



**ECONOMY OF TOMORROW**

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## **Green Jobs in India: Potentials and Perspectives**

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- In India, the issue of a green economy has been appreciated by all the relevant economic agents.
- There is a need for appropriate public policy interventions through removing distortions and front-loading of green investments in some key sectors.
- The international community—particularly developed nations and international organizations have a major role to play in supporting the efforts to achieve the common global goal of a green economy.







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## Context

India needs to expand its employment sectors to alleviate poverty, deliver goods and services, create jobs, and improve standards of living. However, the unsustainably high environmental cost of a business-as-usual model and the threat of climate change reversing the progress made on employment creation and poverty reduction are becoming evident. Hence, sustainable development which not only balances but builds on the synergies between economic growth, social inclusion and protection and preservation of the environment is becoming an imperative. Global initiatives to move towards a low-carbon economy are increasingly being paired with the need to create and maintain opportunities for meaningful employment. This assumes even more significance against the backdrop of the recent global financial crisis that the world is still recovering from. From a policy perspective, this potential to create a range of new jobs, while greening the economy can have significant implications. Therefore to meet the twin objectives of high economic growth and tackling climate change, 'green jobs'<sup>1</sup> are increasingly being seen as a win-win for all. This calls for a transition to a low-carbon economy which promotes the creation of green jobs.

This study has been undertaken as part of FES initiative which aims to identify the potentials and prospects for 'green industries' and 'jobs' in selected Asian countries and develop corresponding policy options. It identifies the broad range of policy measures required by the national government to promote and facilitate the greening of industries. The study is broadly divided into three main sections and in the first section an attempt is made to assess the sectoral composition of the economy. The first section focuses on trends in resource use and what advances have been made in improving the environmental performance of the various sectors of the Indian economy. The next section attempts to trace broad range of policy measures adopted to promote green jobs with special emphasis on the interaction between policies for promoting employment and policies for promoting greening of the industry. The section further analysis the challenge faced in greening the economy, and identifies an appropriate mix of policy instruments, underscoring the need for strong institutional integration. The final section touches upon the public debates on green economy, which is still at a nascent stage in India and looks at the perceptions of the key stakeholders for developing an agenda for promoting green jobs. The study also provides conclusion/recommendations by cautioning the issues that need to be resolved before embarking on any concrete policies on green jobs in India.

## 1. India's Economic Model and Its Impact on the Environment

The development theories, in particular Lewis theory, suggest that developing and underdeveloped countries, which are pre-dominantly agriculture dependent economies, need to focus their policies for shifting the abundant resources (labour) from agriculture to industrial and then to the service sector in a sequential process. This sequential shift was expected to be more sustainable and similar to the pattern of growth than many of the current developed nations have followed. In India also there was support to follow this pattern of development and brought policy changes towards this direction after independence. But by the early 1980s, this approach was criticized as it only led to indiscriminate expansion of inefficient and unproductive public enterprises that was putting a higher burden on public finances. In addition to these, disturbances in the global economy has forced India to rethink its development strategy and shift towards integration with the global economy and follow market friendly approach and led to systemic reforms.

<sup>1</sup> For the purpose of the study the definition of green jobs as identified by the UNEP (2008) study on "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World" is considered



The systemic economic policy reforms initiated by India in the early 1990s indeed resulted in substantial changes both in the structure as well as in the composition of growth. Indian economy and its policies, which were largely dependent on the agricultural sector despite industrial policy reforms, have shifted in favour of service sectors. It may be noted from the figure 1 (appendix) that both services and agriculture sector were equally contributing close to 38% of total output in 1980-81. Since then it experienced structural divergence where the share of service sector increased to 58% while the share of agriculture declined to 14% of total output (in real terms).

This structural change, as many argue, might not result in balanced growth as it has by-passed the industrial sector. During the early 1990s, many countries (mostly of East and South-East Asia including China) have followed traditional development models and focused on industrial sector growth and achieved high and stable growth for a long time. But from the resource intensity point, the strategy that India has adopted is more prudent as the growth of service sector is less resource intensive than the other two sectors. This is evident from the figure 2 (appendix), which shows the energy intensity of the GDP of two fastest growth economies of the world, that in India where the growth is service-led, the energy intensity is much lower compared to that of China, which is experiencing industry-led growth. But it is visibly clear, that China has brought down the energy intensity by more than two-thirds from 1980 to 2008 while the same in India is not that substantial, which a cause for concern is. This also suggests that there are not enough policies for reducing the resource intensity in India. It is all the more concerning following the new National Manufacturing Policy-2011 that aims at increasing the share of manufacturing in total GDP from the current level of 16% to 25%.

The development path has however, has witnessed an impressive and steadily rising rate of economic growth for about two decades. The annual growth rate of employment has increased from 1.6% 1993-2000 to 2.5% in 1999-2005<sup>2</sup> mainly due to sectoral and financial reforms. The prospects of a continuation of this high economic growth in the medium term are also high. The percentage of population below poverty line has declined from 36% in 1993-94 to 27% in 2004-05. This percentage of population below poverty line is declining at the modest rate of 0.74%. Despite the financial crisis in 2008 which led to plummeting of growth rates worldwide, the average growth rate of the Indian economy over the last five years (2005/06 to 2009/10) has been 8.5% per annum (Economic Survey, 2009-10<sup>3</sup>). Among the major economies, only China has grown faster than India since 2005. GDP of India grew at 8.6% per annum in 2010/2011 and targets of 8.2% per annum have been set for 2011/12, 9% for 12th Five Year Plan<sup>4</sup>. The UNDP Human Development Report of 2006 has ranked India at 126th position among 177 countries<sup>5</sup>.

Energy consumption in India has also been increasing over the years. India is the 4th largest consumer of primary energy in the world (BP 2011). Primary commercial energy consumption in the country has increased from 469 Mtoe in 2009 (BP 2011) to 480 Mtoe in 2010. However, in per capita terms, energy consumption in India is still much lower than even the global average. Per capita energy consumption India in 2009 was 585 kilograms of oil equivalent (kgoe), which was lower than the per capita energy consumption in middle income countries (1268 kgoe) and much lower than the per capita energy consumption of high income countries (4801.1 kgoe). As of 2009, 289 million people (or 25% of the population) did not have access to electricity in India and about 836 million people (72% of population) relied on traditional biomass

<sup>2</sup> Economic Survey 2006-07

<sup>3</sup> Economic Survey, 2009-10

<sup>4</sup> Approach paper to 12th plan, "A New Approach to the Twelfth Five Year Plan 2012-17", Planning Commission, 2011

<sup>5</sup> UNDP Human Development Report 2006



for cooking (WEO, 2011<sup>6</sup>). Per capita electricity consumption in India was 566 kWh/capita compared to a world average of 2876 in 2008<sup>7</sup>. With economic growth, access to modern fuels and technology choices is assumed to increase as sections of society progress along the economic ladder.

The last few decades, however, made it clearly evident that economic development can no longer be viewed in isolation from environmental protection and social progress. Despite of high economic growth in the Tenth Five Year Plan, the benefits of growth have not sufficiently trickled down to the lower income groups and the challenge of employment, especially good quality and remunerative employment remains formidable. Hence the agenda of moving towards green path and sustainable development has assumed significance like never before.

The next sub-section outlines the trends of energy and resource consumption in the different sectors and the kinds of initiatives being undertaken in various sectors that create opportunities for green jobs.

### **1.1 Trends in terms of resource use in India**

Having established India's national priorities, achieving which will require increasing amounts of energy, this section describes the changing structure of Indian economy over time and the resulting trends in energy and resource use in the different sectors and sub sectors.

Energy intensity, defined as the ratio of the energy consumption to the GDP, is an indicator that shows how efficiently energy is used in the economy. Energy intensity has been observed to follow a certain trend worldwide. Below a certain level of development, growth results in increase in energy intensity. With further growth, the energy intensity starts declining. Changes in the structure of a nation's economy may lead to substantial changes in its energy intensity that is unrelated to changes in the technical efficiency of energy utilization. Therefore, to understand the trends in energy and resource use, it is also important to understand the evolution of Indian economy.

Economic planning in India is done through the Five Year Plans (FYP) that is developed in accordance with the country's needs and vision for growth over the five year planning period. Development of energy and infrastructure has been an integral part of the FYPs since the first FYP in 1951. Different sectors- agriculture, industry and services, have been the focus of these plans given the country's evolving developmental needs over time (Planning Commission). The first FYP focussed on development of the agricultural sector and multipurpose irrigation projects. The second FYP placed emphasis on developing heavy industries and generating employment opportunities. The 3rd-8th FYPs aimed at building self-sufficiency in food grain production. The 8th FYP was also the period of liberalisation and privatisation of the Indian economy and led to modernisation of industries in India. Since then, social sector issues, human resource development and provision of basic services for health, education and employment have been the focus of FYPs in India. The 12th FYP that comes into force in 2012 focuses on 'inclusive growth' and development of India's agriculture, education, health and social welfare through government spending. As a result, there has been a change in India's structural composition over time. While a large majority of Indian population (52% of the workforce in 2010, MoA, 2011) continues to be employed in the agricultural sector even today, the share of agriculture in the gross domestic product (GDP) has declined significantly and steadily over the years (Fig 1). In 1955-56, agriculture and allied activities accounted for almost 55% of the country's GDP. The share of services sector was nearly 35% and the share of industry sector was a little over 10%. In

<sup>6</sup> World Energy Outlook 2011, International Energy Agency, Paris

<sup>7</sup> World Bank Indicators. Last accessed on 5December 2011



2010-11, services account for more than 65% of the GDP and the share of agriculture has declined to less than 15%. Industries account for 20% of GDP. The 12th FYP also aims to create employment through developing India's manufacturing sector.

The energy intensity of India is over twice that of the matured economies, which are represented by the OECD (Organization of Economic Co-operation and Development) member countries. India's energy intensity is also much higher than the emerging economies—the Asian countries, which include the ASEAN member countries as well as China. However, since 1999, India's energy intensity has been decreasing and is expected to continue to decrease<sup>8</sup>. The indicator of energy–GDP elasticity, that is, the ratio of growth rate of energy to the growth rate of GDP, captures both the structure of the economy as well as the efficiency. The energy–GDP elasticity during 1953–2001 has been above unity. However, the elasticity for primary commercial energy consumption for 1991–2000 was less than unity (Planning Commission). This could be attributed to several factors, some of them being demographic shifts from rural to urban areas, structural economic changes towards lesser energy industry, impressive growth of services, improvement in efficiency of energy use, and inter-fuel substitution.

Along with changes in the structural composition, over time there have been changes in the energy and resource consumption patterns in each of the sectors.

## Agriculture

Indian agriculture is largely rainfed and not mechanised. But over time and after the Green Revolution the energy and resource needs of the sector have also evolved. The sector today needs fossil fuels for production of chemical fertilizers, diesel and electricity for running machines and equipment, energy for food storage, processing and distribution. Tractors, irrigation pumps, agricultural equipments are direct consumers of energy in the agricultural farm, while fertilizers, chemical pesticides, hybrid seeds, & feed supplements for livestock are indirect energy consumers. The average farm power availability in India has increased from about 0.25 kW/ha in 1951 to about 0.295 kW/ha in 1971-72, 1.35 kW/ha in 2001 and 1.502 kW/ha in 2005-06 (MoA 2010). As per estimates by Central Institute of Agricultural Engineering (CIAE, 2010)<sup>9</sup> in order to sustain the projected population of 1.363 billion by 2025, agricultural production in India has to be increased by 85% and productivity by 100% from the present level by intensification of agriculture. It is estimated that the energy input to agriculture would have to be increased from the present level of 1.502kW/ha to 2.4 kW/ha. About 65% of this power will be through tractors and self-propelled machines for which alternative fuel sources need to be tapped.

Energy consumption in the agriculture sector also varies from crop to crop and from region to region based on the resources available and uses. Rice–wheat rotation is an energy intensive crop rotation system. Irrigation consumes maximum energy in all the farm operations for both paddy (81.9%) and wheat (38.1%) (See table 1 in appendix).

Agriculture is a major consumer of diesel and electricity in the country. Diesel engines and electric motors are used for irrigation equipment, operating threshers and other stationary machines. Irrigation water pumping is the second most important direct commercial energy end use in Indian agriculture after land preparation (TERI, 2010<sup>10</sup>). In 2008-09, the agricultural sector accounted for 12% of the diesel consumption

<sup>8</sup> <http://www.indiacore.com/overview-energy.html>

<sup>9</sup> The Vision 2025 document of CIAE 2007, CIAE, Bhopal

<sup>10</sup> TEDDY 2010, The Energy and Resources Institute





and 18% of the electricity consumption in the country. The growth of electricity consumption in the sector over the plan years is shown in table 2 (appendix). During the first FYP, electricity consumption in agriculture sector was 316 GWh, accounting for 3.11% of the total electricity consumption during the plan period. This figure increased to 99023 GWh accounting for 18.84% of the total electricity consumption during the tenth plan period. At the end of the first year of the eleventh plan the total electricity consumption in agriculture was 104182 GWh. The electricity consumption in the agriculture sector has been increasing mainly because of greater irrigation demand for new crop varieties and subsidized electricity supply to the sector. In the consumption of electricity for agricultural purpose (by state), Andhra Pradesh ranked first during 2007-08, accounting for 15241 GWh of consumption, followed by Maharashtra, which accounted for 12675 GWh. Northern, southern and western states consume more amount of electricity for agricultural purpose when compared to eastern and north-eastern states.

The agricultural sector also requires fertilizers and pesticides. Nitrogen, phosphate and potash are the fertilizers commonly used in India. Fertilizer consumption in India over the past few years is shown in tables 3 and 4 (appendix). Fertilizer production requires energy, though different kinds of fertilizers differ in energy intensity. Nitrogen production requires roughly 70 000 kJ per pound of nutrient (30 000 Btu per kg). In contrast, the production of phosphate and potash account for only about 45% of the total energy requirement for these nutrients. Moreover, the energy requirement for nitrogen fertilizer is 4.5 times that of phosphate fertilizer, and 5.7 times that of potash fertilizer.

Water for irrigation is a critical requirement in agriculture and is also specific to crop and soil type and to the application of fertilisers. Annual requirement of water for irrigation in India in 1990 was 437 BCM which increased to 541 BCM in 2000, 688 BCM in 2010 and it is expected that by the year 2050 annual requirement of water for irrigation will reach as high as 1072 BCM. Water foot printing is a technique that can be used to estimate the water requirement per product. The estimates of current and expected water requirements in different sectors of the country are shown in table 5.

As an important consumer of energy, efforts are being for greening of the agricultural sector in India. As irrigation is usually the major user of energy, using modern technologies such as sprinkler, drip, micro-irrigation can help reduce not only the water requirement for irrigation but also the electricity or diesel requirement for running the pump sets. There are reportedly more than 15 million electric and 6 million-diesel irrigation pump sets in operation (TERI, 2010). Energy efficient motors account for a very small percentage of motor sales in India. Retrofitting of even 10% of the existing inefficient pump sets (~15.35 million as of March 2007) annually would translate into a savings of ~ 4 billion kWh (kilowatt-hour) per year at the user's end and ~900 MW of equivalent generation capacity. Other key conservation practices include crop residue management, nutrient management, irrigation water management, precision agriculture, pesticide management etc.

The National Mission on Sustainable Agriculture outlines strategic interventions to tackle the impacts of climate change on Indian agriculture and also to improve food security, equitable access to food resources and livelihoods and economic stability at the national level. Interventions include measures for improved crop seeds, livestock and fish culture, improved water efficiency; pest management, improved farm practices; nutrient management; agriculture insurance and credit support; creation of new market infrastructure and alignment of R&D with market needs and livelihood diversification (NMSA, Draft, 2010<sup>11</sup>).

<sup>11</sup> <http://agricoop.nic.in/Climatechange/ccr/National%20Mission%20For%20Sustainable%20Agriculture-DRAFT-Sept-2010.pdf>



## Industry

The industry sector comprises of mining and quarrying, manufacturing and electricity, gas and water supply sectors. The main energy sources consumed in the industrial sector in India are electricity, natural gas and petroleum products such as naphtha, high speed diesel (HSD) and furnace oil. Natural gas is used extensively in the production of nitrogenous fertilizers and is also used in the petrochemicals industry. Naphtha is used in the manufacture of chemicals and petrochemicals in India. Furnace oil is utilized in the manufacture of chemicals.

The energy and other inputs of the industry sector change with change in composition of manufacturing and change in technology. For instance, the production of nitrogenous fertilizers has remained constant at about 11 million tonnes for almost the past decade. The capacity has also remained more or less constant at 12 million tonnes. Despite the plans (Working Group Report on Fertilisers for XI plan) to increase the capacity of urea, no increase in capacity and production was witnessed till 2008-09. The specific energy consumption in the fertilizer sector has been declining as the share of natural gas based fertilizer units is consistently increasing. Natural gas is the most appropriate feedstock for the production of nitrogenous fertilizers. As in 2008-09, 93% of the feedstock was based on natural gas. It is assumed that specific fuel consumption would decline further as natural gas would be the only feedstock used for fertilizer production in the future.

The industry sector is the largest consumer of electricity as electricity is a key requirement for industrial processes. Industrial sector is a bulk consumer of electricity. Electricity consumption in the industrial sector has increased at 8% per annum from 2603.81 GWh in 1950 to 198890 GWh in 2008-09 (CEA, 2010). However, though the sector remains the largest consumer of electricity, its share in total electricity consumption has decreased from 63% in 1950 to 38% in 2008-09.

A number of interventions have been undertaken in the industries sector to improve energy efficiency and promote use of renewable energy. The Bureau of Energy Efficiency (BEE) formed under the Ministry of Power (MoP) has been entrusted with the responsibility of implementing the Energy Conservation Act, 2001. The Act has identified 685 industries (including thermal power plants and railways) as designated consumers (DCs), which includes sub-sectors such as aluminium, cement, fertilizer, pulp and paper, and textile. The DCs have to report their energy consumption and energy conservation efforts in individual units on a yearly basis through an online e-filing system. Apart from DCs, the BEE has identified the small and medium enterprises (SMEs) sector as an important energy consumer. In this regard, it has initiated the BEE-SME programme, which is aimed at improving the energy efficiency of the sector. The Electricity Act, 2003, the policies framed under the Act, and the National Action Plan on Climate Change (NAPCC) provide for a roadmap for increasing the share of renewables in the total generation capacity in the country. For this, the Renewable Energy Certificate Regulations were issued in January 2010 and the first trading session was launched in February 2011. The concept of smart grid is emerging as an integral part of India's national electricity policy and aims to increase the share of renewables in electricity generation. The National Mission on Enhanced Energy Efficiency (NMEEE) has been launched under the NAPCC and aims to introduce a market based approach for developing energy efficiency opportunities. The programme envisages save fuel in excess of 23 million tonnes of oil equivalent (mtoe) annually, avoiding power generation capacity addition of 19,000 MW and mitigating the carbon emissions by 98 MT per year, by 2014-15. The NMEEE consists of four initiatives, namely the Perform Achieve and Trade (PAT) scheme, Market Transformation for Energy Efficiency (MTEE) scheme, Energy Efficiency Financing Platform (EEFP) and Framework for Energy Efficient



Economic Development (FEEED). The Standards and Labeling Programme for equipment and appliances and the Bachat Lamp Yojanaprogramme have been launched under the NMEEE.

## Services

Services sector comprises of financing, insurance, real estate and business services (16.7% of GDP in 2009-10); trade, hotels (16.3%), community, social and personal services (14.4%); construction (8.2%) and transport and communication (7.8%) This has been the fastest growing sector in the Indian economy and is growing at almost 10% annually. In 2009-10 the services sector grew at 10.1%, 9.6% in the 2010-11(Economic Survey, 2009-10). Of these, the fastest growing sectors are transport, storage and communication (rate of growth of 15% in 2009-10); financing, insurance, real estate and business services (rog 9%). Trade, hotels, and restaurants showed a growth rate of 6.7% and community, social, and personal services grew at 11.8%.

As a result, energy consumption in the sector is increasing rapidly. The transport sector is the second largest and fastest growing consumer of energy in the country and there is also a steep increase in energy consumption in the commercial sector. The commercial sector accounted for over 9% of the electricity consumption in the country in 2009-10.

One of the important challenges in this sector is the collection of data since the services sector remains largely unorganised and informal in India. This makes it even more difficult to gather data on and monitor energy consumption in the sector. However, despite this limitation, efforts are being made towards greening the sector, particularly in the buildings sector where electricity benchmarks have been generated for different kinds of buildings in different temperature zones in the country and efforts are being made to reduce energy consumption in the construction of buildings by making them compliant with the ECBC and GRIHA codes.

## 2. Policies

A number of measures are being taken in India to address these inter-related issues of economic growth, inclusive development, climate change and energy security. In the short term, energy efficiency and effective demand side management would play a key role in meeting India's energy demands with minimum dependence on imports. In the long term, augmenting energy resources would be crucial for increased energy security. Before the Stockholm Conference (1972), sustainability meant economic viability. It was Mrs. Indira Gandhi, then Prime Minister of India, who first talked about social sustainability during the Stockholm Conference on Human Environment (1972). Mrs. Gandhi pointed out that poverty is major cause and consequences of environmental degradation. In 1987 Mrs Gro Harlem Brundtland stated "you cannot tackle hunger, disease, and poverty unless you can also provide people with a healthy ecosystem in which their economies can grow." These are the principles on which climate change responses and sustainability measures have been built<sup>12</sup>. India's National Action Plan on Climate Change (NAPCC) was released in June 2008. The NAPCC identifies eight national missions running through 2017 and outlines existing and future policies and programs addressing climate mitigation and adaptation. These are, namely, the National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining the Himalayan Ecosystem,

<sup>12</sup> [http://www.un.int/india/india\\_and\\_the\\_un\\_env.html](http://www.un.int/india/india_and_the_un_env.html)



National Mission for a Green India, National Mission for Sustainable Agriculture and National Mission on Strategic Knowledge for Climate Change<sup>13</sup>. At the Conference of Parties under the UNFCCC in 2009, India also voluntarily pledged to reduce its energy intensity by 20-25% in 2020 over the 2005 levels. Such initiatives would lead to what are (albeit loosely) defined as green jobs.

The Government of India has enacted several policies to support the expansion of renewable energy. The Indian Renewable Energy Development Agency (IREDA) is responsible for implementing many of the Indian government's renewable energy incentive policies. Rajiv Gandhi GrameenVidyutikaranYojana implemented in 2005 supports extension of electricity to all rural and below poverty line households through a 90% subsidy of capital equipment costs for renewable and non-renewable energy systems. National Electricity Policy of 2005 allows the State Electricity Regulatory Commissions (SERCs) to establish preferential tariffs for electricity generated from renewable sources.

The Ministry of Environment and Forests has been at the forefront of the issues related to environmental protection. Various institutional and legislative measures have been introduced and have moved from the conceptual stage to implementation. In 2009 the Indian Network for Climate Change Assessment, a body of institutions and scientists, was launched to provide guidance for policy makers. Other areas, such as transparency in environmental and forestry clearances, have received renewed impetus to promote environmental protection and natural resources management, including through the activities of the National Mission for Green India, Mission Clean Ganga, and National Green Tribunal.

As state governments also have roles to play in expanding green growth, the Thirteenth Finance Commission included the environment and forests in its devolution formula so that states can also become partners in achieving green targets. Further, based on the commission's recommendations, beginning in 2015 India is to start reporting green domestic product, which should help in monitoring the contribution of green policies to the overall economic growth process.

## **2.1 Interaction of policies and programs for promoting employment and environmental protection**

India has demonstrated its commitment towards sustainable development through a series of legislative, policy and institutional measures nationally besides participation in multilateral environmental agreements, which integrate environmental, social and development concerns. India's sectoral priorities include poverty eradication and livelihood security through employment generation, universal access to modern energy services, prevention of land degradation, afforestation, watershed development in dry lands, rural connectivity, mass transport, conservation and sustainable use of biodiversity, clean water and facilitation of technology development and transfer. Environmental protection and conservation has also been promoted through various policy measures. The National Environment Policy, 2006 is a response to India's commitment to a clean environment and intends to mainstream environmental concerns in all development activities.

There are many such initiatives both at the institutional as well as at policy level to address the environmental concerns. At the institutional level, access to public information through Act, setting of Green Tribunals, creation of Central Pollution Control Board to monitor industries' discharge, enactment of Biological Diversity Act, drawing of rules for wetland conservation, etc. are expected to address the

<sup>13</sup> <http://www.c2es.org/international/country-policies/india-climate-plan-summary/06-2008>



core issues of pertaining to forestry, biodiversity, pollution control, land degradation, water management, climate change, marine and coastal environment, and clean energy. In addition, as part of National Action Plan on Climate Change (NAPCC) that links development and climate change, recently India cleared the National Mission for a Green India, which aims to increase India's forest area on 10 million hectares by 2020. There have been policies and programmes targeted towards promotion of energy efficiency and renewable energy as part of government's effort to ensure clean energy. Likewise several programs and policies and targeted schemes have been introduced to eradicate poverty either through a direct focus on employment generation, training and building-up assets of the poor, or indirectly through a focus on human development with an emphasis on health, education, social infrastructure and women's empowerment. Most of the employment generation programmes have been through promotion of self-employment (Swarnajayanti Gram SwarajgarYojana, SwarnajayantiShehariRojgarYojana, Self Help Groups etc.), wage employment (MGNREGA), and food security through employment (SampoornaGrameenRojgarYojana). Innumerable programmes and policies aimed at promoting employment and livelihood and other social policy goals have been detailed in table 6 and 7 (appendix).

It is clear from the above discussions that while employment has been a concern for policymakers in India for several years and innovative programmes, including those backed by legislations have been introduced time and again, there still seems to be a lacuna in terms of inclusion of the concepts of the green economy and promoting green employment. More often governments are not always well equipped to deal with the cross-cutting and long-term nature of many environmental and employment challenges. Environmental protection, innovation, industrial growth, greening of industry, trade and creation of green employment and investment are all seen as separate policy issues and their inter linkage is rarely acted upon. There seems to be a dichotomy in synchronising the concepts of growth, greening the economy and employment creation which can be termed as green employment. This dichotomy seems to stem from the fact that the concepts of 'green jobs' and 'green economy' are at a very nascent stage. From a public policy perspective, the greening of industries or creation of green jobs is a cross-cutting exercise, which traverses a range of policy streams. Moreover it calls for synchronisation of four important types of policies namely industrial policy (e.g. technology development), environmental policy (e.g. resource conservation measures), regional development policy (e.g. provision of local infrastructures) and employment policy. Currently, many of the strategies adopted by governments are entirely sectoral in approach and are implemented by ministries focussing solely on their specific mandates. For instance, there are three ministries operating in the arena of labour and employment, industrial development and environment protection - Ministry of Labour and Employment (MoLE), Ministry of Commerce and Industry (MoCI) and Ministry of Environment and Forest (MoEF). Although MoEL has mentioned about promoting of green jobs and greening of work place in a report released in 2011<sup>14</sup>, its primary goal is not just creation of only green jobs. Similarly the industrial policy does not talk exclusively of greening the industries.

The flagship project for employment generation, MGNREGA was envisaged for enhancing the livelihood security of people in rural areas by guaranteeing hundred days of wage-employment. It is a social welfare and employment creation program. However, it has led to the creation of green jobs - jobs which helped arrest rising temperature, depleting water table and deforestation (Sharma 2010, Gupta 2010<sup>15</sup>). The Central government is deliberating whether the work done under the scheme could help

<sup>14</sup> <http://indiagovernance.gov.in/news.php?id>, accessed on 1st Feb 2011.

<sup>15</sup> Paper presented in National Conference on Green Jobs, New Delhi, 2010. Information can be obtained from [http://www.ilo.org/global/topics/green-jobs/WCMS\\_142088/lang--es/index.htm](http://www.ilo.org/global/topics/green-jobs/WCMS_142088/lang--es/index.htm).





workers earn some extra money through carbon credits<sup>16</sup>. Similarly, the India's National Action Plan on Climate Change which was formulated to embark on a sustainable development path that simultaneously advances economic and environmental objectives also has the co-benefits of energy efficiency investments including the creation of jobs and business opportunities. CDM projects also have huge potential for creating additional employment opportunities which can be termed as green jobs. However, the green opportunities for all of these projects/programs has been only incidental, since these projects were not aimed at creating or promoting only green jobs. Correspondingly many of the activities undertaken by other ministries (line Ministry of Agriculture, Ministry of New and Renewable Energy) have also led to creation of more opportunities for green jobs. More often, the national ministries and even the regional and local agencies tend to work in relative isolation, despite the fact that they often introduce policies and invest in projects that have a major impact on the responsibilities and work of other agencies. A large number of issues still continue to exist and there has not been an overall policy for greening of the economy or promoting green jobs.

Policy integration or even working under some broad guidelines is an uphill task due minimal institutional coordination. The OECD (2008<sup>17</sup>) suggests that governments can foster stronger institutional integration by decoupling the link between economic growth policies and environmental pressures, and think of potential win-win outcomes. Perhaps for the Indian context the policy integration should take place both "vertically" between different tiers of government; and "horizontally", between different sectors of government as suggested by an UNIDO (2011<sup>18</sup>) study.

## 2.2 The challenges of greening the economy and creation of green jobs

In recent years, although some headway has been made towards improving the environmental management and industry development regimes, India still continues to face formidable challenges in fostering the greening of industries and promotion of green jobs. The barriers faced are plentiful and complex, but can broadly be attributed to a combination of market and policy failures, poor resources, lack of skill development, support for green business ventures and weak political commitment and governance.

### Market failure

Market driven approaches for greening of the economy have gross limitations. In some sectors where the goods are public or merit goods, market outcomes may not be socially desirable. While government intervention is needed to correct market failures, it is noted that the government manipulation of market prices is also a source of problems. Some of these price distortions include input subsidies (for e.g. to encourage the use of fertilizer or irrigation) and energy subsidies with predictable wasteful use. These price distortions lead to excessive consumption of energy and natural resources per unit of output. Hence, reducing price distortions is an important step toward the greening of industries.

### Lack of resources

One of the major constraints for greening of the enterprises and industries in developing countries as identified by various studies in OECD (1999<sup>19</sup>) report is the lack of resources or expertise to adopt new

<sup>16</sup> <http://www.livemint.com/2009/02/08133801/NREGA-workers-may-earn-money-f.html> accessed on 1st Feb 2011.

<sup>17</sup> OECD. 2008. OECD Environmental Outlook to 2030, OECD, Paris.

<sup>18</sup> UNIDO, 2011. Green Industry Policies for supporting Green Industry, UNIDO, Vienna.

<sup>19</sup> OECD. 1999. Technology and Environment: Towards Policy Integration. TI/STP(99)19/FINAL, OECD, Paris.



green technologies, despite the long term economic and environmental advantages in doing so. Human, technical and financial resources constrained have severely limited the government efforts in promoting green industry and green jobs in India.

### **Skill development**

The labour markets covered by the concept of green jobs are varied and range from activities in the water and waste sector, work in agriculture and forestry, development of new fuel and energy systems to consultancies in financial industries dealing with carbon trading and green investments. The jobs involve a wide range of skills, experience and qualifications. The greening of jobs relies on specialist knowledge and expertise, especially in the fields of science, technology and engineering. These areas are vital in the process of making the transition to more environmentally sustainable jobs, and will help to secure availability of skilled workers in key economic sectors. One of the major gaps is the lack of close cooperation between education institutions, governments and the business community in order to ensure that education learning outcomes equip individuals with the skills necessary to be competitive in a greening job market.

### **Support for green business venture**

The state of the market, economy and the government policies have an important influence for promoting green business ventures or greening of industries, as they provide the environment through which industrial changes take place. A stable macroeconomic environment plays a crucial role in influencing the ability of the firms to risk investments in environmental technologies, goods, services, and new market opportunities. Although the government has created an enabling environment by promoting public and private investment in sectors like renewable energy, forest conservation and water management, the business opportunities are still inadequate. The support for green business ventures is often crippled by inadequate availability of working capital, lack of right demand conditions for the enterprise, scant financing options, inefficient subsidies, limited opportunities for global partnership and trade and lack of local action. A robust and dynamic innovation system for the greening of industries is also found to be wanting.

### **Barrier for adoption of clean technologies**

The Ministry of Environment & Forests is promoting adoption of clean technologies in various sectors of industries and The National Environment Policy, 2006 contains provisions for adoption of clean technology. Besides during 10th Plan period, efforts were made to promote clean technologies in paper industries, thermal power plants, refineries, iron and steel plants and textile industries where a budget of 12.50 crore was earmarked. During 11th Plan, it is suggested that such technologies may be promoted in other sectors like distilleries, electroplating and tanneries etc. where the budget allocation is to the tune of 16.50 crores. However there have been barriers to the adoption of clean technologies - many of them are proprietary, and protected by strong patent regimes held abroad. The vendors, accordingly, would extract large premiums in the absence of competitive substitutes. There is also lack of coordination in R&D efforts in the country aimed at developing a shelf of commercially viable clean technologies.



### 3. Perceptions/Discourses Regarding Green Jobs

Unlike in many developed economies, in particular in Europe, the issue of “going green” is not yet being discussed broadly in the mainstream in part because there are not enough resources to meet the basic needs of substantial segments of the population. The concept of a green economy needs to become center of policy debates in the country more so as one of the major themes in the coming conference on sustainable development to be held in Rio is “a green economy in the context of sustainable development and poverty”. However, the idea of a green economy, in terms of sustainable development has existed for long in India, although the use of the terms ‘green economy’ and ‘green jobs’ to describe several of the initiatives is relatively recent.

In India, climate change is a concern not only in itself, but more so because India is twice as vulnerable to the risks and negative impacts of climate change. Also, the vast majority of the population, because of its low purchasing power, and lack of access to technology and finance, has low adaptive and coping capacity to respond to the negative impacts of climate change. Thus, climate change and sustainability issues have started gaining importance in the public policy debates and deliberations. The views on green economy is reaffirmed in the Marrakesh Accord at the seventh Conference of Parties under the UNFCCC text that states that “economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties...and...addressing the many challenges of climate change will make a contribution to achieving sustainable.” Responses to climate change are, therefore, not viewed in isolation in India, but as part of broader developmental efforts. For instance, the mitigation of greenhouse gases emissions is important for its vast range of co-benefits including higher energy security, health benefits due to lower levels of air pollution, higher agricultural yields and many others. In this context the concept of green jobs is important in India as it provides an opportunity for employment and livelihood generation and at the same time helps in the greening of different sectors. These views were reiterated by different stakeholders at the recently concluded Delhi Sustainable Development Summit in February 2012 at New Delhi.

India has also witnessed the emergence of campaigners strongly advocating environmental protection and sustainable development. The torchbearer has been R. K. Pachauri, the chairman of the International Panel on Climate Change and director general of TERI. Dr Ashok Khosla, President of International Union for Conservation of Nature (IUCN) flagged existing environmental problems will increase as the climate changes. “We need to redefine our relation with nature, and understand that its regenerative capacity has reduced from overexploitation.” Linking global commons to biodiversity, M. F. Farooqui, Additional Secretary at the Ministry of Environment and Forests (MoEF) said, “Biodiversity has an important role in creating local livelihoods, and commitment to protect biodiversity would stem from this recognition.”

The International Labour Organization (ILO), in collaboration with the Ministry of Labour and Employment, has been organizing discussions and deliberations focusing on the emerging trends and issues relating to the creation of new, environment-friendly employment opportunities and the transformation of existing occupations in the shift toward greener economics<sup>20</sup>. In an acknowledgement of the need for linkages between environment and creation of jobs, the Multistakeholder Taskforce on Green Jobs

<sup>20</sup> Policies as drivers of green jobs. Paper presented by Mr. Vincent Jugault at ‘Green Jobs, Greener Business Training for Constituents and Partners’ – Thailand during 28-30 June 2011. [http://www.ilo.org/wcmsp5/groups/public/--asia/--ro-bangkok/documents/presentation/wcms\\_159039.pdf](http://www.ilo.org/wcmsp5/groups/public/--asia/--ro-bangkok/documents/presentation/wcms_159039.pdf) (accessed 15 March 2012).





and Climate Change was established in March 2009 under the leadership of the Ministry of Labour and Employment and with support from the ILO. The taskforce consists of representatives from worker and employer organizations, government departments, research institutions, and non-governmental organizations seeking to address the employment and labour market aspects of environment-related strategies and policies for promoting environmentally friendly opportunities for work<sup>21</sup>. However, it should be recognised that public debates related to the questions of green economy, green jobs and promotion of eco-industries have not garnered enough momentum at the regional and local level.

### 3.1 Key stakeholders

Although the issue of climate change and environmental concerns are almost at the core of public policy making, the concept and discussion of promoting green jobs, as identified by international discourses, is still in a very nascent stage in India. One of the major reasons for this is the presence of large informal sector that supports more than two-thirds of total employment in the country. This proportion is much higher in the small and medium enterprises and almost all in the agriculture activities are in informal sector.

On the political front, there are no clear differences in terms of the direction of the debate on green growth in the country. Divisions do, however, exist among the various political camps—in part depending on who is in power—regarding the use or abuse of natural resources and the consequences for the livelihoods and employment of local people and growth. Government at the central and state levels, irrespective of political affiliation, have at the least expressed concern for the environment, although in some cases pro-environment actions have been largely driven by judicial activism (for instance, banning illegal mining in the southern state of Karnataka). Civil society organizations and government departments, rather than the political parties, are the leading voices on issues concerning the environment and will continue to be until the economy adequately addresses poverty and deprivation.

For instance, Confederation of Indian Industry (CII), which is a non-government, not-for-profit, industry led and industry managed organisation, is playing a proactive role in offering an advisory services to the industry in the areas of green buildings, energy efficiency, water management, environmental management, renewable energy, green business incubation and climate change activities. Likewise, The Energy and the Resources Institute (TERI) a global think tank research institute established in 1974 conducts cutting-edge scientific technological and policy research in the areas of energy, environment and sustainable development. GRIHA (Green Rating for Integrated Habitat Assessment), which is a design & evaluation tool for green buildings and habitats has been conceived by TERI and developed jointly with the Ministry of New and Renewable Energy.

The premier academic institutes in India like IIT, BITS Pilani, NIT Trichy, IIT Varanasi etc. have been playing pioneering role in developing green technological innovations. Some of the key projects developed by IIT include waterless urinals, geo-spatial infrastructure for water resource management, low- cost environment-friendly bamboo structures, bio-energy for rural enterprise, solar energy-based cooling system and water-saving and management of sewage disposal<sup>22</sup>. However, trade unions, who should be most important stakeholders on any discourse related to green jobs, are yet to be mainstreamed into the main policy making process. This can be exemplified by the fact that establishment of a climate

<sup>21</sup> [http://www.ilo.org/newdelhi/info/public/pr/WCMS\\_142306/lang--en/index.htm](http://www.ilo.org/newdelhi/info/public/pr/WCMS_142306/lang--en/index.htm). (accessed 15 March 2012)

<sup>22</sup> <http://www.hindu.com/2010/04/24/stories/2010042460260400.htm> accessed on Feb 1 2012



task force, an integral part of a national action plan on climate change and green jobs did not have any representation from the trade union movement<sup>23</sup>. Much of the lack of engagement however comes from the fact that this is seen as new subject for the trade union movement in India. Their roles have principally been confined to voicing their opinions in seminars and conferences organized for effective bargaining with employers and government. There is a need to create a larger platform for trade unions to analyse India's approach to climate change and green jobs and work towards an understanding on how trade unionists will work together towards a solution at national levels.

Various private players have forayed into the areas of clean technology in the areas of renewable energy, water saving techniques, sanitation etc. For instance, Aarti, Ankur and TIDE have developed fuel efficient stoves, dryers, kilns, and biogas technologies to conserve biomass and create new business opportunities. Dow Water Solutions and Veolia have been able to put together purification solutions that can help rural communities get clean water at affordable prices. Jain Irrigation has developed water saving sprinkler irrigation systems. Similarly Suzlon is a major wind technology company. Development Alternatives, a not for profit organization, has been actively involved in researching and developing of appropriate environmentally sound, cost effective and income generating building technologies. However, as the MSMEs are one of the key players in India's economic development in terms of its capacity to provide larger number of jobs, a wide range of issues like investments, technological up-gradation, asymmetric information, suitable skills etc. prevent them from turning green. Some initiatives like promoting green entrepreneurship and introducing innovative green technology through government interventions would result in sustainable production. Through this process, the domestic MSMEs could become more competitive both in domestic and international markets and help in reducing resource intensity while creating more stable jobs and enhance social welfare. The government interventions can include tax concessions and cheaper credit for investments in green technologies; providing knowledge sharing platforms so that it can ensure technology transfer and help in marketing; upgrading skill development of entrepreneurs as well as labourers in new technology so as to improve productivity.

With specific regard to the concept of green economy and green jobs, many stakeholders also believe that while adaptation, mitigation and sustainability efforts have been on-going for long, but there is not much knowledge on the socio-cultural aspects of such initiatives. Green economy has emerged has a catchphrase in recent times that could open up new avenues to sustainability and proper utilisation of bio-resources. Adaptation and biodiversity conservation efforts would be attractive to local people when their economic and cultural aspects are highlighted. Thus the concept of green jobs, because it addresses people's wellbeing and ownership of resources may be a more effective way forward than talking about biodiversity and climate change alone.

Issues of green jobs in India have been addressed by various organisations and the academic community. Studies and literature, however, on green jobs in India has largely focused on collecting evidence and different examples of green job creation. Various studies have compiled the estimates of employment opportunities created by clean energy as compared to carbon intensive jobs (TERI 2009<sup>24</sup>,

<sup>23</sup> <http://www.imfmetal.org/index.cfm?c=24617&l=2> accessed on Jan 25th 2012

<sup>24</sup> The Energy and Resources Institute. 2009. Promoting environmental services sector in Asia: Resource and Energy Efficiency Services. Background paper for "International Conference on Green Industry in Asia", Technical session: Promoting energy and environmental services, September 9-11, 2009, Manila, Prepared for UNEP, Paris.



CGN 2010<sup>25</sup>, TERI-GCN, 2010<sup>26</sup>). These studies have also made great strides in stimulating the debate on defining, understanding and quantifying green jobs. The Global Climate Network has compiled estimates of employment opportunities created by clean energy compared to carbon-intensive jobs from nine countries. For India, the study states that by 2020, wind energy will generate 243,225 jobs, and the solar sector will produce 234,350 jobs.<sup>27</sup> In another study, by the United Nations Environment Programme, a proposed project on community-level waste segregation has the potential to provide 2,500 jobs to rag pickers with an average earning of USD 75 per month.<sup>28</sup> Nevertheless, research on linkages between the existing growth and employment policy interaction with policies to promote greening of industries and creation of green jobs in general is scant.

Given this situation, there is a major role for not just the government, but also for many other partners such as private sector, NGOs, civil society, academia, international financial and development institutions, trade unions, and other institutions in helping the transition to green economy.

### 3.2 Key entry points

Public policy can play larger role in other sectors as well and stimulate eco-friendly investments. Many countries have already introduced such measures (green public procurement and eco-labelling in Republic of Korea and Thailand<sup>29</sup>) and seen substantial improvements in efficiency of resource consumption. These best practices may be looked at while making policies for promoting green industry in India. Based on the best practices available, the UNEP (2011) report suggests that for the transition to green economy, the national governments need to follow certain guidelines and some of the suggestions that are relevant in the Indian context are as follows<sup>30</sup>:

1. Establishing sound regulatory frameworks:
  - a. A well-designed regulatory framework to define rights and create incentives that drive green economic activity as well as remove barriers to green investments.
  - b. Standards to be an effective tool for achieving environmental objectives and enabling markets in sustainable goods and services.
2. Prioritizing government investment and spending in areas that stimulate the greening of economic sectors:
  - a. Tax incentives to help promote investment in a green economy and mobilize private finance.
  - b. Price support measures and net metering have been successfully used to promote renewable energy technologies.

<sup>25</sup> Global Climate Network, "Low carbon jobs in an interconnected world", Global Climate Network Discussion Paper No 3., GCN: March, 2010, p. 23-4

<sup>26</sup> HimaniUpadhyay&NehaPahuja, 2010, Low Carbon Employment Potential in India: A Climate of Opportunities, TERI-GCN discussion paper

<sup>27</sup> Global Climate Network, "Low-Carbon Jobs in an Interconnected World," 23-24.

<sup>28</sup> United Nations Environment Programme, "Lessons Learned on Mainstreaming Pilot Projects into Larger Projects," 2009.

<sup>29</sup> <http://www.imfmetal.org/index.cfm?c=24617&l=2> accessed on Jan 25th 2012

<sup>30</sup> UNEP, 2011, Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication - A Synthesis for Policy Makers, [www.unep.org/greeneconomy](http://www.unep.org/greeneconomy)



3. Limiting spending in areas that deplete natural capital:
  - a. Many subsidies represent a significant economic and environmental cost to countries.
  - b. Subsidies reduce the profitability of green investments.
4. Employing taxes and market-based instruments to shift consumer preference and promote green investment and innovation:
  - a. Market-based instruments are powerful tools and are being increasingly used to address a range of environmental issues.
  - b. Markets establishing payments for providing ecosystem services can influence land-use decisions by enabling landholders to capture more of the value of these environmental services.
5. Investing in capacity building and training:
  - a. Inter-governmental organizations, international financial institutions, NGOs, the private sector and the civil society to play a critical role in providing technical and financial assistance for capacity building.
  - b. Restructuring, training and skill enhancement programmes to prepare the workforce for a green economy transition.

#### 4. Inference

To sum up, as many studies shown, transition to green economy has potential to achieve long term development objectives such as 'Faster, Sustainable and more Inclusive Growth' as specified by India's 12th Plan Approach Paper. Moreover, the issue of green economy has been appreciated by all the relevant economic agents. However, there is a need for appropriate public policy interventions through removing distortions and front-loading of green investments in some key sectors that attract all the other stakeholders. Collaboration and co-ordination among the stakeholders is very important for effective transition. Some of the bottlenecks for greening of industry or to create avenues for policy formulation for promotion and creation of green jobs stems from the fundamental disconnect in understanding the basic concepts of green employment and determining its relationship to the wider economy and to the national development objectives. Moreover, it is generally perceived that shifting to green business will mean high initial costs and could compromise growth as well as employment targets. The international community—particularly developed nations, international organizations, and so on—have a major role to play in supporting efforts in these nations to achieve the common global goal of a green economy. Nevertheless, some of the issues which need to be resolved before embarking on any concrete policies on green jobs are:

- What is the scale of overall environment-related economic activity and employment in the economy?
- How do we estimate core environment related jobs and green jobs?

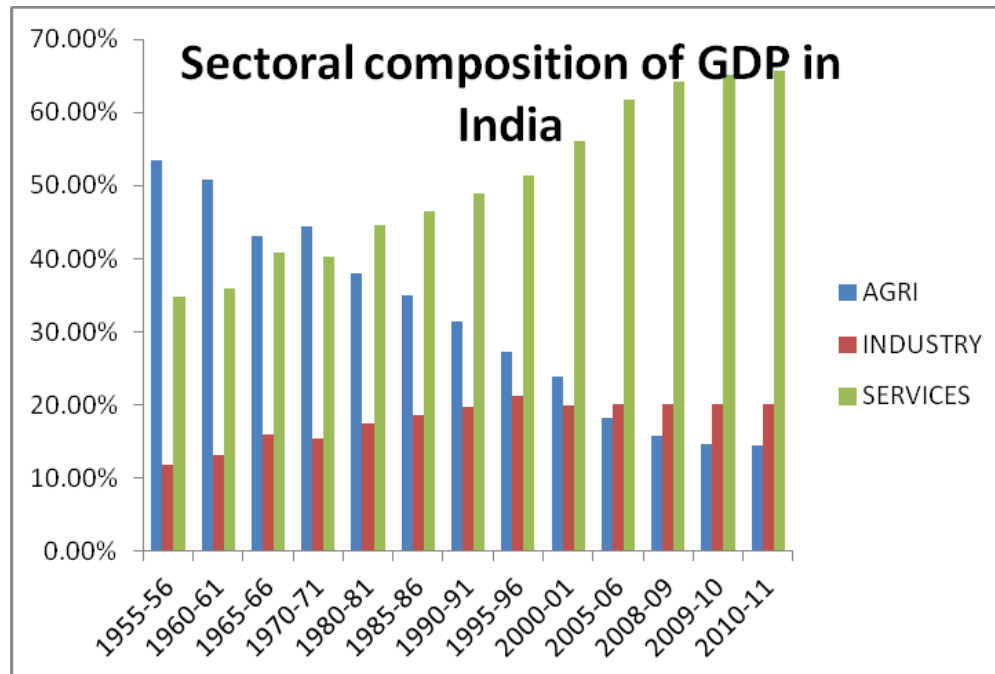


- What are the challenges that the country may face in transitioning to the Green Economy? Which sectors gain and lose due to greening of economy?
- What are the incentives for the private players to invest in green industries?
- How many indirect jobs do the green economic activities support?
- How sensitive is green employment to policy changes and other interventions in the wake of rapid economic developments?
- How can the country develop a tangible yet comprehensive framework of action, touching upon issues regarding policy decisions and possible reform, investment, and creation of green employment?
- What are the employment impacts of climate change and other environmental practicalities and policies?

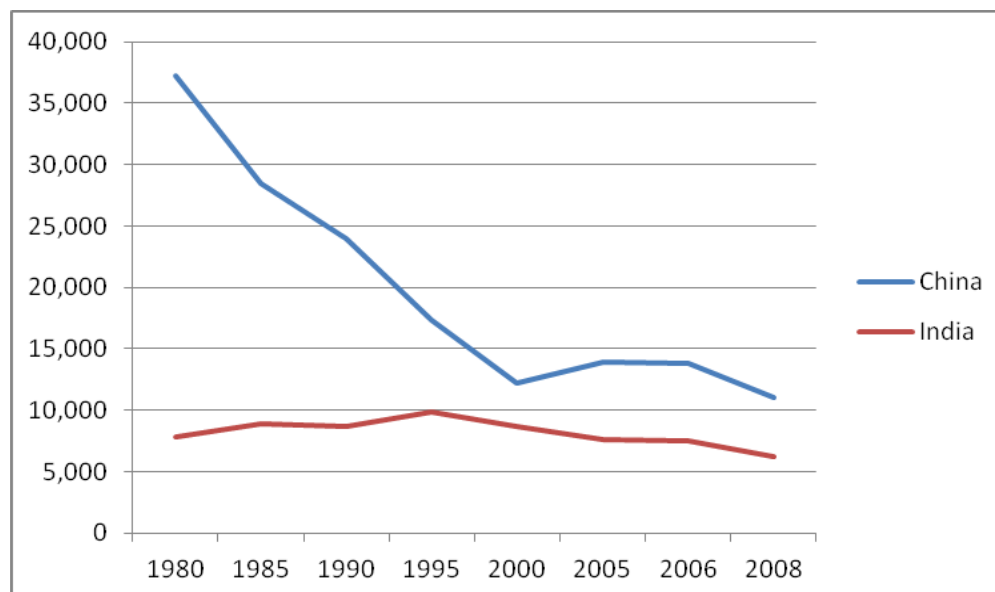




## Appendix



**Figure 1** : Structural Composition of Indian economy from 1955-56 to 2010-11  
Source : Source: RBI Handbook of Indian Statistics, 2012



**Figure 2** : Energy Intensity (energy consumption per dollar of GDP, Btu per U.S. Dollars)  
Source : Source: International Energy Statistics (accessed on 16th February, 2012)



**Table 1:** Energy use and energy production of some of the major crops in India

	Crops	Productivity (kg/ha)	Total energy (MJ/ha)	Energy productivity (kg/MJ)
<b>Cereals</b>	Paddy	3125	13076	0.239
	Wheat	2873	14657	0.196
	Maize	2140	9956	0.215
	Sorghum	950	4745	0.200
<b>Pulses</b>	Green Gram	510	4315	0.118
	Black Gram	406	3870	0.105
	Bengal Gram	596	5464	0.109
<b>Oilseeds</b>	Mustard	960	8051	0.119
	Soybean	1092	6382	0.171
<b>Cash Crops</b>	Sugarcane	61500	59192	1.039
	Cotton	938	9972	0.094
	Potato	15520	31352	0.495

Source: Energy Management in agriculture-Status Issues & strategy, Dr. Nawab Ali, ICAR

**Table 2:** Growth of Electrical Energy Consumption Pattern-Utilities & Non-Utilities (GWh)

Year	Electricity consumption in agricultural sector (GWh)	Share of electricity consumed in agricultural sector
1950	162	2.89
1955-56 (End of 1 <sup>st</sup> Plan)	316	3.11
1960-61 (End of 2 <sup>nd</sup> Plan)	833	4.96
1965-66 (End of 3 <sup>rd</sup> Plan)	1892	6.21
1968-69 (End of 3 Annual Plans)	3465	8.37
1973-74 (End of 4 <sup>th</sup> Plan)	6310	11.36
1978-79 (End of 5 <sup>th</sup> Plan)	12028	14.32
1979-80 (End of Annual Plan)	13452	15.76
1984-85 (End of 6 <sup>th</sup> plan)	20961	16.83
1889-90 (End of 7 <sup>th</sup> plan)	44056	22.58
1991-92 (End of 2 Annual Plans)	58557	25.33
1996-97 (End of 8 <sup>th</sup> plan)	84019	26.65
2001-02 (End of 9 <sup>th</sup> Plan)	81673	21.80
2002-03 (1 <sup>st</sup> year of 10 <sup>th</sup> plan)	84486	21.47
2003-04 (2 <sup>nd</sup> year of 10 <sup>th</sup> plan)	87089	20.82
2004-05 (3 <sup>rd</sup> year of 10 <sup>th</sup> plan)	88555	19.77
2005-06 (4 <sup>th</sup> year of 10 <sup>th</sup> plan)	90292	19.03
2006-07 (End of 10 <sup>th</sup> plan)	99023	18.84
2007-08 (1 <sup>st</sup> year of 11 <sup>th</sup> Plan)	104182	18.03

Source: CEA, All India Electricity Statistics 2009





**Table 3:** Fertilizer consumption in nutrient terms during 2005-06 to 2009-10 (in lakh tonnes)

Fertilizer type	2005-06	2006-07	2007-08	2008-09	2009 -10* (only Kharif)
Nitrogenous (N)	127.23	137.73	144.19	150.9	74.86
Phosphatic (P)	52.04	55.43	55.15	65.06	41.32
Potassic (K)	24.13	23.35	26.36	33.13	16.07
Total (N+P+K)	203.4	216.51	225.7	249.09	132.25
Per ha Consumption (kg)	105.5	111.8	116.8	128.6	NA

Source: Department of Fertilizers. Note: \*Estimated

**Table 4:** Consumption of Major Fertilizers in India (In Lakh Tonne)

Year	Urea	DAP	MOP	N	P	K	Total	Kg/ha
1999-00	202.78	69.37	20.49	115.92	47.98	16.78	180.69	94.9
2000-01	191.86	58.84	18.29	109.2	42.15	15.67	167.02	89.63
2001-02	199.17	61.81	19.93	113.1	43.82	16.67	173.6	91.13
2002-03	184.93	54.73	19.12	104.74	40.19	16.01	160.94	84.49
2003-04	197.67	56.24	18.41	110.77	41.24	15.98	167.99	88.19
2004-05	206.65	62.56	24.06	117.13	46.24	20.61	183.98	96.59
2005-06	222.97	67.64	27.31	127.23	52.04	24.13	203.4	-
2006-07	243.37	73.81	25.86	137.73	55.43	23.35	216.51	-
2007-08	259.63	74.97	28.81	144.19	55.15	26.36	225.7	-
2008-09	266.49	92.31	40.77	150.9	65.06	33.13	249.09	-

Source: Dept. of Agriculture & Cooperation, Ministry of Agriculture, DAP: Di-Ammonium Phosphate, MOP: Muriate of Potash, N: Nitrogen, P: Phosphatic, K: Potassic

**Table 5:** Current and expected requirement of water in India (in BCM)

Sector	1990	2000	2010	2025	2050
Domestic	32	42	56	73	102
Irrigation	437	541	688	910	1072
Industry	NA	8	12	23	63
Energy	NA	2	5	15	130
Others	33	41	52	72	80
<b>Total</b>	<b>502</b>	<b>634</b>	<b>813</b>	<b>1093</b>	<b>1447</b>

BCM: billion cubic meters

Source: Compendium of Agricultural Statistics, 2002, MoSPI

**Table 6:** Key initiatives relevant to employment, environment and social security

1. Employment generation
<ul style="list-style-type: none"> <li>▪ Employment generation under the Mahatma Gandhi National Rural Employment Guarantee Act</li> <li>▪ Swarnajayanti Gram Swarajgar Yojana</li> <li>▪ Sampurna Grameen Rojgar Yojana</li> <li>▪ Rural Business Hubs in Partnership with Panchayats</li> <li>▪ Self Help Groups</li> <li>▪ Swarnajayanti Shehari Rojgar Yojana</li> </ul>



<b>2. Labour welfare</b>
<ul style="list-style-type: none"> <li>▪ Social security for agricultural and unorganized labour</li> <li>▪ Minimum wages enforcement (including farm labour)</li> <li>▪ Prevention of child labour</li> <li>▪ Welfare of women labour</li> </ul>
<b>3. Environment protection</b>
<ul style="list-style-type: none"> <li>▪ Afforestation</li> <li>▪ Area covered under plantation of public and forest lands</li> <li>▪ Number of seedlings planted on public and forest lands</li> <li>▪ Prevention of pollution of rivers and water bodies</li> <li>▪ Solid and liquid waste management in</li> <li>▪ Integrated Energy Policy (2006)</li> <li>▪ Environmental Action Plan (1993)</li> <li>▪ National Action Plan on Climate Change (2008)</li> </ul>
<b>4. Support to farmers</b>
<ul style="list-style-type: none"> <li>▪ Watershed development and dry land farming</li> <li>▪ Marketing and infrastructural support to farmers</li> <li>▪ Irrigation facilities (including minor and micro irrigation) for agriculture</li> <li>▪ Credit to farmers</li> <li>▪ Distribution of waste land to the landless</li> </ul>
<b>5. Food security</b>
<ul style="list-style-type: none"> <li>▪ Targeted public distribution system</li> <li>▪ Antodaya Anna Yojana</li> <li>▪ Establishing grain banks in chronically food scarcity areas</li> </ul>
<b>6. Clean drinking water</b>
<ul style="list-style-type: none"> <li>▪ Swajaldhara</li> <li>▪ Accelerated Rural Water Supply Programme</li> <li>▪ Accelerated Urban Water Supply Programme</li> </ul>
<b>7. Welfare of scheduled castes [SCs], scheduled tribes [STs], minorities and other backward classes [OBCs]</b>
<ul style="list-style-type: none"> <li>▪ SC families assisted</li> <li>▪ Rehabilitation of scavengers</li> <li>▪ Rights of forest dwellers-owners of minor forest produce</li> <li>▪ Primitive tribal groups</li> <li>▪ No alienation of tribal lands</li> <li>▪ Implementation of Panchayats (extension to scheduled areas) Act (PESA)</li> <li>▪ Welfare of minorities</li> <li>▪ Professional education among all minority communities</li> <li>▪ Reservation of OBCs in Education Employment</li> </ul>
<b>8. Improvement of slums</b>
<ul style="list-style-type: none"> <li>▪ Urban poor families assisted under seven point charter viz. land tenure, housing at affordable cost, water, sanitation, health, education and social security</li> </ul>
<b>9. Social security</b>
<ul style="list-style-type: none"> <li>▪ Rehabilitation of handicapped and orphans</li> <li>▪ Welfare of the aged</li> </ul>



<b>10. Rural roads</b>
▪ Rural roads – Pradhan Mantri Grameen Sadak Yojana
<b>11. Energization of rural areas</b>
▪ Bio-diesel production
▪ Rajiv Gandhi Grameen Vidyutikaran Yojana
▪ Renewable energy
▪ Energizing pump sets
▪ Supply of electricity
▪ Supply of LPG
<b>12. Development of backward areas</b>
▪ Backward Regions Grants Fund

Source: [http://mospi.nic.in/Mospi\\_New/upload/Revised-tpj\\_2006.pdf](http://mospi.nic.in/Mospi_New/upload/Revised-tpj_2006.pdf)

**Table 7:** Key Indian legislations relevant to sustainable development

<b>Environment</b>	
Key acts	The forest Act, 1927 The Wildlife (protection) Act, 1972 Water (Prevention and Control of Pollution) Act, 1974 The Forest (Conservation) Act, 1980 Air (prevention and Control of Pollution) Act, 1981 Environmental (Protection) Act, 1986 Motor Vehicles Act, 1988
<b>Social</b>	
Key acts	Protection of Human Rights Act, 1993 National Trust Act, 1999 Commissions for the Protection of Child Rights Act, 2005 Right to Information Act 2005 Gram Nyayalayas Act, 2009 Right of Children to Free and Compulsory Education Act, 2009
<b>Economic</b>	
Key acts	Foreign Trade (Development and Regulation) Act, 1992 Competition Act, 2002 Fiscal Responsibility and Budget Management Act, 2003 Micro, Small and Medium Enterprises Development Act, 2006
<b>Socio-ecological (environment and social)</b>	
Key acts	Person with Disabilities Act, 1995 (right to employment of the disabled) The Geographical Indications of Goods (Registration and Protection) Act, 1999 Protection of Plant Varieties and Farmer's Right Act, 2001 The Patents (Amendment) Act, 2005 Maintenance and Welfare of Parents and Senior Citizens Act, 2007
Green economy (economic and environment)	
Key acts	Energy Conservation Act, 2001, The Electricity Act, 2003



<b>Sustainable develop (social, environment and economic)</b>	
Key acts	The (Wildlife Protection Act), 1972 and its amendments in 1991, 2002
	Panchayat Extension to Scheduled Areas Act, 1996
	Biological Diversity Act, 2002 and the Biological Diversity Rules, 2004
	National Rural Employment Guarantee Act, 2005
	Forests Rights Act, 2006

Source: MoEF 2011, Sustainable development in India: Stocking in the run up to Rio+20



## About the authors

**Mini Govindan** has a Ph.D degree in Development Studies from Institute for Social and Economic Change, Bangalore. She has worked extensively in several states of the country having different socio-cultural dimensions on various issues related to energy and water resource development and management. She has wide experience in multi-stakeholder approaches to management of natural resources including working with local communities, private sector, and government officials. Her other areas of work include green jobs and green economy and mainstreaming gender into development practices. She is associated with Social Transformation Division at TERI.

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**The Energy and Resources Institute (TERI)** is an autonomous not-for-profit research institute established in 1974. It is the largest developing country institution involved in research activities in the fields of energy, environment, climate change and sustainable development. TERI takes a comprehensive view of development, wherein efficient use of natural resources and protection of the environment are seen as essential prerequisites for economic welfare. Its uniqueness lies in the fact that its activities stretch across local, national and international levels, achieving a high level of vertical integration in thought and action. It is headquartered in New Delhi and has regional offices in Bangalore, Goa, Guwahati and Mumbai. TERI also has affiliate institutes and representation in Washington D.C., London, Tokyo, Ethiopia and Dubai. In 1999, the TERI University was established under the UGC Act as the academic wing of the organization.