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

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ABSTRACT

DESCRIPTION

The transfer and diffusion of green technologies in developing nations is critical for climate change mitigation efforts. However, there are many barriers, the foremost being the high cost of green technology. Indian Railways had to face this challenge when it replaced energy inefficient incandescent lamps with energy efficient green products, with the aim of reducing peak lighting load in 0.65 million households of railway housing colonies. This case demonstrates how governments in developing nations could use sustainable procurement as a tool to create synergy with an existing international instrument, such as the Kyoto Protocol, for financing the cost of adoption and penetration of green technologies in these countries. The solution adopted in Indian Railways could be replicated in other similar situations within developing nations.

Learning objectives:

To use sustainable procurement policy (SPP) as a basis to demonstrate the benefit of green technology.
To use the Clean Development Mechanism (CDM) as a financial instrument for adoption of green technology.

Subjects covered:

Sustainable procurement; Kyoto Protocol; Clean Development Mechanism; Green technology

Setting:

- Indian Railways, India

DISCLAIMER

The views expressed in this case are from the authors and, have nothing to do with their affiliation with Indian Railways.

CONTEXT AND BACKGROUND

According to Gupta, Omkar, & Desai (2011), the Indian economy has witnessed an unprecedented growth in its output, resources consumed, and consequently, environmental impact over the last two decades. Since 2001, the average gross domestic product (GDP) growth rate for the Indian economy has been 7.5%. Due to rapid economic growth, the demand for energy in India has been growing rapidly. As a natural consequence, India's aggregate greenhouse gas emissions have increased from 1.2 billion tons CO_2 in 1994 to 1.7 billion tons CO_2 in 2007 (Atasu, Wassenhove, & Sarvary, 2009), a compound annual growth rate of 2.9%, earning India fifth spot in aggregate greenhouse gas (GHG) emissions in the world (Indian Network for Climate Change 2010). This situation is expected to worsen, as it has been estimated that by 2031, India's energy needs would be about seven times that of 2001 levels.

Conventional wisdom suggests that developing countries should "leapfrog" over standard (non-green) technologies, implementing green technologies from the start, to avoid getting trapped in high-carbon paradigms (Hasper 2009). However, transfer and adoption of such green technologies from developed to developing nations is wrought with many challenges– intellectual property rights concerns, financing issues, technical know-how of the putative recipients, complementary inputs and institutions to cultivate technologies, small producers catering to local markets, and trade barriers (Hasper 2009).

CHALLENGES WITHIN INDIAN RAILWAYS

Indian Railways is the national railroad carrier of India which transports more than 16 million passengers and 1.5 million tonnes of freight each day and employs 1.34 million employees. It consumes almost 2% of India's total electricity consumption. The United Nations Development Programme (UNDP) project, "Improving Energy Efficiency in Indian Railways", estimates that by 2020, Indian Railways would have a projected energy demand of 37,500 million kWh. Many employees of Indian Railways reside in the housing colonies provided by the employer. Most of these households use energy inefficient incandescent lamps (ICLs) for their lighting needs, thus, increasing peak electricity demand in the evening. The introduction and adoption of energy efficient lighting solutions to these households opens up direct and indirect challenges for Indian Railways. These challenges include creating awareness about energy efficiency potential of CFLs among stakeholders, improving quality of CFLs available in the market, improving availability of CFLs in the rural market, overcoming the initial price barrier of buying CFLs, and bolstering investment confidence that the returns on the initial investment required will indeed materialize.

In a tender for procurement of goods and services, tender is awarded by the public authority to the lowest technically suitable, economical bidders. The basic guiding principles/criteria for public procurement (award of tenders) in India include maximising economic growth, promoting efficiency and effectiveness, building fairness, creating healthy competition amongst suppliers, and maintaining transparency in the use of procedures. However, these criteria fail to take into account the environmental consequences and costs of producing a product at various stages – raw material(s) acquisition, manufacturing, packaging, distribution, reuse, maintenance, and end of life disposal of the product or service. The key question which needs to be addressed is whether the present award criteria in public procurement provides best value for tax payer money. With such award criteria, it is virtually impossible for the public authority to purchase energy efficient lamps, which comes at a much higher initial cost than the ICLs. Therefore, there appears a justifiable need to switch over to a new procurement policy, whereby the organization meets its need to provide goods and services that offers value for money on the whole. Thus, whilst minimising damage to the environment, this change proves beneficial not only to the organisation, but also to society and the economy.

The management of Indian Railways was determined to challenge the conventional wisdom that adopting green technology is costly. A multidisciplinary project team was given the task of looking for solutions that would reduce peak lighting load in housing colonies through the adoption of green technology by its employees. However, to add spice to the challenge, management added a boundary condition – the proposed solution should not invite any additional cost either to the organization or to its employees. The challenges ahead were daunting for the project team considering the goal set by management. The project team had, to not only scout for an appropriate solution available in the global market that addresses the challenges mentioned above, but also, to adopt tools for facilitating adoption of such a solution within the boundary conditions set for it.

AVAILABLE TOOLS FOR SOLUTION

After reviewing different procurement models and after a number of brainstorming sessions, the project team decided to base the solution on a sustainable procurement policy. With the policy as a basis, the team demonstrated to the stakeholders the benefits of adopting a green solution, despite its high initial costs. The team organized various stakeholder meetings across India and emphasized on how the latter could maximize benefits from using the proposed green product in their households. This approach was proven to be useful, as occupants of housing colonies could clearly visualize the benefits of adopting the green solution. It also helped in removing doubts from the stakeholders' minds regarding the proposed green solution.

Nevertheless, the biggest challenge for the project team was to figure out the financing

mechanism, to kick-start the project. Various options that were put forth during brainstorming sessions were:

- direct subsidy by the government to households (to meet the high initial cost of green technology);
- free supply of green technology by distribution company/Indian Railways to consumers, with recovery obtained in the form of monthly installment by consumers;
- subsidy reduction for electricity consumption (currently provided by the government to consumers) in order to make energy efficient products attractive; and
- subsidy for manufacturers (to reduce cost of producing green products).

All these options above were rejected by the management since the solution did not meet the boundary condition set by the management i.e. neither the organization, nor its employee would incur any extra cost for adopting a green solution in achieving the goal of reducing peak lighting load of housing colonies. Subsequently, the project team was able to single-out a green solution that would reduce peak lighting load of housing colonies within a short time, but the proposed solution had high initial costs. They were figuring out various ideas, including international protocols such as the Kyoto Protocol, which India is a signatory, to arrange for funding of the entire project (see Figure 1 and Box 1).

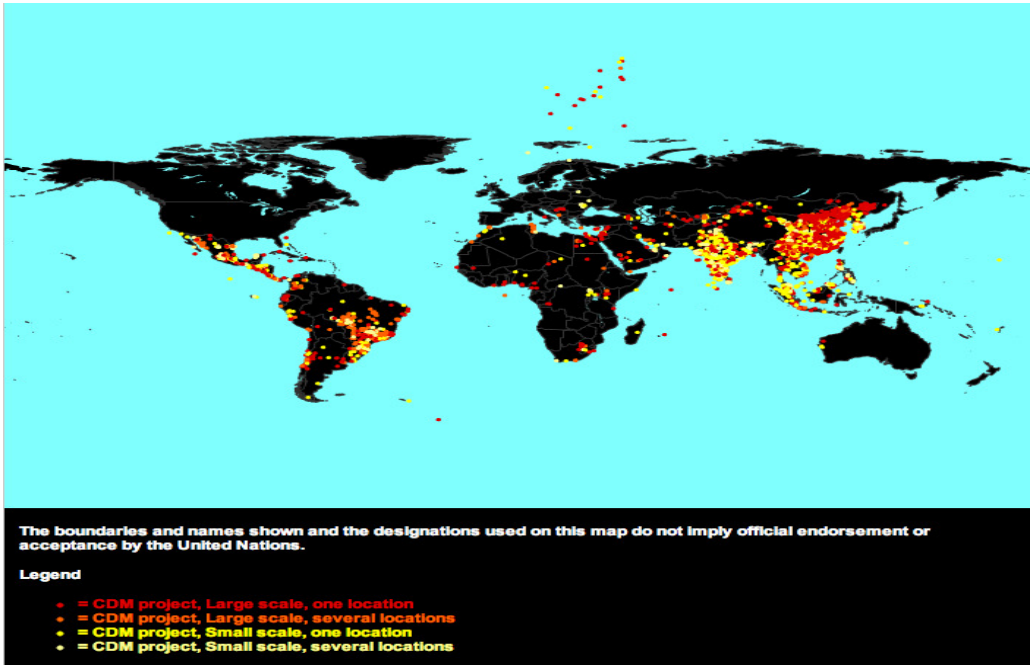

Figure 1. Distribution of CDM projects (UNFCCC 2013)

The Clean Development Mechanism (CDM) has seen a fair degree of success over the last ten years in 83 nations. The 6,000th CDM project, under implementation in Vietnam, aims to reduce GHG emissions by 32,000 tons a year by installing 21 megawatts of wind power into

an electric power grind. Speaking on this milestone, Peer Stiansen, chair of the CDM executive board said, "This is a remarkable milestone for a remarkable tool created to combat climate change and contribute to sustainable development". However, when closely observed, it is noted that uptake of CDM project across nations has not been even, with four nations - China, India, Brazil, and Mexico - leading the pack, accounting for over 85% of all projects. Other developing countries, particularly in Africa, are far from satisfied with this outcome.

Box 1: Clean Development Mechanism (CDM) under Kyoto Protocol

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. Under the Kyoto Protocol, emission caps were set for each Annex I countries whereas, no emission cap is imposed on Non-Annex I countries. However, to encourage the participation of Non-Annex I in emission reduction processes, a mechanism known as the Clean Development Mechanism (CDM) has been provided. The Clean Development Mechanism (CDM) of Kyoto Protocol allows emission-reduction projects in developing countries to earn Certified Emission Reduction (CER) credits, each equivalent to one tons of CO_2. These CERs can be traded and purchased by industrialized countries to meet

According to Talberg & Nielson (2009) many factors such as institutional framework, access to investment capital, the economic growth of the nation, the availability of information on undertaking of CDM projects, opportunity for taking up CDM projects, the in-country costs of undertaking a particular project in a particular country, and the political, administrative and financial risks of undertaking a project in a particular country, combine to make a country more or less attractive for CDM projects. Besides this, the development of a project design document, obtaining host country approval, project validation and registration, project monitoring, verification, and certification with the UNFCCC requires a lot of documentation and technical expertise. Furthermore, the entire process itself takes about 12-24 months and is very complex, requiring coordination with several agencies and stakeholders throughout the life of the project.

Finally, the project team found a workable solution and successfully implemented it to provide green lighting solution in approximately 400,000 households of Indian Railways. However, with little expertise in handling a project of such complexity, the team outsourced the project design and implementation to professionals, limiting its role to regulatory compliance. To top it all off, the team not only met the boundary condition set by the management, but also generated income for the organization.

KEY OUTCOMES OF THE PROJECT

This project resulted in significant reduction of peak lighting load without compromising on

the lumen output and, thus, contributed towards sustainable development, through the adoption of an energy efficient technology, which would otherwise, due to a cost barrier, not witness such a large market penetration in India.

Economic benefit: The project resulted in direct energy savings of 112 giga units per annum (1 Unit = 1 kWh), resulting in total savings of Rs. 44.8 Crores (USD 8.96 Million) per annum, in the energy bill of railways households.

Social benefit: 400,831 households have directly benefited from this project as they received free green solutions for their lighting needs. Each household would be saving Rs. 1280 per annum in energy bills over the project duration of 7 years.

Environmental benefit: The project has reduced energy consumption by approximately 80 kWh for each use of green product per annum, and thereby, carbon emissions from upstream fossil fuel power generation. It would result in a reduction of approximately 90,000 tonnes of CO_2 emission (CER equivalent) per year.

In the end, this project demonstrated how government can use available instruments as a tool for creating synergy with business and consumers, to encourage penetration and adoption of green technology.

THE CHALLENGE AHEAD

The above paragraphs discuss the background challenges in Indian Railways, available options for addressing the precise task given by management of Indian Railways, and outcomes of the project implemented by the team. However, the case does not describe the actual solution adopted by the project team. The readers of this case are expected to derive the details of the actual solution through the following tasks.

Discussion Questions

Question 1:
You are one of the members of the project team in Indian Railways. You note that despite its high initial economic cost, your project team should still demonstrate the benefits of buying green solutions to the stakeholders. What then are the changes that you would suggest to the current procurement policy of Indian Railways?

Use the list of issues in the left column of Worksheet 1 to assist you in the discussion on barriers for introducing green procurement policy in your country. If time permits, and the course allows, use Worksheet 1 as a basis to conduct a survey with stakeholders to identify most significant obstacles. Compile the results of this survey to devise an appropriate strategy for introducing such a procurement policy in your country.

Workheet 1: Barriers for introduction of green procurement policies

Perceived/Actual barriers	Strongly Don't Agree	Don't Agree	Agree	Strongly Agree
Legal framework for integration of environmental and social consideration in procurement decision				
Procurement guidelines of organization				
Availability of sustainable products in the national market				
Higher price of sustainable products in the market				
Non-availability of information (criteria, prices, services) concerning green product and service alternatives				
Lack of awareness and knowledge about sustainable procurement policy (SPP) issues				
Difficulty in identifying green product and service alternatives within the procurement market				
Uncertainties concerning the legal position of green procurement (e.g. because of complexity)				
Lack of political/management support for SPP implementation.				
Lack of support from multilateral organization such as United Nations Environment Programme (UNEP)				

Question 2:

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

Discuss the role of following factors in successful introduction of green technology in Indian

Railways housing colonies:

a. Sustainable procurement policy
b. Communication with stakeholders
c. Availability of green technology in the market
d. Product quality assurance

Question 3:

Some of the challenges for introducing energy efficient products/services, essential for your country's growth on a low carbon path, are listed below in the first column (on the left) of Worksheet 2. In the next four columns, some of the proposed measures to address those challenges have been suggested. Discuss the suitability of particular measure(s) to address these challenges.

Worksheet 2: Challenges for introducing energy efficient products/services

Challenges	Legislative	Administrative	Awareness & Capacity Building	Public – Private Partnership
Initial cost barrier of green solution				
Quality of green product/service available in market				
Availability of green product in rural market				
Low/subsidized electricity tariff				
Benefits of green product over conventional product				
Return on investment of private players				
Disposal cost of green product at the end of life				

Question 4:

Is your country a 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 the role of following factors for the successful take off of a Clean Development Mechanism (CDM) project in your country.

a. Institutional and administrative framework
b. Access to investment capital for carbon emission reduction project

c. The availability of information on undertaking of CDM projects
d. The current level of carbon emissions in your country
e. The price of Certified Emission Reductions (CERs) in international market

Identify political, administrative and financial risks of undertaking a CDM project in your country.

Question 5:

Does your country have a dedicated national energy or environment fund or other financial instruments to support such initiatives? How does the CDM compare with alternative financial instruments or models in your country?

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