



# Green Growth and Development Quarterly

Volume 2 • Issue 1 • October 2013



The Energy and Resources Institute

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### **Acknowledgements**

We gratefully acknowledge Department for International Development (DFID) for providing support for this newsletter. We acknowledge Rajiv Sharma, R K Joshi, Hemambika Varma, Meenakshi Dwivedi, Aparna Mir, and Shilpa Mohan from TERI Press. We acknowledge M K Bineesan and P D Tiwari from the Green Growth and Development Division for executive support at various points.

### **Published by**

The Energy and Resources Institute (TERI)

TERI Press

Darbari Seth Block

IHC Complex

Lodhi Road

New Delhi – 110 003 / India

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## FOREWORD BY EDITOR-IN-CHIEF

The imperatives for greening of growth and pursuing a resource efficient path of development are becoming clearer as our knowledge of the closed system that the economy of the world functions within becomes apparent. Two major reasons why green growth is receiving worldwide attention are, firstly, because the scarcity of some resources is increasing to a level where economic activity and human welfare can be affected adversely. Secondly, the damage and degradation of the global commons has reached a point where the impacts of such a process are becoming increasingly negative and serious. In the first category, the projected scarcity of hydrocarbons could lead to price increase in the future, as a result of which some countries and some sections of society would find it a challenge to access these in the market once they cross a particular threshold in costs. Similarly, in the case of water, growing scarcity in several parts of the world would make it difficult for communities and societies to be able to get adequate water for drinking against the prospects of a growing population and several factors constraining the supply of water in various parts of the world.

Greening of growth would require a range of interventions and policies, beginning with research and development, which would help to develop new technologies and bring about innovation to ensure higher efficiency of use of certain resources as well as the development of substitutes which would not encounter scarcities that hydrocarbons and water, for instance, are likely to present in the future.

In the case of the global commons, we find today that the concentration of greenhouse gases in the earth's atmosphere is leading to climate change with impacts and consequences that are becoming increasingly serious. At the same time, the oceans which are absorbing increasing quantities of carbon dioxide are exhibiting acidification, which would become progressively more harmful for marine resources and various forms of marine life. Fortunately, greening of the economy can often be achieved without net addition of costs in an economic system. As a result of institutional and other barriers, we are actually not utilizing opportunities that exist for reducing environmental damage and degradation which are available at net negative cost. What is essential, therefore, is to put in place a set of policies and to remove

## Foreword

certain institutional barriers, by which greening of growth becomes a sustained effort. Essentially, therefore, it is useful for policy-makers and leaders of the society across the globe to identify the so-called low-regrets measures, by which resource use efficiency and greening of growth can be enhanced adequately and rapidly for overall benefit to the society.

This issue of the *Green Growth and Development Quarterly* provides a wealth of information and analysis by which the benefits of greening an economic system would become even more compelling than is the case currently.



**R K Pachauri**

Director-General

The Energy and Resources Institute

## INTERVIEW



### Luis Alberto Moreno on Sustainability Approaches by the Inter-American Development Bank

*Luis Alberto Moreno is the current President of the Inter-American Development Bank.*

**TERI:** The countries of Latin America and the Caribbean (LAC) would be investing large scale resources in upgrading existing infrastructure and in the creation of new facilities. Some of these projects will be directly funded by governments and the others would be through Public Private Partnerships (PPPs). How do you think the countries of these regions can ensure that infrastructure projects are actually green in nature including those implemented by governments and through PPP projects? How is the Inter-American Development Bank (IDB) promoting greening of infrastructure projects?

**Luis Alberto Moreno:** Let me start by reaffirming our strong commitment to sustainable development. The IDB has a strategy in place that calls, inter alia, for the allocation of 25 per cent of our financial flows by 2015 to investments in addressing climate change, protecting biodiversity, and promoting sustainable use of natural resources (a goal, which has been already reached).

We have also established and staffed a division on Climate Change and Sustainability to promote the agenda throughout the Bank and recently approved a Biodiversity Platform that we expect will support improved conservation and sustainable use of biodiversity assets in the region. Within this context we are in the process of drafting a modern and ambitious strategy on infrastructure that will likewise address the regional needs for sustainable investments.

We are aware and keen to tap into the substantial potential for green and ecosystem-based infrastructure in the region and expect that the private sector will actually play a leadership role in this regard. Let me also indicate that I am personally active in the Latin America Conservation Council, an initiative led by key private sector players in the region. The Council, amongst its tasks for this year, includes an effort to visualize what



is needed to promote green, smart infrastructure investments in the region. The IDB is actively engaged in this effort.

**TERI:** The LAC region is richly endowed with biodiversity, and a large number of the rural poor depend on ecosystem services derived from natural resources for their livelihoods, employment, and local enterprises. It would be essential to see that micro, small, medium enterprises (MSMEs), and communities have access to knowledge for valuing of these ecosystem services for the poor. How is the IDB creating mechanisms and facilitation for MSMEs and communities in this regard?

**Luis Alberto Moreno:** You are absolutely right. The region houses five of the so called mega-diverse countries (Brazil, Colombia, Mexico, Peru, and Ecuador). The part of the solution to ensure the sustainable use of these resources is information and knowledge. The IDB is working with MSMEs on many fronts (access to services, financial mechanisms, capacity-building, and other areas).

Most notably, the IDB through its Multilateral Investment Fund (MIF) supports economic growth and poverty reduction in Latin America and the Caribbean through encouraging increased private investment and advancing private sector development. It works with the private sector to develop, finance, and execute innovative business models that benefit entrepreneurs, poor and low-income households; partners with a wide variety of institutions from the private, public, and non-profit sectors; evaluates results; and shares lessons learned. The Fund has as of late greatly increased its involvement on issues of climate change.

**TERI:** In LAC, over 34 million people do not have access to electricity and over 85 million still rely on traditional biomass (e.g., wood and dung) for their daily cooking needs. How is the IDB planning to tackle the energy needs of this section of the population, so that people can benefit from clean, sustainable, and accessible energy? What is the IDB's policy and approach towards development and dissemination of clean energy technologies for the poor?

**Luis Alberto Moreno:** The IDB is engaged in this area through its LAC Sustainable Energy for all (SE4ALL) initiative. The purpose of this initiative is to extinguish energy poverty in the region, in coordination with the United Nations (UN) SE4All global initiative. The initiative was launched in 2010 and has three objectives, which are being pursued through a varied portfolio of activities using our technical and financial resources.

First, we seek to provide universal access to modern energy. As you say, approximately 34 million people in the LAC region live without access to electricity



and nearly 85 million live without regular access to clean and modern cooking fuels. Although this represents a minority portion of the population in our region, 6 per cent and 15 per cent of the LAC population respectively, all should have access to a better quality of life with affordable, clean, and modern energy.

Second, we intend to help double renewable energy use. Countries that are dependent on fossil fuels are hurt by volatile and often high fuel prices. Increasing renewable energy use is a strategic investment to improve a country's economy that will strengthen energy security, reduce local environmental impacts, avoid greenhouse gas emissions, and promote the development of local enterprises and jobs.

Finally, we are working to expand energy efficiency technologies and measures throughout the region. As LAC economies expand fast into the 21st century, the region will continue to increase its energy demand. In this scenario energy efficiency measures have the potential to save large amounts of energy with positive economic and environmental impacts.

The IDB has committed to support these goals by investing up to one billion dollars a year in these three areas.

**TERI:** An increasing level of knowledge would be required for promoting green growth and development in the LAC region. Does the IDB pursue specific policies for upgrading knowledge and its use in countries of the region to ensure a movement towards green growth and development?

**Luis Alberto Moreno:** We have a very active portfolio of activities which address knowledge and capacity-building in the region. As part of these activities, our Sustainable Energy and Climate Change Initiative (SECCI) has sponsored a strong effort in capacity-building and knowledge generation in green development, in particular as these relate to climate and energy issues. The Bank is also partnering with other financial resources, including the Climate Investment Fund, the Fast Start Mechanism, the Adaptation Fund, the Global Environment Fund (GEF), and the Special Climate Change Fund to bring the necessary technical and financial resources to bear on these issues. Let me give you an example. In 2012, SECCI made an investment of US\$1 million to visualize the potential for development of concentrated solar power in the Atacama Desert in Chile (one of the highest solar radiation regions of the planet). Through this investment the IDB was able to catalyse the allocation of about US\$70 million of Climate Investment Funds to anchor the development of a Solar Power Plant.

These resources in turn have attracted about US\$400 million of additional resources, already committed to the financing package for the investment. This financing package

is being offered to potential developers and we expect to have a party selected in a few months. As you can see, one dollar in knowledge generation has leveraged 400 times its value in investment capital.

**TERI:** What is your view on south-south cooperation involving the LAC region and other developing countries? Do you see regional development banks assuming this role more actively?

**Luis Alberto Moreno:** I am personally committed to this process. In the recent past we have entered into an agreement on cities and climate with the Asian and African regional development Banks. Under this cooperation, we are exchanging experiences by city managers, as well as data and tools to guide our efforts on sustainable cities.

More broadly, we continue to seek opportunities to help countries in the region benefit from activities in other regions. In another recent example, we are facilitating a cross fertilization of experiences on the development of financing mechanisms for geothermal energy between Mexico and Chile, and on tools to avoid deforestation between Colombia and Peru. Through the Global Green Growth Forum, in which the IDB is very actively engaged, we expect the experiences of countries such as Korea, Kenya, and others to be shared with countries in the region.

Finally, we have a vested interest in supporting the integration of the regional economies in the continent and this will only come about through strong south-south partnerships.

**TERI:** In bringing about awareness and creating conditions for green growth do you feel the media would have a role to play? If so, how can we ensure that media persons are trained in and sensitized to green economy issues?

**Luis Alberto Moreno:** Without a doubt, media has a major role in disseminating experiences on green growth. Let me take advantage of your question to let you know that the IDB is developing a multi-media platform on adaptation practices to climate impacts in the region, and we expect it to have a feel and content akin to a regular weekly magazine.

We are working very actively on this platform and hope to launch it in the next few months. We expect it to be an excellent resource for media outlets looking to tell the positive examples that are advancing towards a climate smart development.

Overall, we welcome and in fact encourage the involvement of third parties in learning about these issues; the Bank, due to the nature of its work is a source of practices, knowledge, and information generated through its involvement with countries, companies, and other partners. We hope this vast depository of information is widely used and media outlets can be a useful mechanism to achieve this goal.

## INTERNATIONAL CASE STUDY

# Moving Towards a New “Green Growth” Paradigm: Initiatives in Sri Lanka

*HE Prasad Kariyawasam*

**R**apid economic growth increases pressure on environmental sustainability. Most countries today are confronted with multiple crises relating to energy, water, food, and finance. Environmental impact due to unsustainable production and unbridled consumption are posing unprecedented challenges to all countries,



including Sri Lanka. The crises, especially in the context of climate change, energy, water, and food provide a unique opportunity for fundamental restructuring of the economic development model that could encourage and sustain a Green Economy.

Since environment and economic policies are complementary, we need to regulate market mechanisms to promote new and innovative investments in green technology. In this process we should be mindful to ensure that the solutions and incentives should be attuned to each country's potential and limitations in terms of energy availability, wealth, and natural resources as well as cultural heritage. Credit must be given to countries such as Sri Lanka that sustain substantial forest cover which act as lungs, absorbing carbon emission. Governments alone cannot manage and fund the transition to a green economy; the private sector and the civil society can and must play a fundamental role but requires incentives.

Sri Lanka maintains a high physical quality of life especially in education and healthcare. Life expectancy at birth in Sri Lanka is 76 years, literacy is 92 per cent, and population growth 0.9 per cent. In terms of natural resources and biodiversity conservation, Sri Lanka has maintained a satisfactory level of natural forests (23 per cent) and tree cover (over 60 per cent of land area). Moreover, in respect to climate change, Sri Lanka is in a significant position being a low carbon emission country with only 600 kg per person per year. However, with the transition from an agricultural economy to industry and increasing consumerism, Sri Lanka is experiencing several environmental issues that have an increasingly negative impact on sustainable development endeavours.

Sri Lanka has identified the way for moving towards a new "Green Growth" paradigm by seeking to harmonize "economic growth" with "environmental sustainability". Following are some of the green growth initiatives by Sri Lanka to hasten its journey towards achieving sustainable development and economic growth:

- Sri Lanka has established the National Council for Sustainable Development under the leadership of HE the President of Sri Lanka to ensure political commitment at the highest level.
- A new programme named Green Lanka to evolve long term plans for sustainable economic and social development has been developed. A comprehensive plan to be implemented from 2009–16 titled "National Action Plan for Haritha (Green) Lanka Programme" was evolved under the supervision of the National Council for Sustainable Development. This covers ten environmentally sensitive thrust areas. This programme has been incorporated into Sri Lanka's National Development Agenda "Mahinda Chinthanaya–Vision for the Future".

- An Environmental Conservation Levy Act to secure financial resources for environmental management based on the Polluter Pays Principle has been enacted.
- To interpret human development with ecological factors, an index called “Sustainable Human Development Index” has been developed.

Sri Lanka, as an environment friendly and nature protecting nation, is committed to do more to prevent environmental degradation, such as air, water, and land pollution, in order to foster Green Growth and Development.

***HE Ambassador Prasad Kariyawasam is High Commissioner for Sri Lanka to India***

## Community-Based Resource Pooling for Access to Cleaner Cooking Fuel Among Urban Poor

*Bibhu P Nayak, Christine Werthmann, and Veena Aggarwal<sup>1</sup>*

### Introduction

More than a fifth of the urban population in India, mainly the poor, still use biomass-based cooking fuels. The National Sample Survey Organization's (NSSO) survey in 2009–10 found that 22.5 per cent of the urban population use traditional fuels such as firewood, chips, dung cake, and other locally available biomass (NSSO, 2012). The World Energy Outlook 2011 also maintains that of the 2.7 million people without access to clean cooking fuel in the world, 0.84 million live in India (IEA, 2011). This constitutes 72 per cent of India's total population with 0.75 million living in rural India and 0.9 million living in urban and peri-urban areas. The direct burning of biomass for cooking is accompanied with 'severe health impacts, gender inequities, local, and global environmental change' (Foell et al., 2011). A large population in urban areas being without access to cleaner cooking fuel is a matter of concern. Though liquified petroleum gas (LPG) for domestic consumption is subsidized, only 64 per cent of the urban households use LPG as a cooking fuel (NSSO, 2012).

The adverse impact of the use of firewood as a cooking fuel on health and on (urban) environment has been widely researched (Smith, 2000; ICMR, 2001; World Bank, 2002a; UNDP/ESMAP, 2003; Mehta and Shahpur, 2004; Smith et al., 2005; Liddell and Morris, 2010). The first major difficulty associated with the burning of biomass is the smoke and the resultant morbidities. This mainly affects women and children who spend most of their time close to the cooking area. Indoor air pollution is the major driver of acute respiratory infection-related morbidities and mortalities in India and is also responsible for 'lung cancer, ischemic heart disease and tuberculosis (TB) in women, blindness, cataracts, asthma, other adverse pregnancy outcomes such as low

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<sup>1</sup> The authors acknowledge funding support from Federal Ministry of Education and Research (BMBF), Germany under its Future Megacities Programme and also the research support of Deepika, P R Krithika, and other members of the project team. The usual disclaimer applies.



birth weight, prematurity, and early infant death' (Lakshmi et al., 2013; Smith, 2000). Also, the urban poor who live in smaller houses and congested localities have higher exposure to smoke. Thus, it is especially the poor and marginalized who suffer most from the situation. An additional problem aligned with the use of biomass fuels is the time consuming collection process and related hardships. Poor households living in slums collect firewood either from nearby shrubs, avenue plantations or buy it from the open market. Those who collect the firewood (mostly the women in the household) locally spend about eight to ten hours a week on its collection and may have to walk up to ten kilometers to fetch firewood. With shrinking open space for shrubs and trees in the fast growing cities, the hardship of the poor increases and also results in increased pressure on remote forests. Hence, greater access to clean cooking fuel among the urban poor would not only improve their quality of life, but would also address the greater issues of reduced burden of diseases, better urban environment, and global warming mitigation.

In this context, it is important to understand the factors that deter the shift towards cleaner cooking fuels such as LPG among the urban poor. Though the households purchasing firewood spend almost the same or an even higher amount for firewood in comparison to the cost of LPG use, the non-affordability of the initial cost of buying a LPG connection is a major constraining factor. This paper explores whether community-based resource pooling can facilitate such a shift based on experience from a pilot project implemented in two slums in Hyderabad. As part of this pilot project, individual households come together, form a group, pool their financial resources and thereby, each month, a few households receive an LPG connection. This resource pooling continues until all the members of the group get the LPG. The idea is to facilitate a process of empowerment, where social institutions such as trust and cooperation among urban slum households enable the transition from biomass-based cooking fuels to cleaner cooking fuel. This pilot is found to be effective as all 60 participating households managed the transition to LPG through this resource pooling approach.

## **The Cooking Fuel Choice Pattern among Urban Households**

Household energy choices in developing countries are often explained by the 'energy ladder' and 'energy stacking' hypotheses in literature. Though both of them emphasize income dependency of the household energy choice, the former hypothesizes a linear relationship between income and fuel switching, whereas the latter suggests expanded energy options with increased income of the household. Apart from income, the decision concerning the energy choice of households is a complex interaction of a host of factors that could be economic, technological, institutional, socio-cultural, and



environmental (Kowsari and Zerriffi, 2011; Masera et al., 2000; Reddy, 1996; Leach, 1992). Cooking is an important daily activity in a household and the choice of fuels depends on a variety of factors as mentioned above which influence the affordability, availability, and awareness (Viswanathan and Kumar, 2005). The fuel use pattern of households changes with its changing socio-economic status over time which is referred as fuel transition. The typical transition path for cooking fuel is a shift from biomass to kerosene, LPG, and finally electricity (Alam et al., 1998). The paths could be different depending on availability and other local conditions, e.g., from one biomass to another, from biomass to LPG.

The biomass-based fuels such as dung cake, firewood, charcoal (the 'lower' in energy ladder) are cheaper but more polluting, inefficient, and labour intensive. With increased income the households either abandon or use less of these fuels and shift to fuels that are less polluting, efficient, require less input of labour but could be costly (Masera et al., 2000; Tyler, 1996; Leach, 1998). Reddy (1996) argued that such a shift occurs with increased income only if the discount rate of the households decreases exponentially. Apart from income and other household characteristics, the prices of the fuels and household's perception of their attributes also influence the household choices (Gupta and Kohlin, 2006). The study of Gupta and Kohlin (2006) is based on primary survey data in Kolkata and found that the demand for LPG is sensitive to kerosene while kerosene is sensitive to the coal price.

However, it is not the economic factors and the household characteristics alone that constrain access to cleaner cooking energy. Along with fuel prices, the prices of the stoves also determine the household's fuel choice (Gupta and Ravindranath, 1997; Gupta and Kohlin, 2006). Non-affordability of fuel-efficient stoves and necessary accessories also constrains the fuel choice even if households need to spend more or equal amounts of money on fuels in the 'lower' strata of the energy ladder. The policies and institutional factors also influence household fuel choices by altering the prices of the fuels, thus making the cleaner fuel cheaper and affordable for the poor. At the same time, due to inconsistent policy framework and fragmented institutional responsibilities to make cleaner fuel accessible, as a basic urban service, the intended benefits do not reach the poor (Dhingra et al., 2008).

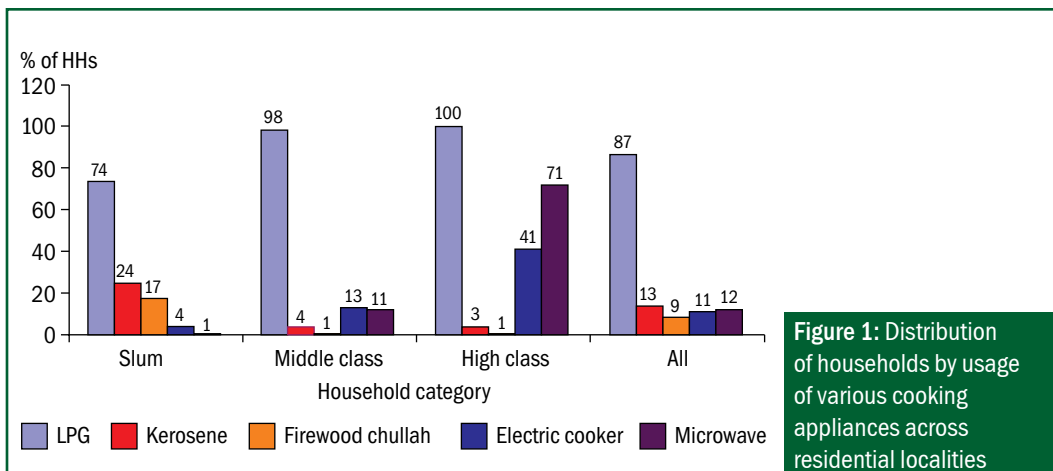
### **Cooking Energy Use Pattern in Hyderabad**

A household survey was undertaken in 2010 to explore the household energy consumption for lighting, cooking, water heating, and space cooling in Hyderabad. A total of 798 households were selected for the survey through a stratified random sampling technique representing three different types of residential locations throughout

the city, i.e., slums, middle class and high class localities. Of the total sample, 48 per cent of the households lived in slums, 43 per cent in middle class localities, and the remaining 9 per cent in high class localities. This paper discusses findings related to household cooking energy only. The survey gathered information on the various kinds of appliances (such as LPG burners, kerosene stoves, etc.) used by sample households for cooking, their average duration of usage per day, and their expenditure along with information on other energy use and socio-economic information.

Various cooking fuels used by the households were LPG, kerosene, electricity, firewood, and other locally available biomass with very few reporting to use dung cakes and solar cookers. LPG was the most dominant fuel reported to be used by 87 per cent of the households (see Figure 1). Households used multiple fuels for cooking and the use pattern changed with residential localities and income level. For instance, the percentage of households using kerosene stoves declined as we moved from slum (24 per cent) to middle class and high class (4 per cent and 3 per cent, respectively). Firewood as a cooking fuel was used mainly by the slum households. On the other hand, the usage of modern appliances such as electric cookers and microwaves was most prominent amongst the middle and high class as shown in Figure 1.

Similarly, the results from the survey also revealed an interesting relationship between household income and the choice of cooking fuel (Table 1). With increased Monthly Per Capita Income (MPCI) of the households, use of LPG and electricity as cooking fuel increased while that of kerosene and firewood decreased. The majority of the households in the lowest two MPCI groups used kerosene and firewood. A significant shift was evident in the use of LPG (from 61 per cent to 90 per cent) when



**Figure 1:** Distribution of households by usage of various cooking appliances across residential localities

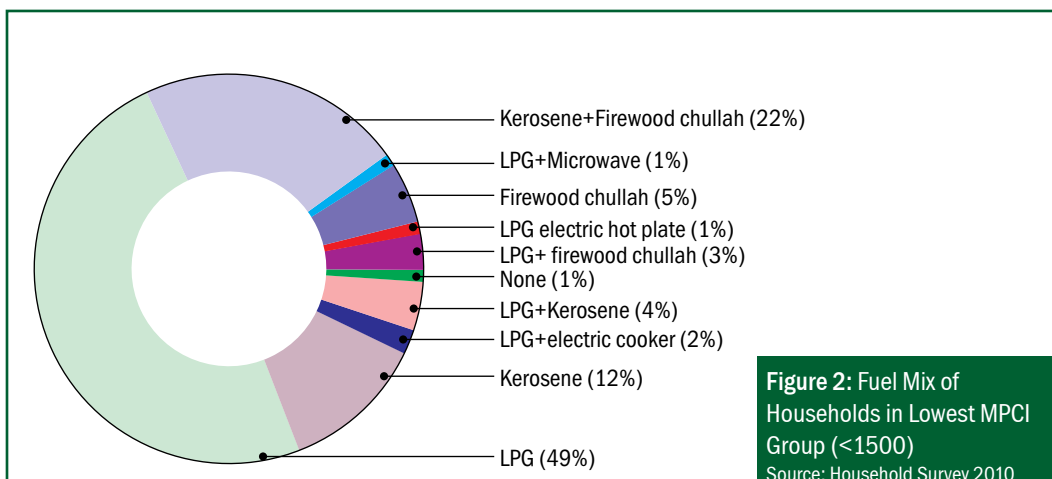
the MPCCI increased from less than ₹1500 group to ₹1500–3000 groups. This revealed a ‘fuel transition’ when households climbed the income ladder. In other words, with increasing income, families switched from traditional fuels to cleaner and more efficient fuels for cooking.

The fuel mix of the surveyed households also varied significantly across the MPCCI groups as well as residential locations and confirmed the notion of fuel hierarchy and fuel stacking as discussed in literature. LPG, kerosene, and firewood were observed as primary cooking fuels. The lowest MPCCI group had the most diverse fuel use pattern and kerosene-firewood fuel mix had the largest share in this group (see Figure 2). It was

**Table 1:** Distribution of households by usage of various cooking appliances across residential localities

Monthly Per Capita Income Group (in Rupees)	% of Households Using				
	LPG Stoves	Kerosene Stoves	Firewood Chullahs	Electric Cookers	Microwave
Oven					
< 1500	61	38	30	2	1
1500-3000	90	10	5	8	2
3000-5000	96	5	1	12	8
5000-7500	100	0	3	13	28
> 7500	100	4	0	39	66
All	87	13	9	11	12

Source: Household Survey 2010



also evident from the graph (Figure 2) that 40 per cent of the households in this group did not have access to LPG. Similarly, among sample households living in slums 25 per cent never used LPG and 31 per cent reported to use fuel mix of kerosene-firewood. So a significant proportion of urban poor did not use the cleaner cooking fuels even if it was subsidized by the government for domestic consumption.

As far as the expenditure on cooking fuel was concerned, a slum household that was not using LPG but using kerosene and firewood spent around ₹300 per month (with an average monthly consumption of 9.6 litre kerosene and about 29 Kg of firewood) on those two fuels<sup>2</sup>. Further, households using LPG spent ₹320 for a LPG cylinder which was used for one and half months on an average for the comparable MPCJ group. This implied that a slum household (not using LPG) spent an amount on kerosene and firewood which was more than the cost of LPG. However, while for a LPG cylinder refill, a household had to spend the total cost of an LPG cylinder upfront, for kerosene and firewood the household could spread the total expenditure over the month by spending on a daily/weekly basis. In some of the slums, some portion of firewood used for cooking was also fetched locally (from nearby shrubs, roadside plantations, etc.). Also, some of the households in slums often did not have the required documents (such as identity and residence proof) to avail subsidized LPG.

So LPG as a cooking fuel not only provided significant cost advantages but was also perceived to be the most convenient cooking fuel by the majority of respondents who were not using LPG. The field survey also suggested that women as well as other members of non-LPG households were better aware of LPG than electrical cooking appliances and safety was not an overriding concern for non-adoption of LPG. So what restricted such a significant portion of the urban poor from using LPG? Was it the upfront refill cost and lack of required documents; were the two factors deterring their access? The study team intended to investigate this further and a field survey was conducted in selected slums in 2011. The field survey suggested that even if several non-LPG households had the required documents and had the ability and willingness to pay the refill cost upfront, they still did not have access to LPG. It had been observed that high upfront costs of LPG ('LPG connection' as popularly known) was a major deterrent in the absence of any micro-finance link or any other easy payment options like monthly installments for such households. In order to obtain an LPG connection, households needed to invest in a stove, a regulator, a security

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<sup>2</sup> The Non-LPG households get 2–4 litres of subsidized kerosene per month under PDS at a price of ₹12 per liter and pay ₹20 to ₹30 per litre in open market for the rest of the requirement. Firewood costs ₹3 to ₹5 per Kg but subject to high seasonal fluctuations (higher prices in monsoon and festive seasons). All the cost and expenditure figures pertain to the survey period i.e., 2010.

deposit for the cylinder, the cost of fuel and documentation charges (a total of ₹3600 to ₹4200 for a single cylinder connection) which often added up to more than an average monthly income of a slum household. Moreover, the application process was cumbersome and often took months. So by the time their turn came, the money saved for this purpose would get used for other pressing needs. Given the gender dimension of cooking and cooking fuel collection, the priority of going LPG among the poor households took a back seat.

The problem of the high upfront cost of an LPG connection has been duly recognized by the policy-makers and the programmes has already been initiated by states like Andhra Pradesh ('Deepam Scheme' launched in 1999) and Delhi ('Kerosene Free Delhi' launched in 2012) to provide one-time capital subsidies for the urban poor to meet the upfront costs. However, such subsidy provisions have huge implications on state budgets, not only in terms of the direct cost of subsidies but also the associated administration costs. In addition, these subsidy schemes only partly reach the intended beneficiaries and instead create a greater scope for corruption and malpractice. Amongst the beneficiaries, at times there is little ownership and utility of such freebies, with some even re-selling it at a premium and others keeping it aside. Looking at the specific local context in Hyderabad, this research aimed at testing whether cooperative solutions could enable households to switch to LPG without necessarily depending on the governmental schemes such as Deepam. The results from the trust experiments conducted among urban slum dweller communities found a reasonable level of trust and reciprocity which further strengthened the belief that cooperative solutions are possible (Werthmann, 2011). So it was decided to initiate a pilot project based on the community-based resource pooling to enable the household to meet the upfront cost of an LPG connection.

### The LPG Pilot

The community-based resource pooling approach is well-known in various parts of the world and is widely used for a range of developmental needs like facilitating credits for populations without access to formal credit systems, management of local natural resources and so on. The novelty of this pilot is that it combines findings from a larger research project to design a solution for a private problem with greater implications for a common good. Often, solving environmental problems is aligned with further privations for poor households and thus, these problems cannot be tackled. In this project, households themselves have a strong incentive to improve the environmental situation as it is they themselves who suffer most from the indoor air pollution and the inconvenience. Importantly, by creating a community-based

self-help solution in mobilizing the resources rather than using a conventional subsidy regime, the project is empowering the people to help themselves by using their own social resources.

As a first step for the pilot, a local NGO was identified for capacity-building and coordination at the field level. In cooperation with the local partner, several slums were visited to examine the interest of the households to participate in the pilot. Since the Trust games had shown higher trust levels in slums with some experience of collective action, it was decided to identify slums which had Self Help Groups (SHGs). The two slums identified for the pilot were Banjara Colony (479 households in total) and Nandanvanam (1,785 households) in the LB Nagar area of Hyderabad and groups of 30 women each were formed from amongst them. In Banjara Colony, 30 per cent of the households were using LPG for cooking, whereas in Nandanvanam it was a slightly higher proportion with almost 43 per cent. All other households used firewood and kerosene for cooking. In Banjara Colony, the firewood was sourced locally but in Nandanvanam it was mostly purchased. Further, the team met the local LPG dealers to discuss the pilot idea and seek their cooperation in providing LPG connection at reasonable prices.

Several rounds of meetings were conducted in both the slums. In these meetings, consensus was built on appropriate institutional mechanisms for the cooperation and it was decided to form LPG Groups. It was left to the LPG group to decide about the amount to be contributed and the rules of the collective action (e.g., how many LPG connections to be bought every month and who would get when, and how much to contribute). Nevertheless, each household contributed the same amount of money for several months. From the pooled resources, each month, some of the members were able to obtain an LPG connection. The group kept contributing until all member households got their LPG connection.

The pilot commenced in March 2011. The LPG group started functioning in Nandanvanam in the month of March itself. The local gas dealer agreed to provide connections to five households every month and charged ₹3600 per single cylinder connection with LPG stove and other necessary accessories. The group decided to mobilize ₹600 from each member households every month. Thereby, every month, five households were able to obtain an LPG connection. Those beneficiary households were chosen by a lottery system every month, as decided by the group. This mechanism went well for the first four months. However, then the local LPG agency increased the prices of the connections. Also, during August 2011, most group members went home to their extended families for festivals and thus during that month no money was collected. Nevertheless, the group was able to cope with these (non-planned)

changes in the implementation and agreed on a rule adjustment. In September, each household paid ₹1,217 (for two months) and the remaining beneficiary households paid an additional ₹62 due to an increase in LPG price. Thus, at the end of September the whole group managed the transition to cleaner fuels. None of the households reported to have borrowed to pay their share of payments. Some of the households also had their cylinders refilled during the course of the pilot. None of the members reported any conflict within the group regarding the payment. Consensus on the payment mechanism was easily reached and members trusted that everyone would contribute until each household had a connection.

For the second group in Banjara colony, a similar process was followed. There, members decided to contribute ₹1,200 every month, twice the amount contributed by the first group. In May 2011, the first contributions were made and ten member households obtained an LPG connection in June, also selected by lottery. Also, as in case of the first group, the prices for the connection increased and the households had to increase their contribution by ₹200. Although all the group members in Banjara colony received a connection, the group dynamics in this colony were rather difficult. First, many households were not sure whether they wanted to participate in this 'collective action' and it took several rounds of meetings to finalize the list of households. This continued for more than two months and was only solved when positive experiences from the group in Nandanavanam were reported to the potential members. Also, finding consensus on the order of beneficiaries was very difficult. Although having a lottery system was the only plausible option, they decided; some members expressed their concern that households who benefitted first might stop contributing. Nevertheless, the project was successful as all participating households managed to switch to the healthier and cleaner cooking fuel, i.e., LPG.

The major effort of the outside agent, in this case, the local NGO and the study team, was to support the initial set-up of the group. Since then, the group members took responsibility for all activities involved. The differential responses of the communities could be explained by different socio-economic characteristics and access to alternative fuel. As none of the households in Banjara colony was buying firewood from the market and as the collection did not cost anything except time and labour of women, they were reluctant to invest in LPG. Hence, the availability of free firewood discouraged the households to switch to LPG. Also, some households reported that they believed the government would provide connections in future and that they did not mind waiting for few more years to have a subsidized or free LPG connection from the government through the Deepam scheme.



## Conclusions

The results of the pilot suggest that community-based resource pooling can overcome the affordability problem of urban poor for transition towards cleaner and convenient cooking fuels such as LPG. The transition towards cleaner cooking fuels like LPG for poor households has the potential for immediately improving the quality of the environment in urban areas, for a more efficient utilization of energy and a reduction in deforestation in the long run. Such a transition also leads to an improved standard of living in terms of cleaner indoor air and thereby to better health conditions. The use of LPG also helps women in engaging in other income generating activities using the time that they usually would have spent for firewood collection or cooking. Importantly, by creating a community-based self-help solution in mobilizing the resources rather than using a conventional subsidy regime, the pilot empowers people to help themselves by using their own social resources. The pilot proved that urban slum dwellers can be and are a strong community with well-developed social capital. Also in cities, trust as a social institution can be an excellent driver for development. However, this pilot project only addresses the demand side problem for fuel transition and needs to be complemented by reforms in supply-side management. It is important that the distribution agency also recognises the group and supports such groups until all households get connections; otherwise the collective action breaks down and may lead to conflict among the members of the group.

This community-based resource pooling for LPG has important policy relevance. The Government of India is working on a scheme to provide one-time financial assistance of ₹1400 to households for taking up LPG connections (Economic Survey, Government of India, 2011, p. 269). This proposed scheme would cover all households below the poverty line and plan to provide new LPG connections for 3.2/4.2 million households annually. The annual financial outlay for this scheme is estimated to be ₹4,900 million. The major difficulties in the operationalization of this scheme will be targeting the right beneficiaries and raising financial resources. This community-based resource pooling model can complement this proposed scheme as the assistance of ₹1400 (against the actual upfront cost of ₹3600 to ₹4200) will enable many poor households to pay the remaining amount. Hence, institutionalizing such collective action initiative has the potential to expand energy access for the urban poor. Additionally, a community-based collective action solution for individual household problems strengthens mutual trust, fosters cooperation in other spheres, and enhances the social capital in the slum communities.

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## Aggregating Ideas for Environmental Governance in India: A Commentary

Harsha Meenawat

The World Commission on Environment and Development (1987) or the Brundtland Commission, in its report 'Our Common Future' defined sustainable development as 'meeting the needs of the present without compromising the ability of future generations to meet their own needs'. In the ensuing years, sustainable development has, as a concept, come to rest upon the three mutually reinforcing pillars of economic growth, environmental protection, and social equality, but it remains contested in interpretation and application. Almost around the same time the term 'governance' became a buzzword and its incidence in policy circles has increased manifold in the last two decades, but its meaning and constituents remain fuzzy to most. Various perspectives of sustainable development have emerged from the viewpoints of institutions and actors/groups, and the interactions between the two; which has resulted in environmental governance taking centre stage at many international forums involving numerous institutions and groups at the supranational, national, and local levels. Tackling the two concepts of sustainable development and environmental governance at the same time, though a great challenge is also a necessity in today's era – as we face novel challenges in managing and conserving our natural resources and improving the quality of life for an ever increasing population at the same time as reducing inequity.

In the light of the overarching historical paradigm of development, environmental governance came to be defined as 'the attempts to address environmental dilemma or to resolve environmental conflicts by creating, changing, or reaffirming institutional arrangements'.<sup>1</sup> While institutions are understood to be the major drivers for the resolution of conflicts and dilemma, the fundamental basis of governance is the effective aggregation of ideas and interests through interaction with actors and

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<sup>1</sup> Paavola J. (2007). **Institutions and Environmental Governance: A Reconceptualization**. *Ecological Economics* 93-103.

stakeholders. Globally, actors and stakeholders for environmental governance include nation states, intergovernmental organizations, non-governmental organizations, major groups, private sector, and civil society. At the global level, the Earth Summit in 1992 laid the roadmap through Agenda 21 to increase the participation of stakeholders in the process of sustainable development at the global, national, and local levels. The conferences that followed have re-iterated the importance of stakeholder participation and role of major groups.

In the context of India, actors for environmental governance are numerous and play varying roles within their capacity in aggregating their interests and ideas for sustainable development. Undoubtedly, the government and its agents have played the most important role in environmental governance by exercising their economic, political, and administrative authority; but at the same time there have been numerous contentions in the recent past that highlight the differences between the decisions taken by the government and the concerns of other stakeholders – the delineation of ‘no-go’ areas, the clearances of developmental activities in ecologically sensitive and culturally significant areas as well as regulatory deficits resulting into colossal environmental externalities reflected in overfishing, destruction of forests, air and water pollution, and degradation of the same resources that form the basis of economic growth and development in our country. The emergence of legislations, such as the Right to Information Act 2005 has led to an increase in sharing of information with a range of stakeholders resulting in an increase in the role of non-governmental actors such as academia, representatives from civil society, lawyers, media, NGOs, and activists in policy deliberations. Despite this sharing of information, policy-making in the field of environment and sustainable development still remains within silos that are the varied government agencies and there remains a gap in bringing the diversity of stakeholder perspectives into policy discussions. In a country like India, environmental governance framework exists at multiple levels and it is imperative to increase interaction between state and non-state actors not only at the federal level but at sub-national and local levels as well.

Recognizing this gap in aggregation of ideas from different actors, groups, and stakeholders, a series of dialogues are being conducted in India by TERI focusing on environmental issues of different geographical regions. The aim of these dialogues is to engage with multiple viewpoints on issues of environmental governance using a multi-stakeholder approach and then formulating the norms/rules for sustainable development in the country by including these viewpoints in policy making exercises.<sup>2</sup>

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<sup>2</sup> The author wishes to acknowledge the support of the Konrad Adenauer Stiftung for the Dialogues on Environmental Governance in the context of Sustainable Development. More information on the dialogues is available at [http://www.teriin.org/index.php?option=com\\_division&task=view\\_area&id=27](http://www.teriin.org/index.php?option=com_division&task=view_area&id=27)

As of now three dialogues have been conducted focusing on the northern mountain region, the western desert region, and the coastal region including marine ecological systems. Two more dialogues are planned in the near future focusing on the plateau and hill regions of central and southern India and finally the riverine regions of northern India. These geographical regions have been chosen keeping in mind that ecological and social systems traverse across administrative boundaries and often have fuzzy outlines. This approach is relevant to the context of environmental governance as it provides a focused discussion on the ecosystem aspect of the region and highlights its relationship with the society and economy most intricately linked with it. The discussions in these dialogues go beyond the traditional sector focus of economic development, environmental degradation, and drivers of social change. This approach is also an attempt to bring stakeholders together and gather varying perspectives across themes to overcome the silo thinking in public policy. Numerous cross cutting issues have been discussed in these dialogues—some of them specific to the ecosystem are under consideration while other are common across ecosystems. Some of the issues highlighted in the various dialogues are brought forward here.

There is a lack of clarity on the concept of sustainable development and the indicators of sustainability. This poses the challenge of contextualizing the core ideas of sustainable development and integrating them into the current environmental governance frameworks. There is a plurality of positions regarding this integration with some groups being apprehensive about sustainable development as merely another way to promote economic development and disregarding the environment. The tendency of looking at natural resources in purely material terms has led to the prioritization of economic development over the long-term impacts on the environment. This approach has been detrimental to the relationship between ecology and culture in our society and is most clearly reflected in the state of our commons that are rapidly deteriorating in health.

Environmental decision-making and debates have reflected the view of the urbanized population since it is easiest to aggregate their opinions and views. There is a lack of integration of traditional knowledge into the new science and planning frameworks for environment and development; and at the same time participatory action is missing from communities due to the lack of sharing of relevant science with them. Communities have played an important role in environmental stewardship and can continue to do so if they are a part of the knowledge generation process.

The impacts of a changing climate are being felt across ecosystems and this has resulted in numerous implications for environmental governance. There is only a basic understanding of the complexities of ecological systems and their interactions with society and climate change brings uncertainty to this understanding. Different



ecosystems respond differently to gradual change and shocks, and the variability of the outcomes is a growing challenge to the governance frameworks for the mountains, deserts, and coastal regions. There is also a lack of integrated data/information within and across ecosystems which has resulted in scepticisms regarding the credibility of science in these regions.

Almost all regions in our country are undergoing demographic transitions creating pressures on resources and challenging the planning processes that have been in place since decades. Migration into cities has not only been driven by economic motives but climate induced as well. Meeting the demands of ever increasing urban population is resulting into action that may prove detrimental to the supporting ecosystems in the future. The challenge is to implement correct adaptive responses after deliberation with stakeholders at multiple levels across multiple disciplines and development of relevant updated databases that can assist in decision making.

Another factor which is unfavourable to environmental governance is the observed disconnect between the federal and state government systems, and across administrative divisions (mostly states) that share ecological systems. While there are discussions of introducing 'payments for ecosystem services' which will incentivize conservation activities by certain groups to allow use of resources by other groups, it should be ascertained that these innovations do not result in purely economic valuations of natural resources incentivizing market based exchanges for vital social and ecological functions.

Institutional arrangements for environmental governance face challenges of efficiency of administrative machinery in implementation of regulations; a general lack of communication and coordination across the various agencies that function in the same area or domain; and some of them even face financial and jurisdictional challenges. There is a need to acknowledge that in the absence of reliable data, well defined and politically accepted priorities for sustainable development, and relevant institutional capacity, there is a lot of arbitrariness in decision-making for environmental governance. Within governance frameworks, government is seen as the most influential actor in providing necessary public services and creating a level playing field for competing agendas; with other actors only playing the role of agents and stakeholders promoting their own agenda. This notion of a single producer of services for public purposes has put an onus on the government (at different levels) to make decisions that are in public interest resulting in a 'top down' approach of decision making and few actors (with access to knowledge and monetary resources) making decisions for the larger population applying their own cognitive and normative frames. This was acceptable when a larger part of the population was either unaware or did not see

the need to contribute, but this paradigm has not resulted in the human progress we wished it would.

Elinor Ostrom in her article describing the concept of Co-production had said, “As long as public officials and citizens in developing countries continue to see a great divide between them, potential synergies will remain mere potentialities.... (textbooks in the fields of public administration, economics, political science) seldom discuss how services are produced and delivered, or how agencies work at levels below that of national government. The role of citizens is depicted as casting ballots and watching the action.... No mention is made of village governance or local governance, which is the only governance that has an impact on the lives of most people...”<sup>3</sup>

There is interesting empirical evidence from India as well as other developing countries that demonstrate the importance of active participation of citizens in the production of services for a public purpose, in ensuring the conservation of commons, and in moving businesses and government towards environmental stewardship. It is time to recognize the role of non-governmental actors, civil society, sub-national entities, and all major groups in managing social and environmental resources; and create the favourable conditions that bring their perspectives into the deliberations around sustainable development.

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<sup>3</sup> Ostrom, E. 1996. **Crossing the Great Divide**: Coproduction, Synergy, and Development. *World Development*, 24(6), 1073-1087.

Energy inequality can be studied<sup>7</sup> at various levels – between rural and urban, between income classes, and across regions. Differences in the pattern of energy consumption exist across regions. Energy inequality can be measured in terms of type of fuel used, quantity of energy used (useful energy or primary energy), prices of fuel and energy access. Energy inequality is closely linked to concepts of energy access and energy poverty, in fact, poverty itself.

To understand the level and magnitude of inequality, the Gini coefficient as well as the Atkinson Index has been calculated across regions of India based on the National Sample household consumption survey (66<sup>th</sup> round, 2009–10). The data analysed is for rural households only. Both measures have been plotted to test the consistency of inequality results across regions in India. India has been divided into 15 agro-climatic zones as given by the Planning Commission, Government of India. The division of agro-climatic zones is based on geographical continuum, which has similar characteristics related to land suitability, potential production, and environmental impact.

Gini is the most commonly used measure of inequality, defined as the mean of absolute differences between all pairs of individuals for some measure. The minimum value is 0 when all measurements are equal and the theoretical maximum is 1 which is the ultimate inequality (Stuart and Ord, 1994).

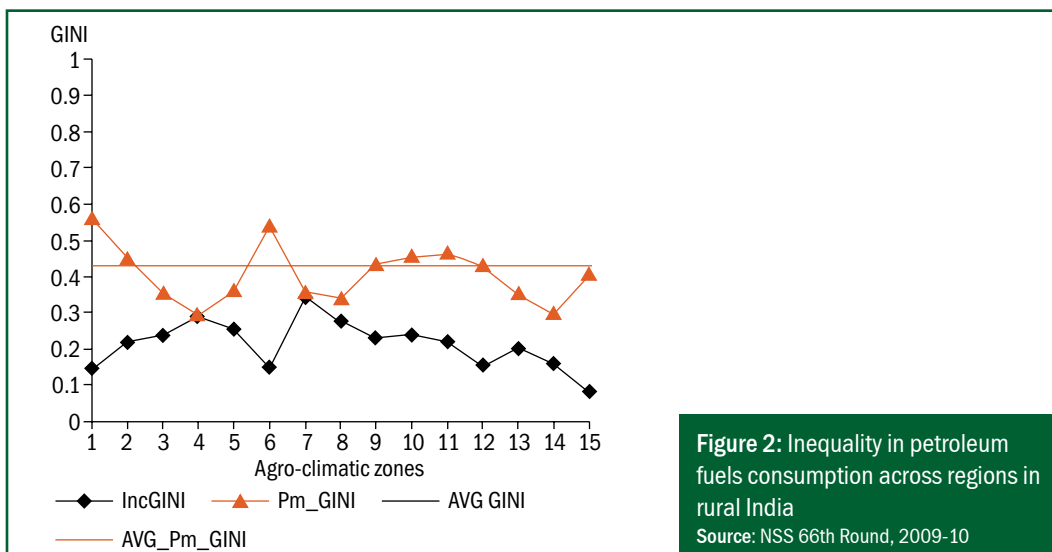
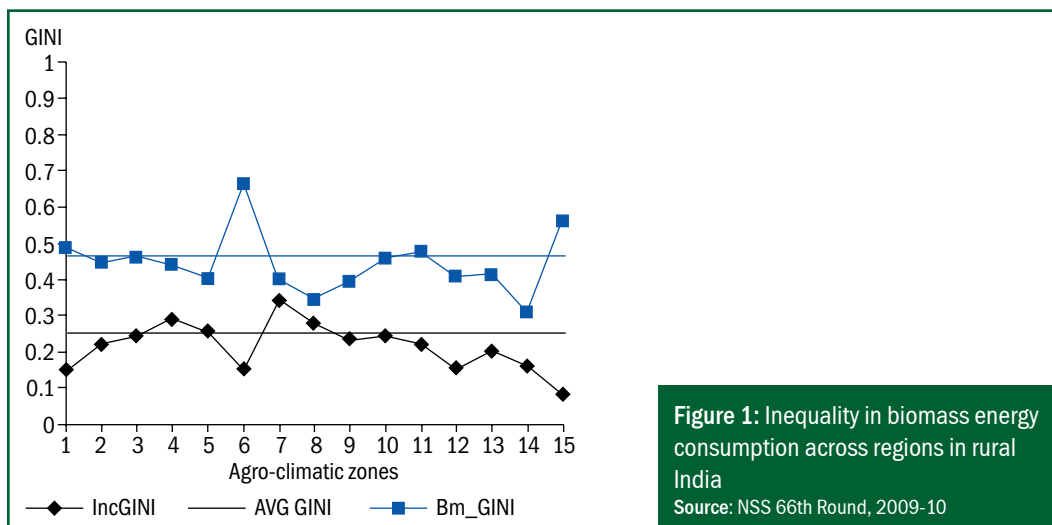
The classical definition of Gini (G) appears in the notation of the theory of relative mean difference:

$$G = \frac{(\sum_{i=1}^n \sum_{j=1}^n |x_i - x_j|)}{(2n^2 \bar{x})}$$

<sup>7</sup> **Acknowledgement:** The authors gratefully acknowledge support received for a Programme of activities under the Framework Agreement between the Norwegian Ministry of Foreign Affairs (NMFA) and The Energy & Resources Institute (TERI) through Royal Norwegian Embassy and Department of Economic Affairs (DEA), Ministry of Finance, Government of India.

where,  $x$  is an observed value,  $n$  is the number of values observed and  $\bar{x}$  is the mean value.

The two graphs below (Figure 1 and Figure 2) plot the Gini coefficient for biomass energy consumption and petroleum energy consumption across regions in India. If we carefully observe the two graphs, we find that the pattern of distribution of the Gini coefficient for biomass (Bm\_GINI) and petroleum (Pm\_GINI) is almost a mirror image of the income Gini (IncGINI). This brings out some interesting observations.



The common understanding is that as incomes increase, a shift to modern fuels would occur. In this case, we find that there is a partial inverse relation between energy inequality and income inequality, which indicates the significant role of factors other than income in determining household fuel choices.

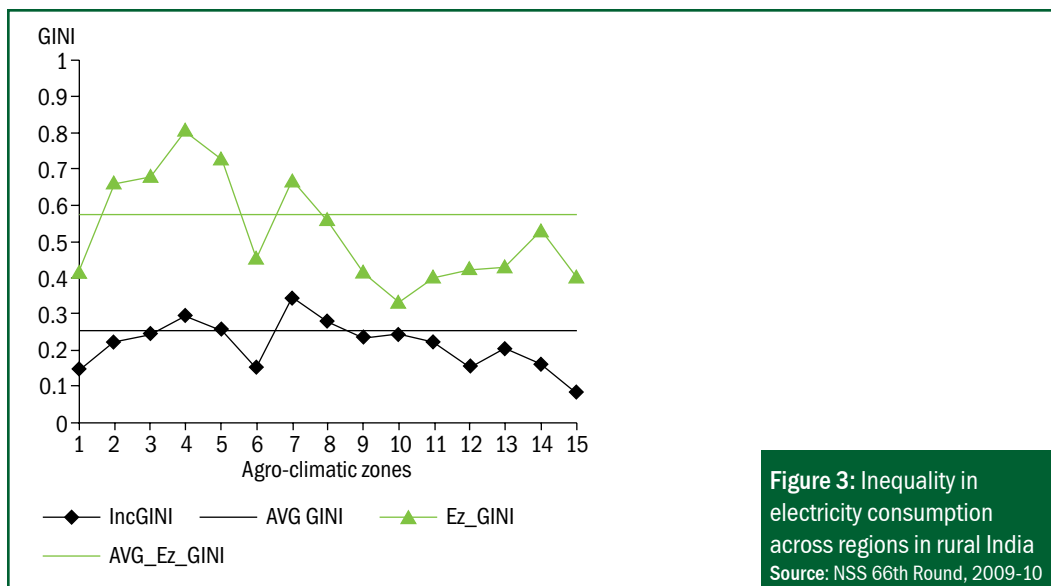
If we look at Zone 6 which consists of the states of Haryana, Punjab, and Delhi, we find the income Gini is fairly low whereas the energy inequality is the highest. While this could arise from the fact that the energy consumption patterns are based on the expenditure approach to income, it is also indicative of the fact that energy choices are not a function of just income. It could also be that given the presence of Delhi in the sample for Zone 6, the income inequality may not be a reflection of the true conditions as the incomes of the 'rural' population in Delhi (the rural population of Delhi has considerable access to an urbanized setting and has a different lifestyle than the rural population of states such as Punjab and Haryana) maybe offsetting the inequalities actually present in the sample of Haryana and Punjab.

On observing Zone 1, which includes the mountain states of Jammu and Kashmir, Himachal Pradesh, and Uttarakhand, we again find that the energy inequality is fairly high, contrary to the income inequality measure. It is plausible that given the low density of population, the income inequalities may not be as evident in these states or it could be that the presence of samples from Himachal Pradesh and Uttarakhand may be offsetting the actual inequality present. It could also be that the consumption patterns are considerably different in these regions as these states also include some of the remotest parts of the country where access to energy is a challenge, thus, indicating significant inequalities in energy consumption.

In the case of electricity, we find that the inequality in electricity consumption follows a similar pattern to that of income inequality. Thus, reiterating that electricity and income have a direct relation unlike in the case of other fuels which are primarily used for cooking.

Thus, when we look at energy consumption patterns and inequalities in energy consumption of different sources across both income classes and regions based on secondary data available from NSS household consumption surveys, there is evidence contrary to the popular opinion that incomes drive energy transitions. We find that there are certain patterns that are not explained just by changes in income levels and thus indicate the presence of other factors defined by certain socio-cultural contexts that a society lives in and has evolved from.

This makes it imperative for further research and understanding into the role of socio-cultural environments of households in determining their energy choices. This would have significant impacts on facilitating an energy policy that would lead to both a transition to modern energy sources and enable a sustained transition.



**Figure 3: Inequality in electricity consumption across regions in rural India**  
 Source: NSS 66th Round, 2009-10

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**M**y name is Wang Yufei. I am from China and I am a senior high school student studying in the Experimental high school attached to Beijing Normal University.

In the present world, environmental problems are among the greatest global challenges. The conflict between economic growth and pollution, questions the applicability of concepts such as “decoupling” negative environmental externalities from growth. High local pollution levels are impacting the health of human and ecosystems alike. Besides, climate change is a global environmental issue that we urgently need to address. Over the past century, the global average surface temperature<sup>1</sup> has increased by 0.74 degree centigrade. No nation can escape from the impact of climate change. Rising sea levels are threatening the very existence of some of our planet’s most beautiful islands. The Intergovernmental Panel on Climate Change (IPCC) Special Report titled, “*Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX)*” clearly shows that the extreme weather events, that will become more frequent and severe, will cause economic and human losses. Moreover, the poor of the world will have to bear the brunt the most. This invokes the principles of “equity”, “common but differentiated responsibilities”, and “polluters pay”.

This is not fiction, this is reality. We cannot wait, we must take action now. We, the youth, understand this and hence, should attach great importance to care about our earth. We are not only Earth’s “residents”, but also “custodians”. If we do not look at solutions now, there will be irreversible damage. We all have to focus on solutions while there is still time to reverse it anthropogenic climate change.

As a youth from China, I have undertaken an initiative related to climate change and would like share my experiences with you. Since childhood, I have been worried about environmental issues. At 14, I volunteered with the “Climate Champion” initiative of

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<sup>1</sup> Feeling the Heat: Climate Science and the Basis of the Convention, available from [http://unfccc.int/essential\\_background/the\\_science/items/6064txt.php](http://unfccc.int/essential_background/the_science/items/6064txt.php) ; last accessed on August 26, 2013.



British Council which is a non-governmental organization. This was my first exposure to international policy issues that are deliberated around the United Nations Framework Convention on Climate Change (UNFCCC).

Being a part of the “Climate Champion” initiative, I was exposed to a UNFCCC related meeting that was held in Tianjin<sup>2</sup>China in 2010.<sup>2</sup> This was the 14<sup>th</sup> session of the AWG-KP (Ad Hoc Working Group, Kyoto Protocol) and the 12<sup>th</sup> session of the AWG-LCA (Ad Hoc Working Group, Long-term Cooperative Action) that took place from 4 to 9 October in 2010 at the Tianjin Meijiang Convention and Exhibition Center (MJCEC), Tianjin, China. Interactions with delegates and listening to the scientists during side events again made me aware of the climate change impacts that have been evident in recent years. I understood that climate change is a reality...a reality that can be seen in melting ice, rising sea levels, receding snowlines, changing ecosystems, and prolonged droughts. I also understood that combustion of fossil fuels is considered to be the largest contributing factor to the release of greenhouse gases into the atmosphere, including carbon dioxide and methane. Furthermore, I also understood that our elder generations have placed their hope in us, the “youth”.

Youth should hence take care of this legacy. Youth can do this through participating in policy-making and decision-making bodies effectively. Youth’s power lies in enthusiasm...in creativity, and we have passions to take actions to address climate change. We should share our imagination, and be brave to speak our minds. Climate change impacts on the development of mankind. So all of us should pay close attention to climate change and live a low carbon life and make a valuable contribution to mitigation and adaptation of climate change.

During summer in 2011, our climate champions gathered together in Xiangshan, Beijing, at a summer camp. Xiangshan Park (Fragrant Hills Park as it is called) is situated<sup>3</sup> in the east part of the western hills, 28 kilometers west of central Beijing. XiangShan is a large park of hills and forest covering 1.6 km<sup>2</sup>. Both the natural scenery and cultural relics are abundant in Xiangshan Park.

We were divided in groups and visited the green building in Tsinghua University, a sewage treatment plant, a garbage segregation unit and green buildings. These are examples of some solutions, which in my view are important to address climate change. It was interesting to learn about the carbon dioxide footprint of buildings and other infrastructure. We then engaged in an exercise where we used eco-friendly material to make our own small green building. Every single material has its corresponding carbon

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<sup>2</sup> Tianjin Climate Change Conference - October 2010: [http://unfccc.int/meetings/tianjin\\_oct\\_2010/meeting/6277.php](http://unfccc.int/meetings/tianjin_oct_2010/meeting/6277.php) ; last accessed on August 28, 2013

<sup>3</sup> XianShang Park; [http://www.kinabaloo.com/xiangshan\\_park\\_beijing.html](http://www.kinabaloo.com/xiangshan_park_beijing.html) ; last accessed on August 28, 2013

## Green showcase

dioxide emissions. The rule of the activity was that the best building should not only have a lesser carbon footprint, but should also be the strongest. This could be seen that the building that could bear the heaviest weight and that could be artistic would win. We used materials such as plastic bottles, chopsticks, iron wires, newspapers etc., to construct our little buildings. Gladly, our building won the second prize! It was inspiring to see the creative imagination of the other groups as well.

From 1–7 October, 2011, me and my friends, as climate champions, went to Ningxia to conduct an investigation. This was our third activity. This time our activity focused on the impacts of climate change on agriculture production and their adaptation strategies. We were divided into two groups. One group went to Guyuan Region in



Exhibit: Youth activity on green construction



Exhibit: Conducting a survey in Pingle Village as a part of "Climate Champion" initiative

Ningxia to visit two villages including Mayuan and Pingle, the other went to Hongsipu Region to visit three villages including Yangliu, Kaiyuan, Juhuatai. We conducted a household survey and interview, collected the data and made an analysis to understand the perceptions around climate change among the local community. We also sought to understand how weather-related events such as droughts affect aspects of local communities living.

We found that precipitation related events have also caused water to become a scarce resource in Pingle Village. This has become the bottleneck in the development of the village. For more than a decade, Pingle Village has seen the phenomenon of migration due to ecological conditions. Through our investigation, we also understood that villagers learn to cope and adapt with/to natural disasters resulting from climate related events. The outcomes of the Climate Champion initiative were made into a documentary and screened during the COP17 (Conference of Parties) in Durban, South Africa. The documentary depicts China's action on climate change and the passion of Chinese youth in this area.

I believe that young people are powerful enough to bring about a change into this world, so we should undertake joint efforts hand-in-hand and undertake initiatives. The way we live affects our natural environment, and in turn, our natural environment affects the way we live. We should also live a green and low-carbon lifestyle, and mobilize more people to follow the path of simple living.

Each nation, each city, each town, each community, and individual has a stake in protecting the global commons. On behalf of the youth of my country, I would like to sincerely appeal to all citizens of the globe to take actions. We, youth from China, also urge the global community and delegates of countries to arrive at a consensus regarding fair and equitable decisions and commit to the goals around multi-lateral forums such as the UNFCCC and to encourage all nations to assume the responsibility of this great task.

I, Wang Yufei, a youth from China cherish an unshakable belief that, with collective actions, sustainable development of human civilization, the advancement of technology, and an increasing awareness and initiative regarding climate change, we will be sure to protect this planet.

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# Knowledge X-change for Sustainable Development: A Knowledge Gateway to Sustainable Development

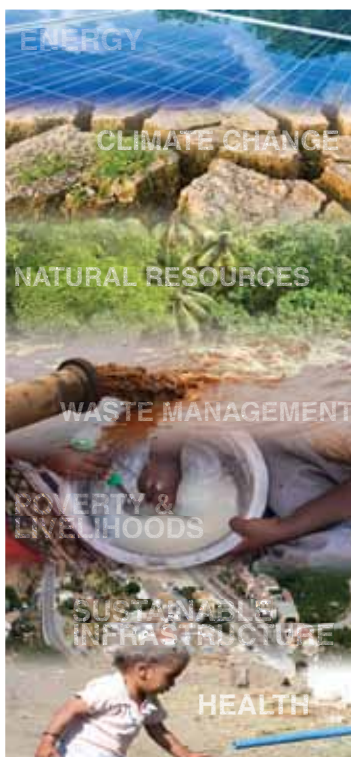
*TERI study showcase<sup>1</sup>*

**A**s sustainable development has wide implications, it is important to draw lessons from the vast amount of available information in understanding and capturing ground realities in the various issues related to the sector. Exchange of ideas and knowledge would help identify and understand knowledge gaps in various areas in order to effectively achieve the intended goals of sustainability. The Knowledge X-change on Sustainable Development (KxSD), an initiative by TERI supported by the UK Government, aims to:

- Facilitate knowledge sharing across the facets of sustainable development;
- Showcase new research and innovative practices, share knowledge and success stories from diverse regions and sectors targeted at policy-makers and the wider research community;
- Focus on three main dimensions of sustainable development – policy imperatives, technology and innovations, and community partnership.

The portal is an effort towards synergizing experiences and knowledge exchange on diverse sectors related to sustainable development. Resources on the website are classified into the following themes related to sustainable development:

- Energy
- Climate change
- Natural resources
- Waste management
- Sustainable infrastructure
- Poverty and livelihoods
- Health



## Explore and Share

Knowledge resources

Research and success stories

Innovative practices

Statistical data

As sustainable development has wide implications, it is important to draw lessons from the vast amount of available information in understanding and capturing ground realities in the various issues related to the sector. Exchange of ideas and knowledge would help identify and understand knowledge gaps in various areas in order to effectively achieve the intended goals of sustainability. The Knowledge x-change on Sustainable Development (KxSD) aims to:

- Facilitate knowledge sharing across the facets of sustainable development;
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- Focus on three main dimensions of sustainable development—policy imperatives, technology and innovations, and community partnership

## Website Features

- *Resources*: This platform serves as a comprehensive repository of knowledge resources on various issues related to sustainable development. Under *Success Stories*, case studies and best practices are captured to demonstrate innovation initiatives. *Innovations* highlight clean and appropriate technologies that have implications at global as well as local level.
- *Information Bank*: It is a collation of bibliographic details of information resources such as Government documents; research papers; policy briefs; reports; policies, acts and notifications. *News* section provides details of recent developments in the field of sustainable development.
- *Statistical data*: Statistics are of importance for preparation, planning, and monitoring of policies as well as for scientific research. This section provides spatial and graphical representation of statistics in the form of maps and graphics arranged according to location and themes.
- *Knowledge café*: This section includes interviews and deliberations of eminent personalities sharing their views on sustainable development issues.
- *Policy instruments*: This section facilitates sharing best practices and case studies on various policy instruments with an objective to help policy-makers and the civil society to make informed policy choices.
- *Share your knowledge*: This platform allows registered users to submit resources in the form of innovations, success stories, papers, statistics, recent developments related to sustainable development.

**Contributed by**  
**Knowledge X-change for Sustainable Development Team**  
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## GREEN FROM THE GRASSROOTS

# Agri-business for Small Farmers: Revitalizing Agriculture in Goa

Asha L Giriyan

### Background

Farming is a traditional occupation in the state of Goa is currently under threat due to rising labour costs, decreasing profits, and increased demand for land for Real Estate. To promote and encourage traditional practices followed by local agrarians, TERI took up a study on “Developing a Sustainable, Collaborative Agri-business Ecosystem for Small Farmers” with the support from Toyota Foundation, Japan, in a small village named Chorao, close to Panjim, city of Goa. The project was of two-year duration from November 2009 to October 2011. The study focused on re-establishing more sustainable methodology development and reviving agricultural activities in the village of Chorao.

The key objectives of the project were awareness creation and demonstrating different ways to enhance agricultural income of the farmers along with promoting sustainable agriculture practices. The methodology adopted was to create awareness, demonstrate production capacity, connectivity and collaboration within the farmers, and to create direct marketing supply chain for their goods in order to achieve greater earning.

The Chorao Island Farmers Club was established with the objective of rekindling the practice of agriculture in Chorao by making it more attractive to farmers and to the youth of the village with several on-field and off-field activities. The Chorao Farmer’s Club started with 22 members and has now expanded to more than 100 members over the project duration.

### Locality and People

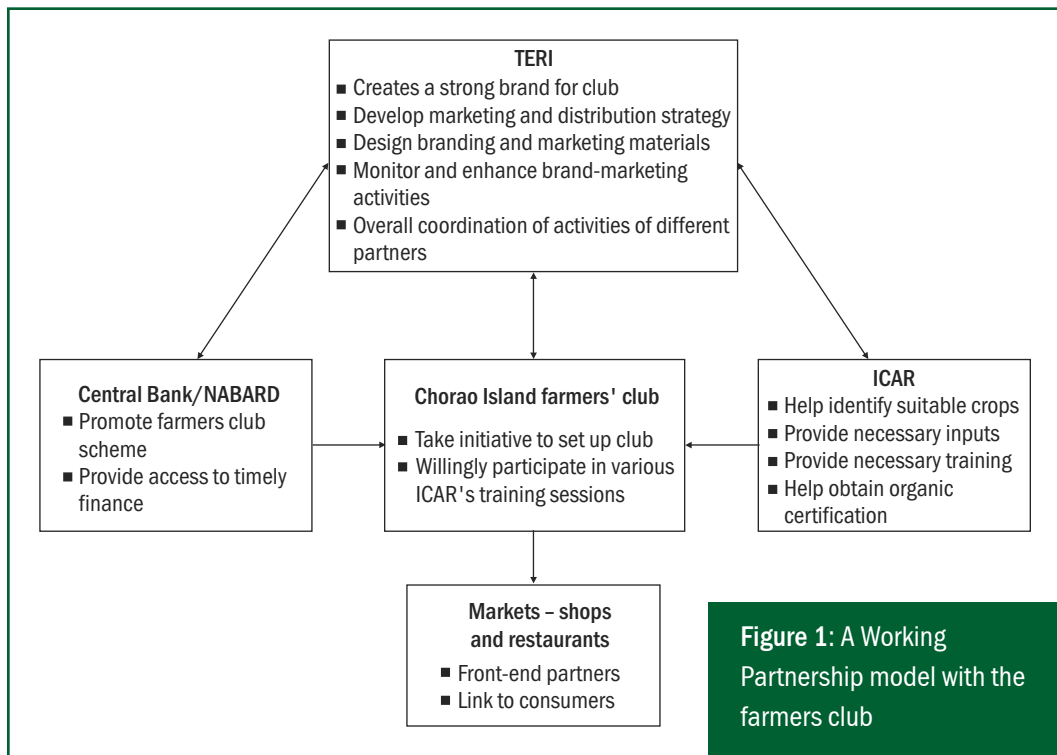
Chorao is an island in the estuary of river Mandovi having a total area of about 10 sq. km with a population of approximately 7,500-8,000 persons and around 1,500 houses. Although Chorao is just 4 km from the capital, Panaji, it has managed to maintain a rural community, although this is fast changing with large-scale migration of people from the island for work.



Since Choraó is an island, it is slightly disconnected from the urban areas of Panjim (the capital city). This geographic disconnection leads to a degree of inaccessibility which makes local residents feel left behind compared to more developed neighbouring areas. The logistical limitations (people and goods have to be taken across the river by ferry) have also disrupted development of new businesses and industries on the island. The community is also unable to benefit from tourism (one of the larger opportunity creators in Goa) since it is located off the beaten track and hence there are almost no local employment or business opportunities for the local population. As a result, the local youth is compelled to seek opportunities elsewhere.

This has created a tradition of migration which is fast eroding agriculture (the key occupation) and the social networks and traditions which bind people together and provide them with a sense of belonging and security. A combination of local politics and the increasing real estate prices are also making it increasingly difficult for the villagers to collaborate to preserve their existing ways of life.

Figure 1 depicts the working model depicts as how we worked with different stakeholders to achieve the goal.



**Figure 1: A Working Partnership model with the farmers club**

## Creating Interest into Agriculture through Innovative Marketing Experiments

In the beginning the agenda was simple, getting farmers join the club through its activities and demonstrating innovative ways and approach in agriculture that can be profitable. Inviting speakers from different government departments and from the Organic Farming community to speak and motivate farmers about continuing with farming as well as providing new ideas of what could be done was an integral part of the initial activities.

Traditional models of selling farm products (in local markets or to contractors) presented limits to how much farmers can earn. The Club decided to experiment with different models of marketing (retail marketing as well as direct-to-consumer) to see how effective these are in raising farm revenue. Additionally, these experiments also served to kindle an entrepreneurial spirit among farmers, who traditionally played the role of “producers” not traders/entrepreneurs. Some of the pilot successful projects that were demonstrated to the farmers were:

### ***Chorao Island Red Kernel Rice Project:***

TERI assisted in establishing Chorao Island as a strong local brand with designing the logo to market the farm fresh food to the supply chain. As a pilot project, it aimed at selling in 1 Kg packs, local parboiled red-kernel varieties of rice to retail stores. Against a target of selling 1,000 Kg of rice in the first year, the Club successfully sold over 900 Kg of packed



**Figure 2:** Designing the packaging for marketing the local rice product

rice through 8 to 10 stores in North Goa District. Having conducted a pilot, the next step was to build on the lessons learnt and scale up the marketing strategies for other local products through branding. Sales were up-scaled by increasing the supply chain to other parts of Goa.

### **AAMche Choraó Mancurad: Marketing of Mangoes**

In the summer months, the popular mango 'Mancurad' is a common horticultural crop of farmers in Choraó Island. Through TERI, farmers experimented with direct-to-consumer marketing. TERI helped in designing boxes and built the practices to be followed right from plucking, ripening and packing to marketing, quality checks, and deliveries. A combination of word-of-mouth marketing and simple communication tools through brochure and websites were done to create interest in the organic and naturally ripened mangoes to customers.

The use of a Reva Car as the delivery vehicle attracted a lot of attention. The experiment was very successful in popularizing the brand and satisfying the consumer needs. The real challenge was setting of the logistics of packaging and home delivery, but the results the Club sought were achieved. A modest target of 300 boxes was set and achieved within three weeks.

### **Mechanization and Adopting New Approaches**

Mechanization of agriculture in the Goan context becomes important because of a shortage of labour coupled with high costs of agricultural labour. Mechanized farming activities were demonstrated to the farmers to attract the younger generation and also to minimize the labour cost.

### **Sustaining Interest and Looking Forward**

Various training programmes and workshops have been organized to provide practical hands-on sessions for farmers of the Club. Experiments and pilot plots on cultivation



**Figure 3:**  
Packaging  
the mangoes  
in attractive  
boxes



**Figure 4:**  
Advertising  
and delivering  
mangoes in an  
eco-friendly van



**Figure 5: Mechanisation as a way to address labour problems**

of exotic vegetables helped to initiate participation, and retain their land assets. Trials with new crops and renewed approaches to farming (eliminating the use of chemicals) served as a model for developing ‘local food security’ by creating strong local farmer-owned entities.

Overall the project has led to increase in knowledge about participatory development and family-based ecological agriculture among local stakeholders. The farmers have gained confidence; it reflected in their willingness to enter into dialogue and networking with other farm organizations. It has created demonstration effect on other farmers in the state, who are looking for opportunities to use the skills and assets they already have, to generate income and create employment in the agrarian sector. Also, a marketing model for traditional varieties of crops, for example, red-kernel rice, has led to an increase in production and increase in farmers’ income. The farmers, other than the club members, are also replicating the model, who earlier found these traditional salt tolerant varieties as low-yielding and preferred high-yielding varieties and hybrids over it.

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# Designing of PES Mechanism: Model of Ecotourism in Bhondsi, Haryana

Aparna Vashisht

**P**ayment for Ecosystem Services (PES)<sup>1</sup> is a broad term used for a variety of arrangements in which the beneficiaries of ecosystem services pay back to the providers of those services. The arrangement is such that the producers of environmental services (like the local inhabitants or local authorities, who protect the ecosystem) receive payments from the beneficiary of these ecosystem services. PES aims to define a financing mechanism which helps in efficient provisioning of several ecosystem services. Participation of local inhabitants is considered essential for successful implementation of all PES mechanisms (Engel et al., 2008; Redford and Adams, 2009).

Bhondsi is a village in Gurgaon district of Haryana in India. The forest area of Bhondsi stretches across 585.5 acres. Rich in wildlife and biodiversity; the place is naturally beautiful. Bhondsi has a part of Aravalli hills, which runs through its forest; and the presence of lake within the forest area adds to its scenic beauty. Bhondsi Gram Panchayat (BGP) 'gifted' a part of the forest to India's former Prime Minister, Shri Chandrasekhar Singh, who brought the entire forest area under his control and built elaborate infrastructure including tree houses, guest houses and trekking path. After a prolonged legal battle between the local villagers and the former Prime Minister on the issue of ownership of forest land, the occupied land was given back to the BGP who then leased out the land to forest department for a period of 20 years. Bhondsi presents a unique case, where forest department has been undertaking maintenance activities in the forest area for past several years; however, the original property rights to the forest land rest with the local villagers.

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<sup>1</sup> **Acknowledgement:** The study to design a PES mechanism for Bhondsi was carried out as a part of Master's thesis at The Energy and Resources (TERI) University; with research supervision and administrative support from TERI University and officials of the Forest Department, Government of Haryana.



Natural landscape at Bhondsi (left); Tree houses inside forest (right)

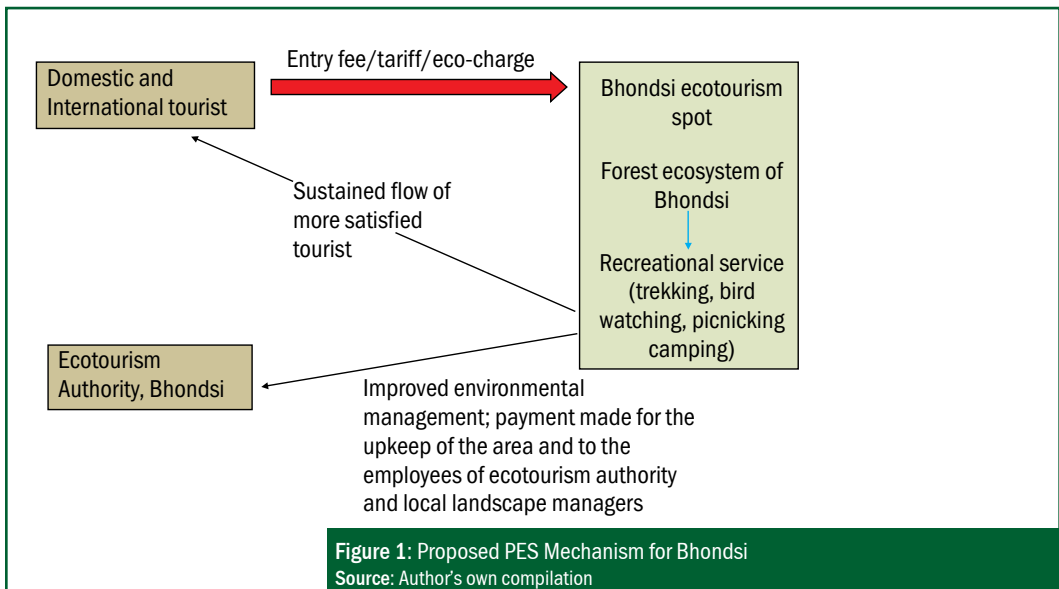
The most prominent ecosystem service being provided by the forest ecosystem of Bhondsi is that of 'recreational service'. The main actors of the Bhondsi forest ecosystem were identified – forest department as the land managers and forest visitors including people who came for picnicking as the service users of forests ecosystem services. Forest officials reported financial crunch and difficulty to sustain the maintenance of forest area. As a result, a significant portion of the forest went unmaintained. At the same time, forest visitors were also not being charged for using the ecosystem services of the forest. This created a situation of market failure, where efficient provisioning of ecosystem services was not taking place. Thus, a need for robust financial mechanism between the land managers and service users of forest was felt. This provided the scope to investigate the potential of a PES mechanism for the forest of Bhondsi.

A review of several case studies was undertaken for designing a PES mechanism for the forest ecosystem of Bhondsi (Mercer et al., 2011; Chiramba et al., undated; Pagiola, 1997; Adhikari, 2009; IUCN, 2008; Manoharan et al., undated). It was felt that with minimal refurbishment of the existing infrastructure, the forest area of Bhondsi could be operated as an ecotourism spot; this formed the basis of the potential PES mechanism for Bhondsi forest area.

Several focus group discussions with villagers; and interactions with the village head (*Sarpanch*) were held to understand their perception, which were kept into consideration while designing a payment mechanism for operation of ecotourism activities. Villagers seemed interested in starting up of ecotourism activities in the forest area, as they linked it with direct income generation through increased employment opportunities. Consultations with forest officials and BGP deliberated that villagers should be the beneficiary in a large way through the ecotourism activities and equitable



distribution of benefits needed to be ensured. The study suggested that villagers with basic knowledge of data entry and computer could be given the task at ‘check-post’ of the ecotourism spot of Bhondsi. Others with good communication skills could work as ‘tourist guides’ or could be made instructors for adventure sports. Rural women could be employed at the local restaurant to cook the local delicacies, which could be a major tourist attraction. Figure 1 depicts the PES mechanism advocating a model of ecotourism that was proposed for Bhondsi.





The PES mechanism proposed an ‘entry fee’ or ‘tariff’ or an ‘eco-charge’ for domestic and international tourists to gain an entry to the ecotourism spot of Bhondsi and to avail the recreational services. Restaurants and activities such as boating, camping, and lodging was proposed to be charged separately. The amount collected would be utilized to reward the local landscape managers for the upkeep of the place and would provide an incentive to the local ecotourism authority to continue with sustained flow of the recreational services. It was realized that an efficient provisioning of the ecosystem services would increase the inflow of visitors.

The study underlines the need to preserve the essence of ecotourism by promoting knowledge about conservation of the environment, offering sustainable recreational service to the nature lovers and generating sustainable livelihood and income opportunities for the local community. During all the interactions with villagers, their sense of belongingness towards the forest area was very pertinent; and thus it is important for villagers to have a say in decision making for Bhondsi’s forest land. It is believed that a participatory approach while implementing proposed PES mechanism for Bhondsi could help generate financial incentives for regulating forest ecosystem services; while at the same time would be advantageous for forest restoration and livelihood generation for local inhabitants. The findings of the present study have been put forth to the forest department and members of BGP. However, the final status on Bhondsi becoming the ecotourism spot is still awaited.

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## BOOK REVIEW

# Putting Green Growth at the Heart of Development

*Arnab Bose*

The Organisation for Economic Cooperation and Development (OECD) has come out with an apposite book titled, Putting Green Growth at the Heart of Development. This is a crucial juncture in human history where the concept of development as reminisced from the beginning of the industrialization age has to see a paradigm shift. The elements of this shift are being laid out in this OECD report. The report crisply captures the narrative of green development in the form of six chapters spelling out the context, the need, the role of policy-makers, the requirement for international cooperation, a method to find out the progress of green growth and the immediate action points.



This book shades out the agenda for, both national and international arenas and as the book reiterates that the primary agenda remains the need for leadership.

Leadership, as often seen in history, is that one attribute which has enabled change. If we look at the energy transitions historically we find that a belief in what is right has got the thing done. The difference now, of course, is that the scale is global, and the situation is more complex. So leadership now entails not only the vision of one person but the vision of a group, closely working with each other, and realizing synergies to enable a transition towards a green paradigm.

It is probably important now to investigate the word 'green' a little further. As the book itself points out that green growth refers to a development pathway which includes sustainable management of natural resources, while at the same time, increasing employment opportunities and the welfare of the people by creating new economic growth opportunities, resilient infrastructure, and secured livelihoods.

Of course, green growth will involve a nexus of various stakeholders at various levels, and they have to be co-ordinated across these levels and sectors. This is a daunting task. And one aspect which has always intrigued me was even if progress is made – is it measurable? Gladly, this book does throw some light in chapter five regarding this particular aspect (in fact the entire chapter has been dedicated to this). One can also appreciate a rather lucid diagram which explains how the indicators have been arrived upon for the purposes of measuring progress.

Another important aspect is financing of green growth and investments into it. Finance itself is a good indicator of progress and fortunately the book addresses this aspect too. Finance has become a little more complicated post 2008 financial crisis. Till that time it could have been easily understood that all incremental costs for green growth or sustainable development would have come from public finance sources from the industrialized countries. However, this has changed since then, as developed countries are rather constrained in terms of availability of their own public finances. Also the banking system is terribly strained. The world has still not gotten out of the crisis, and in fact there are many new macro-economic crises which have started on their own like in the Eurozone and in the emerging economies.

This book points out to several methods, which while addressing macro-economic stabilization efforts also has real benefits for the purposes of green growth. For instance, subsidy reforms in fossil fuels and utilization of the freed public resources for the purposes of cash transfers for the well-being of the poor. Instances of cash transfers have indeed started in several developing countries, including India. The book gives a variety of cases from different countries and can engage a researcher or policy-maker to create a list of options which can be beneficial to their national context.

In addition, keeping in mind the transformed global financial architecture and power equations, the book suggests a three-pillar approach (given in chapter four) for the transition to a green economy. The first pillar includes a call for strengthening finance and investments via restructuring official development finance, catalysing private investments and strengthening international economic instruments. Pillar two includes green technology innovation through co-operation; this is a pertinent pillar the technology transfer regimes might have to be renegotiated. Local development of intellectual property will be important particularly for local adaptation and resilience purposes. The final pillar is with respect to trade in green goods and services and calls for a removal of trade barriers in such goods and services.

It is true that the discourse may be far more complex, and removal of trade barriers might be counterproductive for a particular economy; however, the purpose of the book is to start a dialogue and create awareness of issues pertaining to green growth.



And, to that I say, that the book has achieved what it set out to achieve, that is, putting green growth at the heart of development.

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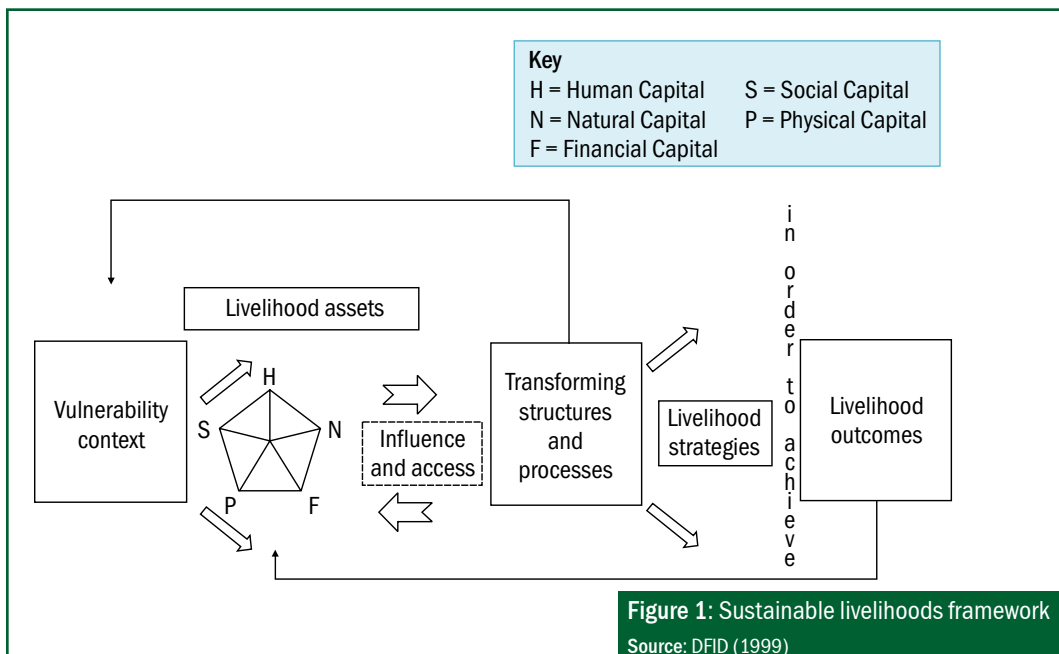
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# GREEN GLOSSARY

## Sustainable Livelihoods

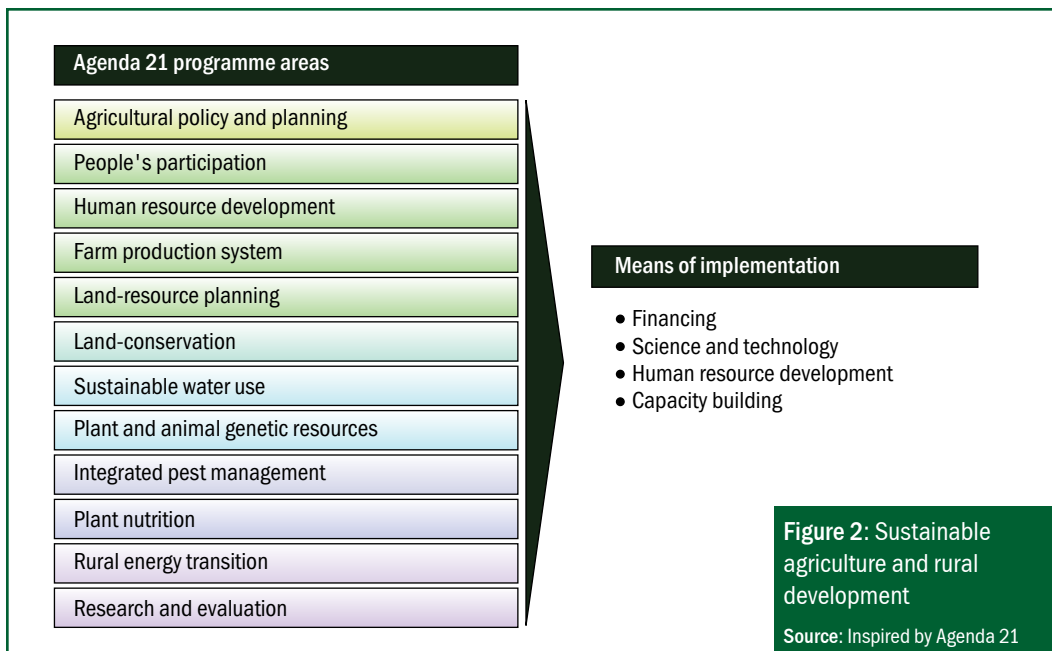
A livelihood comprises the capabilities, assets, and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets in the present and future, while not undermining the natural resource base (DFID, 1999).

Sustainable livelihoods are lifestyles and work-styles that don't deplete the social and environmental capital of economies (IISD).



## Sustainable Agriculture

The FAO definition of sustainable agricultural development is “the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued



satisfaction of human needs for present and future generations. Such development conserves land, water, plant, and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable, and socially acceptable.”

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## **ADB to Lend China \$4.2bn for Green Growth (13 August 2013)**

The Asian Development Bank (ADB) will support green and inclusive growth in the People's Republic of China. ADB has aligned its priorities with the country's 12th Five-Year Plan, in particular to promote socially inclusive development and environmental protection. From 2013 to 2015, ADB has programmed \$4.21bn in assistance to the country. The main areas to be supported are urban development, water supply and sanitation, and transport.

**More:** <http://www.publicfinanceinternational.org/news/2013/08/adb-set-to-lend-china-42bn-for-green-growth/>

## **Setting up of an autonomous institution named “National Institute of Solar Energy” (NISE) for Research and Technology (3 September 2013)**

The Indian government approved the proposal for setting up of an autonomous “National Institute of Solar Energy” (NISE) to assist the Ministry and function as the apex national centre for research and technology development and related activities in the area of solar energy technologies in the country.

**More:** <http://pib.nic.in/newsite/pmreleases.aspx?mincode=28>

## **Norway Ratifies GGGI Establishment Agreement (26 August 2013)**

The Kingdom of Norway deposited its official Instrument of Ratification to the Global Green Growth Institute (GGGI) today, making Norway the thirteenth of 20 member countries to have ratified GGGI's Establishment Agreement.

**More:** <http://gggi.org/norway-ratifies-gggi-establishment-agreement/>

## **UNEP Signs Agreement to Improve Monitoring of Hundreds of International Environmental Accords (9 September 2013)**

The United Nations Environment Programme (UNEP), under whose auspices most of the agreements were negotiated, signed a Memorandum of Understanding (MoU) with the International Organization of Supreme Audit Institutions (INTOSAI - Working Group on Environmental Auditing, WGEA) to ensure that some 280 Multilateral



Environmental Agreements (MEAs) dedicated to supporting the global environment are properly implemented.

**More:** <http://www.unep.org/newscentre/Default.aspx?DocumentID=2726&ArticleID=9607&l=en>

## INVITATION FOR CONTRIBUTIONS FOR VOLUME 2, ISSUE 2

*Green Growth and Development Quarterly* is an international publication that aims to facilitate knowledge and learning processes which will help in enhancing the capacity on emerging 'green' policy concepts. It is a step towards a forward-looking knowledge process for new opportunities linked with growth and sustainable development. The quarterly showcases new research and innovative practices through engaging with stakeholders from government, business, and industry, and research and academia. Topics for the quarterly include:

- Multi-stakeholder actors and engagement in transformative processes for environmental sustainability and inclusive growth;
- Post-2015 agenda and international cooperation on global environment;
- Measuring green growth, environment sustainability and inclusiveness;
- Issues on growth and access to basic services;
- Ecology-societal interface ;
- Sharing experiences from the grassroots; and
- Showcasing research and good practices

We invite contribution for the fourth issue of the quarterly under following sections:

Type of contribution	Description	Length (approx.)	Illustration
Articles (will be subject to peer review)	Covers analysis through original research, reviews and commentaries on topics of policy relevance	6000-8000 words	As required
Green Showcase	Features research, good practices, and initiatives	600-800 words	Preferably 1
Green from the Grassroots	Features insights from initiatives that involve interaction with communities and people	600-800 words	Preferably 2 photos

## Other specifications

### ***Schedule:***

For consideration in the forthcoming issue, submissions are required with illustrations latest by November 30, 2013.

### ***Language and Style:***

The language should be factual, experiential, crisp, and clear. Authors are prompted to avoid academic, bureaucratic or politicized terminology. Your text will be style edited by a professional editor. However, you are kindly asked to consider the following style guide:

- Use British English spelling.
- Use Oxford style ([http://www.askoxford.com/dictionaries/compact\\_oed/?view=uk](http://www.askoxford.com/dictionaries/compact_oed/?view=uk)).
- Use only metric units.
- In the text put numbers in numerals.
- When using acronyms for the first time, spell them out and put the abbreviation in parentheses.

### ***Illustrations:***

Include any credits and permissions to print that may apply to illustrations.

Illustrations should have the following format:

- Photographs should be high resolution (jpeg format).
- Graphs and figures should be submitted separately with excel sheet.

## References

Please provide complete references and citation in APA style. It should be listed in alphabetical order at the end of the article.

Submission to be made to [edit.ggd@teri.res.in](mailto:edit.ggd@teri.res.in)

## NOTES



## NOTES



# Green Growth and Development Quarterly



Green Growth and Development Quarterly aims to understand the many facets of inclusive and green growth. It is a step towards a forward looking knowledge process for new opportunities linked with growth and sustainable development. Volume 2 (Issue 1) of the quarterly showcases new research and innovative practices through engaging with stakeholders from government, business and industry, and research and academia.

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The Energy and Resources Institute

