potential 3.5 kg SO2 – eqv.***
- ***Eutrophication Potential 0.137 kg PO4 – eqv.***
- ***Human Toxicity Potential 48.5 kg DCB-Eq..***
- ***Mercury Emission 10* mg***

Parameters

- ***Primary Energy Demand Use 658 kWh***
- ***Global Warming Potential 113 kg CO2- eqv.***
- ***Acidification Potential 0.7 kg SO2 – eqv.***
- ***Eutrophication Potential 0.027 kg PO4 -eqv.***
- ***Human Toxicity Potential 9.7 kg DCB-Eq.***
- ***Mercury Emission 3+2.4* mg***

Source: Life Cycle Assessment of Illuminants Siemens Corporate Technology, 2009
*** Mercury emission from coal power plant over five years**

Cost Benefit Analysis for using CFL

• Electronic Retrofit CFL	20 W	15 W	11 W
• Replace ICL	100 W	75 W	60 W
• Saving in Electricity for 6000 hrs use = (2-1)*6000/1000 KWH	480	360	294
• Saving in electricity bill per			
• lamp @ Rs. 3.50 per KWH	1680	1260	1029
• Cost of Electronic Retrofit CFL	150	66	66
• Cost of 6 ICLs	66	66	66
• Net saving per ICL point = (4-5+6)	596	1226	995

Assuming life of ICL as 1000 hrs.

Discussion Question -2

You are one of the members of project team in Indian Railways. Based on your experiences, figure out a workable solution to reduce peak electricity load of housing colonies due to use of incandescent lamp that would entail no extra cost either to organisation or to its employee residing in these quarters. Identify key market/ economic challenges for realization and analyze how policy intervention could support overcoming them.

Discuss role of following factors in successful introduction of green technology in Indian Railways housing colonies?

– Sustainable Procurement Policy
– Communication with stakeholders
– Availability of green technology in the market
– Product Quality Assurance

Salient Features of Project

- CFLs to be distributed within 4 weeks to households after delivery at Divisional HQ
- Maximum of 4 CFLs to each household
- 14 W CFL to replace 60 W ICL and 23 W CFL to replace 100 W ICL
- Households must exchange one working ICL with each CFL
- Only CFL in high usage areas (Usage >3.5 hrs.) is to be replaced
- No payment to be collected from Households
- Door-to-door distribution of CFLs
- Spot check within two week of distribution
- Railways to replace CFL from buffer stock, if fused within 3 years

Role & Responsibility Matrix

Activity /Responsibility

- ***Supply of CFLs/ Philips and CQC***
- ***Distribution of CFLs/ Indian Railways***
- ***Collection of ICLs/ Indian Railways***
- ***Storage of ICLs and CRLs/ Indian Railways***
- ***Replacement of fused CFLs/ CQC and Indian Railways***
- ***Disposal of fused CFLs/ Philips and CQC***
- ***Monitoring of project/ BEE and CQC***

Discussion Question- 3

Some of the challenges for introducing energy efficient products/services, essential for your country's growth on low carbon path, are listed below in Column 1 of Worksheet 2. On right, some of the proposed measures to address those challenges have been suggested. Discuss the suitability of particular measure(s) to address these challenges.

Discussion Question- 4

Is your country signatory to Kyoto Protocol under United Nations Framework Convention on Climate Change? What are the reasons for asymmetry in distribution of CDM projects around the world? Discuss role of following factors for successful take off of Clean Development Mechanism (CDM) project in your country.

- Institutional and administrative framework
- Access to investment capital for carbon emission reduction project
- The availability of information on undertaking CDM projects
- The current level of carbon emission in your country
- The price of Certified Carbon Emission (CER) in international market

Transaction Cost ?

- Monitoring Mechanism is heavy and associated cost is high!
- Approx. Rs. 30 Lacs ($0.60 million)

- Rule of Thumb: At least 250,000 CFLs should be distributed to make a CFL program attractive under CDM (~50,000 Households)

Discussion Question- 5

Does your country have a dedicated national Energy or Environment Fund or other financial instruments to support such initiatives? How does CDM compare with alternative financial instruments or models in your country?

Key Leanings from the Project

- Provide 3600 due diligence on project design focusing on SYNERGY
- *Importance of appropriate policy framework*
- Pivotal Role of CDM & CERs market
- *Identify barriers to uptake and develop enablers*
- Consult stakeholders and build transparency in decision making
- *Focus on predictability of returns and ease to investors*