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1. Introduction

Forests cover one fifth of the geographical area of the country and are critical to the social, cultural and economic life of millions of people in the country. These provide fuel wood for energy, fodder for livestock, small timber for domestic use, raw material for industrial requirements and various non-timber forest products for medicinal and other purposes. It has been estimated that more than 300 million people depend on the forests for their livelihoods (MoEF undated a).

Forests meet about 40% of energy needs and about 30% of fodder needs for the cattle population of the country (MoEF 2006a). Contribution of forests to gross domestic product (GDP) of the country is calculated to be between 1 to 1.5% which is underestimated, as it does not include the value of non-marketed environmental services like watershed and carbon sequestration (ibid). If we include value of these services, contribution of the forests will be much higher. A study by Verma (2000) puts the economic value of products and services of Himachal Pradesh forests at INR 1,06,664 crores, whereas only INR 41 crores are accounted and realised as a revenue by the state government.

Forests not only contribute to national development and well-being but are crucial to maintain the ecological balance at global level. These are crucial to sustain global carbon and water cycles, hence these have attained central space in climate change negotiations.

Despite their critical ecological functions and significance, forestry sector does not receive the budget and resources, it deserves. Though Government of India has recently proposed to include forest cover as one of the criterion for allocation of financial resources to states in its fourteenth finance commission report (GoI 2015). There are various issues affecting forests in the country but are largely unattended. Hence, it becomes imperative to study and analyse these issues.

This paper aims to study the key issues of forestry sector in India. The first section gives the state of forest resources. It details out the forest and tree cover, policy context, ownership and management pattern of forests. The second section elaborates the key issues of the forestry sector. The third and final section provides the strategies and roadmap to address these issues.

2. State of forest resources

Forest and tree cover 78.92 million hectares (mha) constituting 24.01% of the geographical area of the country (FSI 2013). In percentage terms, forest and tree cover constitute 21.23% and 2.78% of this area respectively. Based on the canopy cover, forest cover has been classified into open (10% to 40%), moderately dense (40% to 70%) and very dense (above 70%) in the country. If we analyse the density class distribution, very dense, moderately dense and open forests constitute 12%, 46% and 42% of forest cover respectively (Table 1).

Table 1 Density class distribution of forest cover

S.No	Category	Forest cover (Sq.Km)	In percentage terms
1	Very dense forest	83502	12
2	Moderately dense Forest	318745	46
3	Open Forest	295651	42
	Total	697898	100

Source: FSI (2013)

It suggests that 42% of the forest cover of the country is in open forest category, much of which is degraded and either have no or inadequate regeneration (FSI 2013).

There has been an increase in forest cover by 5871 sq. km compared to 2011 assessment by Forest Survey of India; but there has been slight decline in moderately dense, and increase in open forest category. There has been a decline in growing stock of the country by 389 m cu. m between 2011 and 2013, which suggests a decline in quality of forest despite the increase in overall increase in forest and tree cover (ibid).

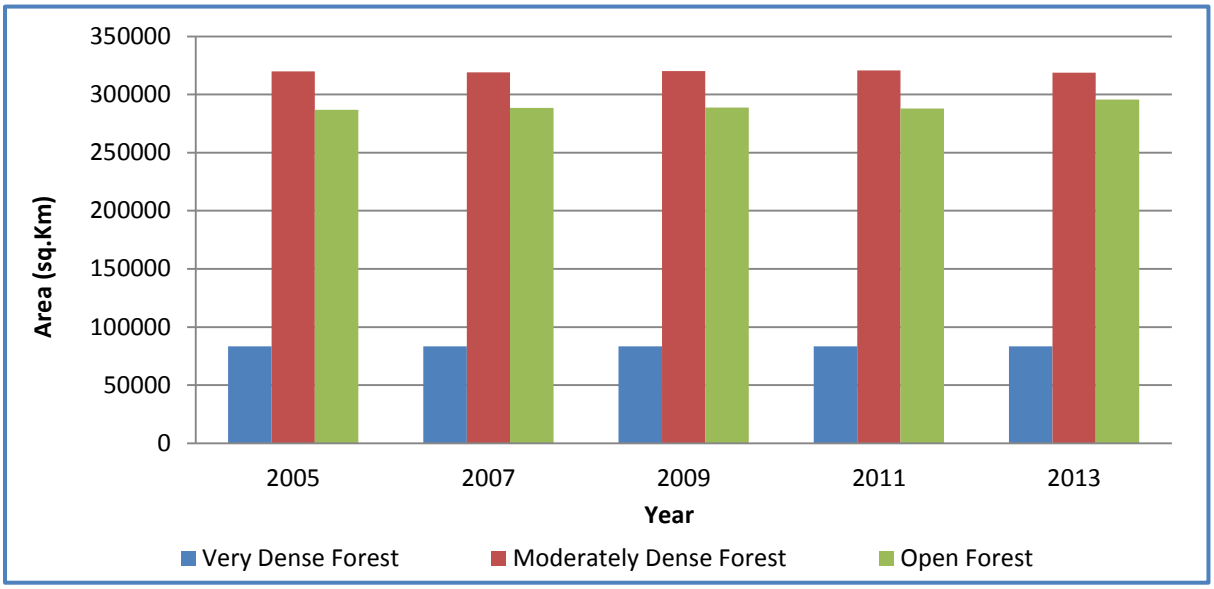

Figure 1 Change in forest cover across different density classes over the years

Sources: FSI (2009, 2011, 2013)

3. Policy Environment

3.1 Indian Forest Act, 1927

The Indian Forest Act (IFA), 1927 was the first comprehensive act governing the forest sector, and it serves till date as the basis for forest administration in the country. It defines forests in the categories of village, protected and reserve forests with a difference in their legal status, management and rights and concessions. This Act describes in great detail

about forest management, role of forest administration and forest offences (MoEF, undated b).

However, the Act is quite dated now. Many of the provisions of the act do not address contemporary issues related to forestry management in the country, such as people's participation. It does not reflect progressive changes in the forest policy of country.

3.2 Forest (Conservation) Act, 1980

This legislation was enacted to control the diversion of forestland for non-forestry purpose and to slow down deforestation. Under this legislation, the approval of the central government is required for diversion of forestland for non-forestry purposes. The user agency has to pay for compensatory afforestation as well as an amount equal to the net present value of the forests diverted. It has substantially brought down diversion of forests for non-forestry purposes.

3.3 National Forest Policy, 1988

National Forest Policy (NFP) of 1988 marked a paradigm shift in forest management from regulatory to participatory. It implied a shift from the earlier revenue-oriented forest management to the current conservation-oriented management. It puts emphasis on meeting peoples' needs and involving them in management of forests. Meeting the subsistence needs of the local communities, maintenance of environmental stability and restoration of ecological balance have been identified as the major objectives of forest management under the NFP. This policy laid the foundation of involvement of local communities in management of forests in the country. The policy had people oriented approach, and thus participatory initiatives like Joint Forest Management (JFM) were initiated.

3.4 National Environment Policy, 2006

In the recent past, the National Environment Policy (2006) recognized that forest laws and formal institutions have undermined traditional community rights and disempowered communities. Such disempowerment has led to the forests becoming open access in nature, leading to their gradual degradation in a classic sense of 'tragedy of commons' (MoEF 2006b). The policy advocates recognition of traditional rights of communities to 'remedy a serious historical injustice'

3.5 Forest Rights Act, 2006

The Forest Rights Act (FRA) though was enacted in the year 2006 but its implementation started in the year 2008 after elaboration of the implementation guidelines and rules. It recognises a range of individual and communal rights on forest resources including ownership and management of forest land, which have been neglected since colonial times. It not only aims to undo the 'historical injustice' to the scheduled tribes and other traditional forest dwelling communities but also targets to empower the communities for the 'responsibilities and authority for sustainable use, conservation of biodiversity and maintenance of ecological balance' (MoLJ, 2007:2 ; MoEF and MoTA, 2010).

However, there is a long history of political struggle before the FRA came into existence (Bose, 2010). This contestation dates back to colonial era when rights of people were systematically usurped and they started protesting against the government (Gadgil and Guha 1993; Guha 2000).

3.6 National Mission for a Green India (Green Indian Mission - GIM)

India adopted a comprehensive National Action Plan for Climate Change (NAPCC) to address issues related to climate change in 2008 (GOI undated). It has eight missions, which cover a range of sectors and issues important for the country. The National Mission for a Green India, one of the missions, addresses forestry sector issues in this plan (ibid).

The GIM aims to treat an additional forest and non forest area of 10 million ha over a period of next 10 years spread over two national plans starting from the 12th five year plan in 2012 (MoEF 2010). It aims to increase the forest or tree cover over 5 mha of area and improve the quality of cover over another 5 million ha. GIM aims to undertake 'holistic view of "greening"' by focusing on ecosystem restoration and biodiversity conservation rather than merely focusing on plantations (MoEF, 2010: G). It proposes to 'shift in mindset from our traditional focus of merely increasing quantity of our forests cover, towards increasing the quality of our forest cover and improving provision of ecosystem services' (Ramesh 2010:C). The mission intends to sequester an additional annual 50 to 60 million tonnes of CO2 by the year 2020. It also aims to improve livelihood and income of 3 million households living in and around forests (MoEF 2010).The estimated budget of GIM for a period of ten years is INR 460 billion (MoEF 2010).

An autonomous and decentralised governance structure has been proposed to implement and manage the mission. The 'revamped' Joint Forest Management Committees (JFMCs) under g*ram sabhas* have been conceived as the institutions at grassroots level (MoEF 2010). Similarly, forest development agencies (FDA) have been made as nodal institutions at the district and state level.

But GIM has made little progress so far. MoEF has issued implementation guidelines in November 2014 with a proposed budget of INR13000 crores for next five years (MoEF, 2014). These guidelines details on selection of landscapes, institutional structure, monitoring and evaluation and financial outlay for the programme (ibid). Much of the proposed budget is drawn through convergence with programmes like Compensatory Afforestation and Management (CAMPA) and Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS). It is yet to be seen the effectiveness of this approach.

3.7 Ownership and management

Government owns around 97% of the forest area and rest 3% is owned by private entities and communities in India (MoEF 2006). However, out of the government-claimed forest area, 18% is un-classed land on which claims of the communities and individuals are yet to be settled. Majority of this un-classed area lies in the north-eastern states of India. Ownership claims are contested in many other parts of the country.

Though ownership of forests is largely with the government, there has been an increasing involvement of communities in the management of forests over the years. It is reported that 28% of forest area is managed in collaboration with communities under the JFM programme. Similarly there have been efforts by companies and individual farmers to manage vegetative cover mainly outside forest area. After the 1980 Forest Conservation Act, which substantially reduced the supply of raw material from state forest lands to wood based industries, the government has been promoting plantation of trees under various agroforestry and social forestry plantation schemes.

However, the majority of the forest area, about 69%, continues to be managed by the government alone, predominantly by forest departments (Table 2).

Table 2 Management pattern of Indian forests

S.No	Management	%age forest area
1	Government	69
2	Government and communities	28
3	Communities and private entities	3

Source: (MoEF and WII 2005, MoEF 2006)

This pattern of ownership and management of forests is representative for many States of the country except the northeast states where forests predominantly are owned and managed by local communities.

3.8 Joint forest management

Joint Forest Management (JFM) was initiated in 1990s as a collaborative arrangement between Forest Department (FD) and local communities to regenerate and manage degraded forests. It has been reported that there are 1,18,213 JFM committees across 29 states managing 22.94 million ha of forest area, which constitutes 29.80% of recorded forest area of the country (FRI 2011). These committees are receiving benefits in form of fuel wood, fodder and various other non-timber forest products (NTFP). Data for annual benefits were available only for 15 states. It has been estimated that 77262 JFMCs across these 15 states are getting an annual benefit of INR 19.28 billion (ibid). It amounts to an annual benefit of INR 0.22 million per JFMC and INR 1944 per household, which is substantial given the socioeconomic context of these forested regions (ibid). But there are several issues related to legal back up, financial support, state control which have affected effectiveness of JFM (FRI 2011; MoEF and WII 2005). It has been reported that due to these issues only 40% of the JFM committees are functional (MoEF and WII, 2006)

4. Challenges

4.1 Climate change

Climate change is likely to have a significant and differential impacts different forest types. Gopalakrishnan *et al.* (2011) studied the impacts of climate change on Indian forests through dynamic regional climate model and dynamic global vegetation models. This study suggests that 45% of forest grids in the country are vulnerable to impacts of climate change. The most vulnerable forest landscapes lie in upper Himalayas, central India, north Western Ghats and Eastern Ghats (ibid). Another study by Chaturvedi *et al.* (2010) suggests that 77% and 68% of forest grids across the country could witness changes in forest types due to change in climate.

Many forest species in Himalayan region are migrating to higher altitudes and some species even face extinction (DoEST 2012; Dubey *et al.* 2003). It has been reported that species such as *Pinus logifolia*,*Lilium polyphyclum* , *Aconitum heterophyllum* and *Woodfordia fructifose* have migrated to 400 m to 500 m higher altitude in a span of 100 years (DoEST 2012). These climatic changes have resulted in shift of apple cultivation areas in the State affecting livelihood of local people.

High altitude species have become more vulnerable. It has been widely reported that *Pinus roxburghii* is invading the habitat of *Quercus leucotrichophora*. Other economic species such as *Cedrus deodar* and *Dalbergia sissoo* are declining sharply due to a mix of anthropogenic and climatic factors in the State (DoEST 2012).

Besides these impacts, climate change is also likely to increase incidences of forest fire and pest attack due to increase in temperature affecting survival and growth of forest vegetation (DoEST 2012). These could further aggravate issues related to forest based livelihoods and man-animal conflict (ibid).

4.2 Forest degradation

As discussed earlier, the open forests constitute 42% of the forest cover in the country, which is largely degraded. Some of the key factors behind the forest degradation are demand and supply gap of forest products, shifting cultivation and forest fires, which have been discussed ahead.

4.3 Demand and supply gap in fuel wood, timber, and fodder

There is a substantial demand and supply gap in major forest products across India (Table 3). This leads to a vicious circle where the unsustainable exploitation of forests contributes to their degradation which in turn reduces the supply of products and services.

Table 3 Demand and supply gap of various forest products across India

	Demand (MT)	Sustainable supply (MT)	Gap/ unsustainable harvest (MT)
Fuel wood	228	128	100
Fodder (green and dry)	1594	741	853
Timber	54.94	40.70	14.74

Source: Aggarwal et al., 2009

4.3.1 Fuel wood

India is world's biggest consumer of fuel wood with 40% of the population dependent on fuel wood for basic energy needs. It is estimated that 65% of the rural population and 22% of the urban population depends on fuel wood for cooking (NSSO 2001). Fuel wood collection and sale is a source of livelihood for 11% of the population, making it the single largest employer in the energy sector (World Bank 2006)

It is estimated that 49% of total fuel wood is supplied from farm forestry and trees outside forests, and the remaining 51% from natural forests in India (MOEF 2006). It has been estimated that 6 to 7 times than the sustainable supply amount of fuel wood is extracted from natural forests (ibid).

4.3.2 Timber

India's requirement for timber was estimated at 54.94 MT for 2006 (MoEF 2000). On the supply side, an estimated 28.81 MT is contributed by farm forestry, 9.38 MT is harvested from forests and 2 MT imported (Wiles 2005). That still leaves a gap of 14.74 MT, much of which is met through illegal exploitation of forests. It has been reported that 0.134 MT of illegal timber is seized every year which is just a fraction of the total illegally harvested wood (MoEF undated a). This deficit is further expected to increase to 60.3 MT by 2020 (Khanduri and Mandal 2005).

4.3.3 Fodder

India has a cattle population of 500 million for which only 11 m ha of pastureland is available in country. This leads to a grazing intensity of about 46 animals per hectare as against the optimum level of 5. It is estimated that more than 270 million cattle graze in the forests against the carrying capacity of 30 million (ICFRE 2001). It is also estimated that 78% of India's forest area is affected by grazing; which the incidence of grazing is estimated as being high in 18 % forest area, medium in 31% and low in 29% (MoEF 2006). It adversely impacts the stock and regeneration capacity of forests due to over-browsing, lopping and trampling of young saplings.

4.4 Encroachments

It is a complex issue which has legal, rights and livelihood dimensions. As per government estimates, 1.34 mha of forest area is encroached in the country (ibid). State governments have failed to act on the directives and guidelines issued by central government and Supreme Court to avoid any adverse political response which has led to further encroachments (MoEF 2006).

4.5 Forest fires

Fires affect 3.73 mha of forests area annually in the country causing loss to forest products and services (Bahuguna and Upadhyay 2002). Most of these fires are man-made, created to facilitate the extraction of NTFPs, ensure a good yield of grass, or to clear forests for shifting cultivation. In some parts of the country, fires are set up for socio cultural and religious purposes as well. The traditional system of fire control through fire lines has serious limitations.

It results in the loss of valuable timber and biodiversity. Although it is very difficult to understand the total damage to forest ecosystem but most common impacts are drying of saplings and trees, stunting of growth and burning of soil organic matter. Forest fires also expose soil to erosion (DoEST undated). Biodiversity is severely affected both above and below ground level. Controlled burning, clearance and maintenance of fire lines are some of the common control measures.

4.6 Rights and livelihoods of forest dependant communities

Around 300 million people depend upon forests for their livelihoods in the country (MoEF undated a). The forest dependant communities have been struggling for their land and resource rights since Independence. With the enactment of Forest Rights Act in 2006, people are waiting their rights to be legally recognised. But there are various issues like low awareness and recognition of community rights, low recognition of rights in wild life areas and rights of extremely vulnerable groups, which has marred the implementation of the Act (MoEF and MoTA, 2010). Government of India issues amendment rules in 2012 to clarify and elaborate on the issues related to community rights, livelihood needs and other issues. About 1.56 million claims have been recognised until 31st January 2015 across the country covering 3.8% of the forest area of the country (MoTA, 2015). In the five states of Chhattisgarh, Maharashtra, Orissa, Rajasthan and West Bengal, where data for individual and community rights is available, individual and community rights constitute 99.6% and 0.4% of the recognised claims respectively. The average area recognised under individual and community claims is 1.15 ha and 20.65 ha respectively. But many of the issues related to the implementation of FRA still persist.

Besides the FRA, there are many policy and operational level constraints, which affect rights and livelihood of local people. Some of the constraining policy measures include nationalisation of important NTFPs including tendu leaves, bamboo and mahua flowers. State forest departments monopolises the trade of economically important NTFPs and timber. The dependant gets their share as wage labourers only. Similarly, various state

governments have put restrictive felling and transit riles for forest produce, which discourages cultivations of trees at private lands.

5. Ways Forward

The discussion clearly points to a number of policy and implementation challenges required in the forestry sector across the country. Strategies are suggested to address issues of forest degradation, climate change and rights and livelihoods of local people. Gap in the demand and supply of forest products is one of the major reasons for forest degradation across most of the country. Two types of strategies addressing demand and supply of these products have been suggested. Similarly, strategies to address other drivers of degradation such as forest fires, encroachments, weed infestation have been elaborated. Livelihood strategies constitute an important part of addressing different issues. Finally, strategies to adapt to climate change have been presented.

Short term

- Linkages need to be established between research institutions, state forest departments and private sector to produce good quality planting material. As envisaged in twelfth five year plan model nurseries can be established in selected forest divisions.

- Forest Policy, 1988 aims to bring 33% of the geographical area under forest cover. It would require additional 29.5 mha of area to be vegetated. This target seems to be more theoretical than practical and achievable. There has been an increase of only 5.71 mha in forest cover over last 28 years i.e. from 1987 to 2013 due to financial, technical and land availability issues (Aggarwal et el., 2009; FSI 2013). Forest and tree cover for last ten years have stabilised with a very marginal increase. Hence, it is very difficult to achieve a target of 33%. Government has kept a more realistic target of 5 mha for greening under 12th Five Year Plan to increase the forest and tree cover in the country (Planning Commission 2013). Treatment of 5 mha of forest and non-forest land can be undertaken during this period. Out of this there could be 2 mha could be additional whereas 3 mha of existing degraded area could be treated for quality improvement.

- Use of alternative fuels should be increased. Expansion of LPG in rural areas can be expanded from 6 to 10% in the rural areas which can save 1.22 million tonnes (MT) of fuel wood every year. Similarly, there can be extension efforts in collaboration with Ministry of Renewable Energy and state agencies to promote of improved chullahs (IC) in 10 million households. Each IC can save about 400 Kg of fuel wood annually.

- It has been estimated that ecotourism and other ecological values from JFM areas alone could yield USD 1.7 billion by 2020 in India (World Bank 2006). It could be well above USD 6 billion for all forest areas of the country. Ecotourism has been exploited at a limited scale but has the potential to become a major driver of local economies. The ecotourism programme should be up-scaled gradually by identifying hotspots, creating infrastructure and facilities with the help of the private sector, and building the capacity of local communities.

- Legitimate rights of people under FRA should be recognised. Community rights for the management of the forest resources, which have been neglected so far should be considered. After recognition of legitimate rights, illegal occupations should be vacated with the help of local institutions.

- There are several bottlenecks for forestry enterprises in India. These include government control over profitable forest produce, constraining regulations, lack of credit availability, poor technologies and low value addition. Requirement of transit permits and felling regulations for nationalized species discourages private enterprise. Forest-based communities should be trained as processing and value addition entrepreneurs.

- Guidelines can be issued to involve climate change issues in the Forest Working Plans. More awareness about the climate change issues needs to be generated among the forestry staff across all levels. Implementation of climate adaption measures such as checking forest fires and forest fragmentation should be implemented. Planation of monocultures should be discouraged.

Medium term

- 15 mha of forest and non forest area can be treated during this period.10 mha of existing degraded area can be improved through a mix of plantations and assisted natural regeneration to improve the quality of the forest. Additional 5 mha can be brought under forest and tree cover through plantations on available common lands and private lands through social forestry and agroforestry measures. It would require additional finances resource allocation for the state forest departments

- Alternative fuels such as liquefied petroleum gas (LPG) can be extended to 20% of rural households. Similarly, improved challahs and devices based on solar energy can be provided to 20 mha. Other renewable Legal restrictions on felling and transit of agroforestry species such as eucalyptus, poplar and other state specific species need to be removed to encourage plantations on private lands.

- Claims to individual and community rights should be completed. Livelihoods of the right holders should be strengthened through training them in modern agriculture, animal husbandry and forest management.

- Collection and processing of non-timber forest produce tendu leaves, sal seeds, aonla, bamboo need to be promoted in collaboration with private sector. Middlemen can be removed from the system though formation of cooperatives such as in the states of Madhya Pradesh, Chattisgarh and Andhra Pradesh.

- JFM institutions need to be strengthened through establishing strong linkages with Gram panchayats and allocation of green funds. Village level green volunteers can be trained for conservation of natural resources

- Research on the impacts of climate change on forest structure and various functions need to be undertaken and integrated with forest management.

Long Term

- During this period 20 mha of country's forest area can be treated for improving the forest quality in existing open and scrub forests through plantations and natural regeneration. 12 mha of additional area can be brought under forest and tree cover, which will make 27% of the geographical area under green cover. It would require sustained financial support and objective monitoring to reach such a target.

- Alternative fuels such as LPG can be provided to 50% of rural households and improved challahs and solar cooking devices can be provided to 50M households. It will drastically reduce the pressure on forests.

- We need to move from Joint Forest management to Community Forest Management where, gram panchayats have complete responsibilities over management of forests under their jurisdiction. Forest Department can provide the technical support, and monitor the implementation of important policies

- Small Scale forestry enterprises are linked to state and national markets through digital platforms, which will substantially improve the livelihoods of local people.

- Research based adaptation measures should be fully integrated into Forest working Plans and management practices.

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A unique developing country institution, TERI is deeply committed to every aspect of sustainable development. From providing environment-friendly solutions to rural energy problems to helping shape the development of the Indian oil and gas sector; from tackling global climate change issues across many continents to enhancing forest conservation efforts among local communities; from advancing solutions to growing urban transport and air pollution problems to promoting energy efficiency in the Indian industry, the emphasis has always been on finding innovative solutions to make the world a better place to live in. However, while TERI's vision is global, its roots are firmly entrenched in Indian soil. All activities in TERI move from formulating local- and national-level strategies to suggesting global solutions to critical energy and environment-related issues. TERI has grown to establish a presence in not only different corners and regions of India, but is perhaps the only developing country institution to have established a presence in North America and Europe and on the Asian continent in Japan, Malaysia, and the Gulf.

TERI possesses rich and varied experience in the electricity/energy sector in India and abroad, and has been providing assistance on a range of activities to public, private, and international clients. It offers invaluable expertise in the fields of power, coal and hydrocarbons and has extensive experience on regulatory and tariff issues, policy and institutional issues. TERI has been at the forefront in providing expertise and professional services to national and international clients. TERI has been closely working with utilities, regulatory commissions, government, bilateral and multilateral organizations (The World Bank, ADB, JBIC, DFID, and USAID, among many others) in the past. This has been possible since TERI has multidisciplinary expertise comprising of economist, technical, social, environmental, and management.

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