

15

Energy

OVERVIEW

15.1 The Eleventh Plan envisaged an increase in primary energy availability (that is, from coal, lignite, crude oil, natural gas, hydropower, nuclear power, wind power, and non-commercial energy) at 6.4 per cent per year taking the total availability from 550 Mtoe in the terminal year of the Tenth Plan to 715 Mtoe in the terminal year of the Eleventh Plan. Present prospects make it evident that the actual growth in primary energy production will be lower than projected in most sub-sectors (see Table 15.1). Demand for energy will also be lower because of the impact of the global crisis on economic growth. However, it is noteworthy that the net effect will be an increase in the projected import dependence on both coal and crude oil.

15.2 These developments highlight the urgency to maximize domestic production in the Twelfth Plan period and manage demand more effectively to increase energy security. It calls for concerted action on several fronts. The priorities for action in each of the energy producing areas are indicated in this chapter.

15.3 An Integrated Energy Policy, which was approved by the Cabinet in 2009, lays down an agenda for policy action in the major energy sectors. Implementation of this agenda would help push the energy sector towards greater economic rationality and financial viability

TABLE 15.1
Production, Consumption, and Import Requirements of Primary Commercial Energy, 2011–12

Energy Resources	As per the Eleventh Plan	As per MTA
Coal		
Production (MMT)	680.00	629.91
Demand/Off-take (MMT)	731.00	713.24
Import (MMT)	51.00	83.33
Lignite		
Production (MMT)	55.59	
Crude oil		
Production (MMT) ##	206.73	186.86
Demand/Off-take (MMT)	141.79	150.61
Import (MMT)	102.28	103.41
Natural Gas/LNG		
Production (MMSCMD) ##	176	170
Demand/Off-take (MMSCMD)	280.00	280.00
Import of LNG (MMSCMD)	83.12	52.50
Electricity		
Hydro capacity (MW)	15,627	8,237
Nuclear capacity (MW)	3,380	3,380
Wind capacity (MW)	10,500	9,000

Note: ## Production figures in case of crude oil and natural gas are for a five-year period.

while also promoting the objective of energy efficiency and energy security. Sector-wise programmes and their physical and financial performances emerging from the Mid-Term Appraisal (MTA) of the Plan are given later in this chapter.

COAL AND LIGNITE SECTOR

15.4 Coal is the mainstay of India's energy sector and accounts for over 50 per cent of the primary commercial energy supply. Around 74 per cent of the coal produced in India is consumed in power generation. Compared to other sources of energy that are available in the country, known coal reserves are expected to last for over 70 years at the present levels of production. The growing gap between the demand and domestic supply of coal has made it imperative to augment domestic production from the public sector as well as from the private sector and expedite the reform process for realizing efficiency gains through increased competition in the sector during the Eleventh Plan.

15.5 The Eleventh Plan envisaged augmenting domestic production with a long-term perspective keeping in view the sharp increase in demand in the power sector and the long gestation periods of coal projects. A new feature of the Eleventh Plan was the strategy of augmenting coal production from captive sources, including captive coal mines in the private sector. An important area of the Plan concerns revival of loss making companies, restructuring of the coal sector by providing autonomy, setting up a regulatory authority for ensuring fair competition, and facilitating private sector participation in commercial coal mining by means of necessary legislative amendments.

15.6 Some of the important key thrust areas for the development of the coal sector identified in the Eleventh Plan are as follows:

- Expediting the passing of the Coal Mines (Nationalization) Amendment Bill, 2000, to amend the provisions of the Coal Mines (Nationalization) Act, 1973, to permit private sector in non-captive mining to augment domestic coal production to meet the rising demand for coal.
- Setting up of a regulatory authority for ensuring fair competition and a level playing field in each segment of the coal production and supply chain, including allocation of coal blocks for exploration and mining.
- Change grading and pricing of non-coking coal from the existing Useful Heat Value (UHV) with

wide calorific bands to a pricing formula with narrow calorific bands as per the international practice of pricing coal based on Gross Calorific Value (GCV). This is expected to encourage efficient use and allocation as well as promoting use of washed coal.

- Promoting e-marketing of coal—up to 20 per cent of the domestic production is to be made available through e-marketing open to traders and actual users.
- The resources for investment for mining operations as well as for new clean coal technologies, Coal Bed Methane (CBM), Underground Coal Gasification, etc. needs to be mobilized, for which the pricing policy has to be made pragmatic.
- De-blocking of coal blocks not immediately to be exploited by Coal India Limited (CIL) for offering them on a bidding basis for both public and private sector companies.
- Amending the Coal Bearing Areas (Acquisition & Development) Act, 1957, to allow private sector rights for coal exploration on par with CIL.
- Rationalizing the freight rate for coal transport and import duty on coal for improving the competitiveness of the sector.
- Intensifying of exploration and upgradation of coal reserves to the proved and recoverable category.

PHYSICAL PERFORMANCE

15.7 An overview of actual physical performance of the coal sector in the first two years (2007–08 and 2008–09) and the anticipated achievement for the third year (2009–10) of the Eleventh Plan are given in Table 15.2.

COAL PRODUCTION

15.8 Coal production was targeted to grow at 9.56 per cent per annum during the Eleventh Plan against an annual growth of 5.6 per cent per annum in the Tenth Plan. The estimated growth in the first three years of the Plan was 7.31 per cent, reaching 7.89 per cent in the total Eleventh Plan period. Although the growth in production will be lower than the Eleventh Plan target of 9.56 per cent, it will be higher than that in the Tenth Plan.

TABLE 15.2
Physical Performance of Coal and Lignite

S. No.	Parameter	2006–07	11th Plan	2007–08	2008–09	2009–10	MTA	11th Plan	
			Target	Actual	Actual	Prov.	Revised	per cent CAGR	
			2011–12				Target	Original	MTA
							2011–12		revised
		1	2	3	4	5	6	7	8
Physical Performance									
1	Coal demand (mt)	463.87	731.10	504.22	545.72	597.98	713.24	9.52	8.98
2	Coal production(mt)	430.83	680.00	457.08	492.94	532.33	629.91	9.56	7.89
3	Coal imports (Total)	43.08	51.00	49.80	56.08	65.65	83.33	3.43	13.47
	Coking coal	17.88	40.85	22.03	21.08	27.26	42.48		
	Thermal coal	25.20	10.15	27.77	35.00	38.39	40.85		
4	Net gap in demand–supply		51.00	47.14	52.78	65.65	83.33		
5	NLC* lignite prod. (mt)	21.0	27.04	21.59	21.31	21.75	26.02	5.17	4.37
	Gross Power Gen. (MU)	115,787	26,077	17,457	15,768	16,600	21,129	10.56	6.00

Note: * NLC's plan includes lignite production and power generation.

Original growth projection in coal demand and production for the Eleventh Plan were based on RE figures 2005–06.

15.9 Coal production was envisaged to reach 680.0 mt in the terminal year of the Eleventh Plan implying an incremental production of 249.17 mt over the five-year period. CIL was expected to add 159.59 mt, Singareni Coal Company Limited (SCCL) 3.09 mt, and captive blocks 86.49 mt. The projected coal production in the terminal year of the Plan was based on realizing an estimated 169.22 mt of additional output from CIL from new projects to be taken up during the Plan. Similarly, SCCL was also envisaged to take up 38 new projects to build the ultimate capacity for contributing 8.33 mt in 2011–12. It is now estimated that 17 major CIL projects, which were envisaged to contribute 100.65 mt will now contribute only 46.72 mt. An important reason for the shortfall is the delay in getting necessary environment and forest clearances. Coal production in the terminal year of the Plan is, therefore, expected to reach to 629.91 mt (CIL 486.50 mt, SCCL 47.00 mt, and others 96.41 mt) against the 680mt originally envisaged leading to a shortfall of 9.3 per cent in production and a demand–supply gap of 83.33 mt. The company-wise details of coal production are given in Annexure 15.1.

CAPTIVE COAL BLOCKS

15.10 The government has allocated 208 coal blocks to captive consumers with estimated geological reserves

of around 49 billion tonnes and a production potential of 657 million tonnes. The Eleventh Plan envisaged 104 mt of coal production from 93 captive blocks by 2011–12. However, the projected production from such captive mines is now expected to be around 81 mt leaving a gap of around 23 mt, which will exert further pressure on coal imports. Out of the 208 captive blocks allotted, only 26 blocks have started coal production. It is stated that some of the allottees are yet to start any activities on the site. Here too environment and forest clearances are an important constraint. The government also needs to review the situation, cancel allotment of blocks to non-serious players and re-allot them to consumers who are more credible.

COKING COAL

15.11 The requirement for coking coal has long exceeded availability from domestic sources. Besides, the steel sector is largely dependent on coking coal imports both with regard to quality and quantity considerations. Coking coal imports amounted to 21.08 mt during 2008–09. This is expected to increase to around 42 mt during 2011–12. The situation is unlikely to change in the near future mainly because Bharat Coking Coal Limited (BCCL) is unable to augment production of the required quality of coking coal from its mines and is also not able to supply the

desired feed to coking coal washeries. As a result, the performance of the washeries is also very poor, with low percentage of yield. There is scope for improving coking coal supplies from BCCL sources provided land acquisition issues, particularly in Jharkhand, are addressed on a priority basis. BCCL also needs to augment domestic production by opening new coking coal mines.

EXPLORATION

15.12 Exploration activities have to be taken up on a priority basis to enhance the level of recoverable reserves. Out of 17,300 sq km of the potential coal bearing area, a 11,865 sq km area had been covered by regional/promotional exploration till the end of Tenth Plan. Of the remaining 5,438 sq km area, 2,791 sq km is planned to be covered under regional/promotional exploration during the Eleventh Plan. Of this, 866 sq km. would be covered by the geological survey under its regular regional exploration programmes and 1,925 sq km. would be covered under the Ministry of Coal's (MoC) regional/promotional programme. Besides, the drilling capacity of the Central Mine Planning and Design Institute Limited (CMPDIL) is envisaged to be increased to 4 lakh metres from the existing 2 lakh metres by providing new drills and replacing old drills to enhance the detailed drilling efforts departmentally. Some blocks are also being explored in detail by CMPDIL through outsourcing under its supervision, with a view to covering the under indicated reserves and bringing inferred categories into the proved category. The MoC has also issued guidelines for conducting detailed exploration by block holders on their own.

15.13 The existing guidelines of the Ministry of Environment and Forests (MoEF) permit only 1–1.5 boreholes/sq km. in forest areas without the need for seeking forestry clearance by the drilling agencies. However, this needs to be increased to at least 15–20 boreholes/sq km.

UNDERGROUND MINING

15.14 Current economic mining practices are generally limited to a depth of 300 m but about 40 per cent of the reserves in the country are beyond this depth. Coal production from underground mines has either

stagnated or declined despite significant investments aimed at improving technology and the working conditions in these mines. The reasons include inheritance of large numbers of small underground mines at the time of nationalization with manual workings and where mechanization is either not feasible or the reserves do not permit it; failure of the longwall technology partly due to inadequate exploration and geo-technical investigations of coal deposits; and lack of assured timely supply of critical spares for foreign equipment. Using other technologies to extract these deeper reserves sharply reduces the reserve recovery ratio. The proposal to increase the borehole density is to enhance the level of proved coal reserves so that the share of underground mining can be progressively enhanced. A strategy also needs to be worked out to encourage the domestic manufacturing of underground mining machinery.

WASHERIES

15.15 The present washing capacity can handle beneficiation of 135.18 mt of throughput, of which 107.80 mty is for non-coking coal and 27.38 mty for coking coal. There is an urgent need to create about 190 mty of additional coal washing capacity for which huge infrastructure facilities will be required, including land, railway sidings, roads, power, water, and other related infrastructure. CIL envisages taking up 20 new washeries (seven coking coal and 13 non-coking coal) for an ultimate capacity of 111.10 mty (coking 21.1 mty; non-coking 90 mty) for implementation by the Twelfth Plan. A suitable policy needs to be initiated to make better use of rejects generated from washeries both from the energy and environment points of view.

ENVIRONMENTAL CLEARANCES (EC) AND R&R ISSUES

15.16 Environmental and forest clearances are critical statutory permissions to be obtained before implementing coal projects. Against the scheduled time frame of 210 days for EC and 150 days for FC, it normally takes nearly 2–6 years to obtain such clearances, any further delays leading to a shortfall in production. The other reasons for the shortfall in production in the Eleventh Plan relate to land acquisition and related R&R issues as well as law and order

problems. State governments need to play a proactive role in resolving these issues. The Planning Commission is examining these issues in depth and will suggest a set of policy initiatives and other measures to address them.

COAL DEMAND

15.17 During the Eleventh Plan, coal demand was envisaged to grow at 9.52 per cent per annum. Against this the likely growth in consumption/off-take in the first three years of the Eleventh Plan works out to 8.8 per cent and it is 9 per cent for the Plan period as a whole. As a result of this, the off-take in 2011–12 has been revised downwards from 731 mt to 713 mt. In case of power sector (utilities) the coal demand has been revised downwards from 483 mt to 473 mt in terminal year 2011–12 of the Plan due to delays in commissioning some projects implying an annual growth rate of 9 per cent against the envisaged growth rate of 9.4 per cent. Also, it is indicated by the Central Electricity Authority (CEA) that there would be a shortfall in capacity addition of coal-based generation by about 16.5 per cent as per the revised plan and accordingly coal-based generation has also been revised downwards to 630 billion units (BU) for 2011–12 against the originally envisaged target of 690 BU. The details of sectoral coal demand are given in Annexure 15.2.

Demand–Supply Gap

15.18 The gap between demand and supply is projected to be 83.33 mt in the terminal year of the Plan based on the lower coal-based generation capacity addition projected in the MTA. The gap would have been even more, if all the planned coal-based power plants had been commissioned in time.

COAL IMPORTS

15.19 Against an overall coal import of 43.08 mt (17.88 mt of coking coal and 25.20 mt of thermal coal) in the terminal year of the Tenth Plan (2006–07), imports in the terminal year of the Eleventh Plan (2011–12) were originally projected at 51 mt (40.85 mt of coking coal and 10.15 mt of thermal coal). However, as a result of inadequate domestic supply, it is now estimated that coal imports in 2011–12 will be 83.33 mt (42.48 mt of coking coal and 40.85 mt of thermal coal)

accounting for 11.7 per cent of the estimated demand as against 7 per cent envisaged earlier. The degree of import dependence is only going to increase in future and the gap at the end of the Twelfth Plan is likely to be much larger. Urgent steps need to be taken at an early stage to enhance coal handling facilities at ports with dedicated berths for coal handling; improving the availability of railway rakes by de-congestion at identified locations; and addressing law and order issues affecting the unloading of railway rakes in time at certain power plants.

COAL REGULATOR

15.20 Independent regulation of the coal sector becomes essential for ensuring that the sector becomes competitive, is able to fix formulae for price revision for long-term fuel supply agreements, and fix trading margins as well as improving exploitation and allocation of available resources. A bill relating to the regulation of coal sector is under consideration by the government.

COAL PRICING

15.21 Current market price for world thermal coal is around US\$ 70 per tonne, a 40 per cent decline from the peak US\$ 121 in 2008 and even below the US\$ 62 thermal coal price average in 2007. Because of this volatility, it is difficult to compare international coal prices with domestic prices. However, even after the decline in international prices, the price of imported coal is much higher than the price of domestic coal. Imported non-coking coal from Indonesia landed price at Chennai port in August 2009 was reported to be Rs 3,389 per tonne; it was Rs 4,288 per tonne for coal imported from South Africa. Against this, the price of non-coking coal supplied by the Mahanadi Coalfields Limited (MCL), Talcher, at Chennai is reported to be Rs 1,560 per tonne for Ennore power station and Rs 1,492 at the North Chennai power plant (based on pre-revised prices). The present Talcher coal cost is Rs 640 per tonne. In other words, even though the cost of delivered domestic coal is more than 2.42 times the cost of coal at the pit head, it is still cheaper than imported coal.

15.22 Part of the price difference between imported and domestic coal is because imported coal has a less

than 10 per cent ash content and around 6,000 K cal per kg of calorific value; whereas the Indian coal supplied to power plants (F and G grade is supplied to power plants in India) has around 40 per cent ash and a higher moisture content with a lower calorific value. If we compare landed cost of coal based on per million kilo calories only, it works out to Rs 565 per million kilo calories for coal from Indonesia and Rs 715 for coal from South Africa at the Chennai port on CIF basis. In comparison to this, the delivered cost of coal from MCL at these two power stations in Chennai works out to Rs 446 and Rs 426 respectively. Normally F and G grade coal is supplied to power stations in India, which has around 40 per cent ash content. The price difference of around 26 per cent after adjusting for the calorific value suggests that domestic coal is underpriced. There is a need to bring coal prices in alignment with international prices after adjusting for calorific value.

15.23 There are other pricing issues that also need to be resolved. Coal prices should be more finely differentiated so that higher quality coal gets a higher price. This was also an important component of the Integrated Energy Policy and should be implemented urgently.

Lignite Production and Gross Power Generation—Neyveli Lignite Corporation Limited (NLCL)

15.24 Lignite production was projected to grow by 5.17 per cent per annum in the Eleventh Plan to reach 27 mt in 2011–12, the terminal year of the Eleventh Plan. However, actual growth is now expected to be only 4.37 per cent per annum and lignite production in 2011–12 will only reach 26.02 mt. The anticipated growth in lignite production from NLCL in the first three years of the Plan is only 1.2 per cent against the initially envisaged growth of 6.9 per cent in the Eleventh Plan. The shortfall in growth is due to the delay in commissioning new power projects. The total electricity produced by NLCL was projected as 26.08 BU in 2011–12 and is now likely to be 21.13 BU indicating a decline of 5 BU. There have also been delays in implementing downstream units mainly on account of delay in supply and erection of equipments by BHEL, the main contractor.

REVIEW OF FINANCIAL PERFORMANCE

15.25 Capital expenditure in the first three years of the Plan has been lower than expected because of a delay in starting new projects, delay in procuring Heavy Earth Moving Machinery (HEMM) because of court cases and the decision of some of the coal companies to outsource overburden removal/coal loading and transport operations, and slow progress with regard to central sector schemes. The likely expenditure in the first three years of the Plan will only be Rs 14,793.75 crore or 39.29 per cent (CIL 43.94 per cent; SCCL 55.63 per cent; NLCL-Mines 45.61 per cent; NLCL-Power 26.49 per cent, and CSSs 56.64 per cent) of the Eleventh Plan outlay of Rs 37,100.08 crore.

15.26 The company-wise/scheme-wise plan outlay and expenditure as projected initially and as anticipated in the MTA are given in Annexure 15.3. Coal sector PSUs are likely to achieve only 80 per cent of the expenditure anticipated in the Eleventh Plan.

15.27 The approved Eleventh Plan outlay of Rs 37,100 crore for MoC was planned to be financed through Internal and Extra-Budgetary Resources (IEBR) of Rs 35,774.37 crore, and a Gross Budgetary Support (GBS) of Rs 1,326.00 crore. The budgetary support sought for the ministry's plan schemes covered Environmental Measures and Subsidence Control scheme (EMSC), R&D schemes, Conservation and Safety measures, and development of transport infrastructure in the coalfields. These schemes were proposed to be funded partly from Stowing Excise Duty (SED) collected under the Coal Conservation Development Act (CCDA), partly from IEBR of CIL, and in some part through budgetary support.

15.28 The review of the financial performance of the coal sector is given in Table 15.3.

REVIEW OF CENTRAL SECTOR SCHEMES

15.29 The approved budgetary support for central sector schemes for the Eleventh Plan was Rs 1,326 crore covering schemes of promotional exploration, detailed drilling in non-CIL blocks, EMSC, R&D schemes, conservation and safety measures, and development of transport infrastructure in the coalfields. These schemes are proposed to be funded partly from

TABLE 15.3
Review on the Financial Performance of the Coal Sector

		(Rs crore)					
S. No.	Sector	10th Plan Expenditure	11th Plan Approved Outlay	2007-08 Actual	2008-09 Actual	2009-10 Ant.	Cumulative Expenditure (2007-10)
1	Coal and lignite	9,909.86	23,556.07	3,186.02	3,557.66	4,120.34	10,864.02
2	NLC (Power)	1,063.32	12,218.00	1,188.17	1,159.10	844.94	3,192.21
3	MOC schemes	922.95	1,326.01	280.03	197.49	260.00	737.52
	Total MOC	11,896.13	37,100.08	4,654.22	4,914.25	5,225.28	14,793.75

subsidence excise duty collected under CCDA, partly from IEBR of CIL, and partly from budgetary support.

Regional/Promotional Exploration and Detailed Drilling in Non-CIL Blocks

15.30 This scheme is aimed at supplementing Geological Survey of India's (GSI) efforts at regional exploration for coal and lignite along with the other components of the schemes—an integrated coal and lignite database, and CBM studies, etc. During the Eleventh Plan, a drilling target of 7.50 lakh metres had been set comprising 4 lakh metres for coal and 3.5 lakh metres for lignite to establish about 20 billion tonnes of coal and 4.06 billion tonnes of lignite. In the first two years, 2.42 lakh metres of drilling had been completed and 1.58 lakh metres is likely to be completed in 2009-10 taking the total to 4 lakh metres (53 per cent) of drilling in the first three years of the Plan period.

15.31 It has been proposed that the blocks outside the purview of CIL be explored in detail to reduce the time lag between offering the blocks to potential entrepreneurs and start of operations by them through budgetary support. The cost of exploration, in turn, will be recovered from entrepreneurs who have been allotted the blocks. For the Eleventh Plan, the approved outlay for this scheme was Rs 472.94 crore to carry out 13.50 lakh metres of drilling in 42 non-CIL blocks to augment coal reserves under the proved category. During the first three years of the Plan, the likely cumulative achievement is projected to be 3.18 lakh metres or 23.5 per cent of the target envisaged. The drilling target has been revised downwards to 11.85 lakh metres. This implies completion of the balance

8.67 lakh metres of drilling in the next two years of the Eleventh Plan, which represents an increase in the achievement in the first three years.

Science and Technology (Research & Development)

15.32 The main thrust areas in this scheme are promotion of clean coal technologies, including beneficiation of Low Volatile Medium Coking Coals (LVMC), *in situ* coal gasification, carbon capture and sequestration, CBM/coal mine methane/abandoned mine methane, coal gasification and coal to oil, etc. It also aims to establish ways/technology for extraction of steep and thick coal seams, open cast bench slope stability and strata control. The progress in science and technology for coal has not been satisfactory. However, there has been some progress in Underground Coal Gasification (UGC) for production of syngas. The activity has been notified as end-use under the captive coal mining policy. MoC has also identified three coal blocks for a coal to liquid project and two of the three coal blocks identified for coal liquefaction projects have already been allocated to two companies; one promoted by the Tata's and other by Jindal Steel and Power Limited (JSPL).

15.33 CBM is available in some deposits and if extracted separately, could form a supplementary source of energy. So far, 26 blocks have been allocated up to the third CBM round and 10 blocks will be allocated in the next round. However, as of now, there is very little production. An expert committee under the chairmanship of Adviser (Projects), MoC is finalizing recommendations to deal with the issues related to simultaneous coal mining and CBM operations.

Conservation and Safety in Coal Mines and Development of Transport Infrastructure in Coalfield Areas

15.34 These two schemes are under the statutory provisions of the CCDA and were being implemented as a part of a non-plan scheme during the Tenth Plan through reimbursement of SED collected under CCDA. The Ministry of Finance (MoF) has taken a view that SED collected under CCDA is a revenue to the Government of India, which is reimbursed back to coal companies for implementation of these schemes. Therefore, this scheme will be treated as a Plan scheme from the Eleventh Plan onwards.

15.35 Development of infrastructure in coalfields is essential for ensuring the evacuation of coal produced in mines to rail heads or railway yards. It is stated that substantial time is taken by the railways to build critical rail links and that this is adversely affecting the movement of coal to the end users. Implementation of four critical rail links: the Tori–Shivpur rail link in the North Karanpura coalfield Central Coalfields Limited (CCL) command area; Gopalpur–Jharsguda rail link connecting coal blocks in Ib Valley Coalfield in MCL area; the Baroud–Bijuri rail link in the Mand–Raigarh SECL (South Eastern Coalfields Limited) coalfield and the Sattupalli–Badrachalam rail link in the SCCL command area have been delayed for a long period. Commissioning of these lines and completing them at the earliest would be essential for the movement of around 125–130 million tonnes of coal to end users.

Environmental Measures and Subsidence Control

15.36 The purpose of this scheme is to improve environmental conditions in old mined out areas, particularly the Jharia and Raniganj coalfields, by implementing a number of schemes for mitigating the damage that occurred due to unscientific mining carried out before the nationalization of coal mines. For this purpose, a master plan for the Jharia–Raniganj coalfields with a total outlay of Rs 9,773.84 crore has been taken up to deal with fire, rehabilitation, and subsidence-prone inhabited areas and diversification of roads/railway lines within the command area of BCCL and Eastern Coalfields Limited (ECL).

Information Technology

15.37 In order to improve the efficiency of the project monitoring system and e-governance, the Eleventh Plan has called for strengthening information technology aspects in the coal sector—computerization of various business functions up to the project-level. Coal and lignite resource information system, resource depletion information system, Integrated Coal Net Application Software, GPS-based truck dispatched system, Geographical Information System (GIS) mapping, and the centralized mail/messaging system are some of the contemplated areas.

WAY FORWARD

15.38 The MTA of performance in the coal sector raises a number of issues that need to be addressed:

- i. Domestic production of coal will not be adequate to meet the growing demand and the gap between demand and supply is likely to widen further to 200 MT in the Twelfth Plan. Measures need to be taken in the Eleventh Plan to tie-up imports from the coal exporting countries besides enhancing the level of domestic production.
- ii. Development work on the captive blocks allocated to multiple users is very slow due to problems of access for mining operations; land acquisition; and environmental and forest clearances. Steps also need to be initiated to cancel the allocation of non-serious players and re-allotting such blocks to interested consumers.
- iii. Prospecting licenses are now being issued along with the allocation of blocks to avoid delays in starting implementing activities.
- iv. The constraints on expanding supply of domestic coal suggest that the present nationalization of the coal sector needs to be reconsidered in order to open up new coal mines for private sector exploitation beyond the captive use that is currently allowed. Since private sector exploitation of petroleum resources, which are much scarcer, is freely allowed, there is every reason for private sector coal development to be favourably considered.
- v. The current economic mining practices are generally limited to a depth of 300 m and about 40 per cent of the reserves of the country are

beyond this depth. Winning of coal under such depths has to be done through underground mining operations. Technologies suitable to mine such reserves need to be deployed to enhance the recovery level.

- vi. Clean coal technologies will be potentially important options in the long term. However, there are significant issues surrounding the current relevance of these technologies for India, including uncertainties in technical and cost estimates along with suitability for Indian conditions.

POWER SECTOR

15.39 Electricity remains a key element of infrastructure, essential for delivering targeted levels of GDP growth. While MTA reveals some progress in this area, the sector continues to face problems of energy and peaking shortages, low quality of supply, and uneconomic electricity tariffs, all of which adversely affect the financial viability of the sector.

ELECTRICITY GENERATION

15.40 Generation of electricity is expanding at a faster pace than it did in the Tenth Plan, though at a pace lower than demand growth, leading to continued peak and energy shortages in the country. The reported energy shortage for 2008–09 was 11 per cent while the corresponding peak shortage was 12 per cent. The generation of power during 2006–07 was 662 BU, which increased to 704 BU (+6.3 per cent) in 2007–08 and to 724 BU (+2.7 per cent) in 2008–09; the target for 2009–10 is 789.12 BU. The likely growth of supply in the first three years of the Eleventh Plan works out to 5.59 per cent as compared to actual growth of 5.32 per cent in the Tenth Plan period. Primarily,

the growth has been in thermal power at 10.48 per cent, with continuous decline in hydro-power (–8.43 per cent). The cumulative generation in 2009–10 (April–December 2009) is given in Table 15.4.

15.41 The growth in thermal generation has mainly been due to increased generation from gas-based projects, which has been possible due to increased gas availability from the Krishna–Godavari basin (D-6) and LNG (Liquefied Natural Gas) imports that registered a growth of 31.41 per cent during April–December 2009.

Peak and Energy Shortages

15.42 Prevailing peak and energy shortages continue to be a cause of concern. Shortages of this magnitude can significantly constrain industrial activity, reduce economic growth, and require business and manufacturing consumers to utilize more expensive back-up generation, which often uses diesel fuel. Reduced economic output also means that these industrial consumers pay less tax revenues to the government at all levels. Use of expensive back-up power by industries adds to their costs and undercuts competitiveness.

CAPACITY ADDITION IN THE PREVIOUS PLANS— ANALYSIS AND TRENDS

15.43 Capacity addition has consistently fallen below target in successive Plans. In the last three Plans (Eighth to the Tenth Plan), the average capacity addition was around 50.5 per cent of the targeted capacity addition. Actual capacity addition of 16,423 MW during the Eighth Plan was 46 per cent less than the targeted capacity addition of 30,538 MW.

TABLE 15.4
Cumulative Generation in 2009–10 (April–December)

Category	(in BU)				
	Target April–December 2009	Generation April–December 2009	Per cent of Target	Generation April–December 2008	Growth (per cent)
Thermal	478.0	468.5	98.0	430.3	8.88
Nuclear	13.6	13.4	98.8	11.3	18.58
Hydro	93.9	85.5	90.9	92.2	–7.27
Bhutan imp.	5.8	5.2	88.2	5.6	–7.14
Total	591.3	572.5	96.8	539.4	6.14

This trend continued in the Ninth Plan. The actual capacity addition of 19,015 MW during the Plan was 53 per cent less than the targeted capacity addition of 40,245 MW. The performance in the Tenth Plan was similar and only 51 per cent addition of the targeted capacity was achieved.

15.44 The total capacity addition in the three Plans put together (Eighth, Ninth, and Tenth) was 56,518 MW, of which 44 per cent was from the central sector, 40 per cent from the state sector, and only 16 per cent from the private sector. The private sector could contribute only 8.71 per cent of the actual capacity addition in the Eighth Plan, 26.6 per cent in Ninth Plan, and 12.67 per cent in the Tenth Plan. Private sector performance is likely to be much better in the Eleventh Plan and is likely to contribute around 32 per cent of the expected capacity addition. Table 15.5 shows the share of the central, state, and private sectors in the previous three Plans and in the current Plan.

TABLE 15.5
Plan-wise Sectoral Share of Capacity Addition

	8th Plan	9th Plan	10th Plan	11th Plan
Central	8,157	4,504	12,165	21,222
State	6,835	9,450	6,244	21,355
Private	1,430	5,061	2,671	19,797
Total	16,422	19,015	21,080	62,374

15.45 The share of hydro capacity in the total installed capacity was around 25 per cent at the end of the Eighth Plan, remained at the same level at the end of the Ninth Plan, and marginally increased to 26 per cent by the end of the Tenth Plan. With the projected hydro capacity addition of 8,237 MW out of the total likely addition of 62,374 MW in the Eleventh Plan (see

Table 15.8), the share of hydro is likely to come down to around 23 per cent. Measures need to be taken to increase the share of hydro and plan open cycle gas-based projects to meet the peak demand effectively.

CAPACITY ADDITION IN THE ELEVENTH PLAN

15.46 The Eleventh Plan originally envisaged a capacity addition of 78,700 MW. The sector-wise and source-wise break-up is given in Table 15.6.

15.47 The Eleventh Plan target implied that capacity creation in the Eleventh Plan would be more than 3.5 times the capacity actually added in the Tenth Plan. Ramping up additional capacity takes time and the capacity commissioned up to 31 December 2009 was only 19,092 MW. It is anticipated that additional capacity aggregating 43,282 MW can be commissioned during the remaining period of the Eleventh Plan. The revised MTA target for total capacity addition is, therefore, 62,374 MW, which is lower than the original target but is nevertheless about three times the capacity actually added in the Tenth Plan. A summary of this capacity is given in Table 15.7.

TABLE 15.7
Revised Targets for Capacity Addition during the Eleventh Plan

Sector	(in MW)			
	Comm- issioned Till 31 Dec. 2009	Likely in the Remaining Period	Total with High Degree of Certainty	With Best Efforts
Central	4,990	16,232	21,222	4,530
State	9,112	12,243	21,355	1,130
Private	4,990	14,808	19,797	6,930
All-India	19,092	43,282	62,374	12,590

Note: The actual capacity addition as on 31 March 2010 was 22,301.7 MW.

TABLE 15.6
Original Targets for Capacity Addition during the Eleventh Plan

Source/Sector	(in MW)				
	Hydro	Thermal	Nuclear	Total	Percentage
Central	8,654	24,840	3,380	36,874	47
State	3,482	23,301	—	26,783	34
Private	3,491	11,552	—	15,043	19
Total	15,627	59,693	3,380	78,700	100
Percentage	20	76	4	100	

15.48 Summary of the capacity (fuel-wise/sector-wise) likely in the Eleventh Plan with a high degree of certainty is given in Table 15.8.

15.49 The revised MTA target of 62,374 MW involves a significant improvement in the pace of capacity addition in the remaining two years of the Eleventh Plan. The following factors suggest that this improved performance would be realized:

- Preparedness during the Eleventh Plan is better than before with respect to timely placement of orders and increase in the manufacturing capacity of domestic suppliers. This was a result of efforts made earlier to augment equipment manufacturing capability and development of new vendors; the benefits of these efforts will be visible in the latter half of the Plan.
- More than 20,000 MW capacity is being executed by foreign suppliers. Generally, supply of equipment in these has not been a problem.
- 15,000 MW capacity is to be commissioned by private players where no delay is expected in execution considering the progress made so far.

- 3,160 MW nuclear capacity to be commissioned during 2009–10 and 2010–11, is achievable considering assured availability of nuclear fuel.
- BHEL has to execute about 2,000 MW hydro capacity and 4,000 MW thermal capacity during the remaining period of 2009–10, followed by 12,800 MW during 2010–11, and about 5,600 MW during 2011–12. Given its track record, BHEL should be able to fulfil this task.

15.50 Table 15.9 gives the total installed capacity at the beginning of the Eleventh Plan, likely capacity addition during the Plan and anticipated installed capacity at the end of the Plan. The total installed capacity indicated here does not include generation capacity of captive power plants.

15.51 The Plant Load Factor (PLF) of thermal power stations in the country has been steadily increasing over the years, representing higher utilization of the installed capacity. The average PLF of thermal power stations of power utilities during 2008–09 was 77.22 per cent. The sector-wise and overall PLF since the beginning of the Tenth Plan is given in Table 15.10.

TABLE 15.8
Capacity Addition in Eleventh Plan: Source-wise

Sector	Hydro	Thermal	Nuclear	Total
Central	2,922	14,920	3,380	21,222 (34%)
State	2,854	18,501	—	21,355 (34%)
Private	2,461	17,336	—	19,797 (32%)
Total	8,237	50,757	3,380	62,374 (100%)
	13.21%	81.37%	5.42%	

TABLE 15.9
Anticipated Installed Capacity at the End of Eleventh Plan

	Hydro	Thermal	Nuclear	Total
Capacity as on 31 March 2007	34,654	86,015	3,900	1,24,569
Eleventh plan target	15,627	59,693	3,380	78,700
Likely addition during Eleventh Plan	8,237	50,757	3,380	62,374
	(52.71%)	(85.03%)	(100%)	
Likely installed capacity on 31 March 2012	42,891	1,36,772	7,280	1,86,943

Note: Figures in brackets indicate percentage of target achieved.

TABLE 15.10
Plant Load Factor of Generating Stations

Year	(in percentage)			
	Central	State	Private	Overall
2001–02	74.3	67.0	74.7	69.9
2002–03	77.1	68.7	78.9	72.1
2003–04	78.7	68.4	80.5	72.7
2004–05	81.7	69.6	85.1	74.8
2005–06	82.1	67.1	85.4	73.6
2006–07	84.8	70.6	86.3	76.8
2007–08	86.7	71.9	90.8	78.6
2008–09	84.3	71.2	91.0	77.2

HYDRO DEVELOPMENT

15.52 The pace of hydropower development has been slow. As against the target of 15,627 MW for the Eleventh Plan, only 8,237 MW (53 per cent) is expected to materialize during the Plan. The following issues need to be addressed if the pace in generating hydropower has to be increased:

- i. Environment and forest clearances
- ii. Development of infrastructure (roads and highways)
- iii. Land acquisition
- iv. Rehabilitation and resettlement issues
- v. Security clearance
- vi. Availability of hydrological data to private developers
- vii. Power evacuation
- viii. Storage project versus Run-of-River (RoR) projects
- ix. Long-term financing

15.53 In order to address these issues, several policy initiatives have been taken, including the Hydro Development Policy initiated by Ministry of Power (MoP); the 50,000 MW hydro power development initiative; incentives for the development of small hydro projects, and an inter-ministerial group to develop a strategy to enhance the pace of hydropower development in the North-Eastern region. Development of hydropower, however, needs a strong push. A policy to develop identified sites with all clearances environment and forests clearances and land acquisition should be taken up on a large number of sites simultaneously. Some of these could then be bid out to private investment.

ATOMIC ENERGY

15.54 Expansion of capacity in atomic energy has been limited in the past due to the lack of availability of domestic uranium or the non-availability of the international supply of uranium fuel because of the restrictions imposed by the Nuclear Suppliers Group (NSG). These restrictions have now been lifted and a much faster expansion in nuclear generation capacity can be expected. The Department of Atomic Energy (DAE) envisages adding 5,900 MW in the Twelfth Plan based on domestic manufacturing capability and an additional 10,000 MW with the support of international players.

15.55 Despite availability of imported uranium, priority must be given to domestic development of uranium mines. This would enable faster development of the sector.

15.56 India's nuclear power strategy has depended on a three-stage development programme consisting of conventional nuclear reactors in the first phase, Fast Breeder Reactors (FBRs) in the second phase, and thorium-based reactors in the third phase. Successful transition to the third phase will enable us to explore India's vast thorium resources thus becoming much more energy-independent beyond 2050. If we depend on domestic uranium resources, the plants in the first phase cannot exceed 10,000 MWe from Pressurized Heavy Water Reactors (PHWRs). A cap of 10,000 MWe would have limited the scale and pace of the FBR programme and, therefore, the production of plutonium which determines the rate at which thorium-based nuclear plants can be mobilized. With the lifting of NSG restrictions, import of uranium would enhance the capacity base of the first stage programme. The government has taken steps to import nuclear fuel from NSG members and reactors from nuclear equipment suppliers to enhance the capacity base in the country. Three hundred tonnes of uranium concentrates have already been imported from France. Steps are on to get long-term supply of 2,000 tonnes of uranium pellets from the Russian Federation in a phased manner.

15.57 The FBR programme is set to be launched with the prototype 500 MWe FBR plant being built at

Kalpakkam and is likely to be commissioned by March 2012. This project is the first of its kind in India and is being implemented by BHAVINI, a public sector company set up to build this project and all future FBR projects. Successful commissioning of this project would go a long way in achieving the three-stage development of India's nuclear power programme in the future.

15.58 DAE envisages starting work on eight units of indigenous 700 MWe PHWRs in the Eleventh Plan. Four units have been already been approved and work has started on them. These are slated for commissioning in 2016–2017. Work is expected to start on Light Water Reactors (LWRs) through international cooperation. Permission for five coastal sites to set up nuclear power parks of 6,000 to 10,000 MWe capacity based on LWRs with cooperation from the Russian Federation, USA, and France, has been accorded in principle by the government. Depending upon when the actual work starts on the reactors it is possible to add a total LWR capacity of 40,000 MWe progressively by 2032. It has been planned that the spent fuel of LWRs will be reprocessed and deployed in safeguarded FBRs and additional PHWRs. This would further enhance the FBR capacity in the long-term and thus increase the role that nuclear energy can play in long-term energy security, without the need for any further import of nuclear fuel. This would significantly increase the role that nuclear energy can play in long-term energy security.

15.59 The third phase of the three-phased nuclear energy programme, needs several complex technological issues to be tackled before our ability to use thorium. A clear analysis and assessment of the need of additional manpower, R&D investment, and new facilities are called for, including elements to be covered in the remaining Eleventh Plan period. Maintaining schedules is of serious concern on this front.

ROLE OF THE PRIVATE SECTOR IN GENERATION

15.60 As can be seen, higher capacity addition in the current Plan is feasible because investment in the private sector has grown rapidly and its share in the total capacity is likely to go up from less than

10 per cent in the Tenth Plan to 32 per cent during the Eleventh Plan. While the availability of plants and equipment is going up with expansion by BHEL from a level of 10,000 MW per annum (December 2007), to around 20,000 MW per annum by the end of 2012, private players like L&T and Mitsubishi JV, Toshiba and JSW JV, and ALSTOM and Bharat Forge are also going to set up new capacities, which will help the Twelfth Plan projects.

NEW INITIATIVES

Ultra Mega Power Projects

15.61 A major initiative for adding to the power generation capacity is the Ultra Mega Power Projects (UMPPs) programme. So far, four UMPPs of 4,000 MW each have been awarded on the basis of a competitive tariff-based bidding. Out of these, five units of 800 MW each are under construction at the Mundra UMPP. Order for another UMPP at Sasan (6x660 MW) has been placed. Orders for Boiler and T.G. sets for the other two awarded UMPPs (Krishnapatnam and Tilaya) are yet to be placed. Five more supercritical UMPPs have been planned. Major thrust is required so that these capacities can be obtained in the Twelfth Plan. An important element of this programme is that supercritical technology has been stipulated, thus building in an important shift to energy efficiency.

Supercritical Projects under Construction

15.62 Efforts to introduce supercritical technology in the country date back to 2000 when the CEA gave techno-economic clearance to NTPC's Sipat (3x660 MW) Thermal Project. However, introduction of technology was delayed mainly due to non-availability of technology in the country. Orders for initial supercritical units, Sipat (3x660 MW) and Barh-I (3x660 MW) were placed by NTPC with foreign companies (Russian and Korean) in 2004 and 2005 respectively following internationally competitive bidding. However, commissioning of these units has been delayed considerably because of contractual problems with the Russian companies.

15.63 Recently, the Government of India approved a policy encouraging domestic production of supercriti-

cal plants by bulk tendering of supercritical units of 660 MW capacity for 11 generating units by NTPC Ltd. for itself and on behalf of its companies, JV and DVC. Winning bidders are required to undertake domestic manufacturing in phases in view of the increasing coal-based thermal capacity. A strategy needs to be worked such that at least 50 per cent of the capacity in the Twelfth Plan is based on supercritical technology. Subsequently, most power plants should be based only on the supercritical technology. Appropriate policy measures have to be chalked out by December 2010.

EMERGING NEW CHALLENGES

- **Chinese Equipment:** Chinese equipment suppliers have entered the Indian power sector market in a big way. Orders have already been placed for Chinese equipment with respect to projects for 36,800 MW during the past couple of years. Import of a huge quantity of Chinese equipment without developing local component vendors would mean continuing the import of components and spare parts from China. This will not only be a costly affair but also weaken the opportunity for developing domestic manufacturing capability. There is a need to develop domestic manufacturing capacity and vendors for spare parts of Chinese equipment.
- **Project Implementation:** Project management tools must be used for timely completion of projects. At the national level, a system should be developed in the MoP or CEA to ensure timely completion of projects both in the public and private sectors.
- **Environmental Clearances:** Environment and forest clearances sometimes take too long. Procedural bottlenecks and issues regarding R&R have also been causing inordinate delays in the implementation of several hydro and coal projects. It takes anywhere between three to five years for a project to get the required clearances. Timely environmental and forest clearances are essential for implementing projects on schedule.
- **Skilled Personnel:** Availability of skilled personnel is going to be critical in view of the large capacity addition programme in the Eleventh and the Twelfth Plans. To increase the pool of skilled personnel, the government had in July 2007 launched the

‘Adopt an ITI’ scheme. So far only 52 ITIs have been adopted by power sector units. Manpower planning will have to be accorded highest priority in the review of activities by MoP and conscious efforts will have to be made to ensure that every single power generating unit in the country adopts at least one ITI.

NEED FOR STARTING TWELFTH PLAN PROJECTS

15.64 In view of the prevailing peak and energy shortages, CEA has estimated a capacity addition requirement of 1,00,000 MW in the Twelfth Plan to meet the growing needs of the economy. Of this around 70 per cent is likely to be thermal-based capacity. Efforts have been initiated to place orders for the projected capacity addition in the Twelfth Plan and tie up the fuel supply and other inputs to ensure timely completion of projects. However, inadequate availability of coal-based projects in the Twelfth Plan continues to be a cause for concern. A gap of 200 mt is estimated in the Twelfth Plan and efforts need to be initiated for increasing domestic production as well as enhancing the level of imports to ensure that there is an adequate supply of coal.

15.65 Gas-based capacity at the end of the Tenth Plan was about 13,000 MW, which is expected to increase to 20,000 MW at the end of the Eleventh Plan. With the recent allocation of gas from the KG basin, available gas from domestic production and LNG imports would be just adequate to feed the existing projects and projects added in the Eleventh Plan. However, considering the present level of domestic production, availability of gas for Twelfth Plan projects is uncertain considering the present level of domestic production. Unless production from new discoveries happens, new capacity addition based on gas may not be feasible. New plants based on imported LNG will have to be taken up seriously and if required policy changes will have to be initiated. Policies that are the most critical will be the ones on pooled pricing of gas to make these imports viable.

AVAILABILITY OF FUEL

15.66 As noted earlier, availability of coal will be a critical constraint in the development of coal-based

power plants in the Eleventh Plan. It will become much more intense in the Twelfth Plan when the projected gap between demand and supply is likely to go up by 200 mt.

15.67 Recently the Empowered Group of Ministers (EGoM) allocated 30 Million Metric Standard Cubic Metres Per Day (MMSCMD) additional gas supplies to power projects, besides the existing allocation of domestic gas. With this, the current allocation of gas to the power sector is around 65 MMSCMD. This has facilitated increase in electricity generation from gas-based power plants considerably. Supply of gas from the LNG terminals is currently around 36 MMSCMD, which is likely to increase to 70 MMSCMD by the end of the Eleventh Plan. Availability of gas from domestic resources as well as from LNG terminals set up in the country would be adequate to meet the needs of the existing capacity and the capacity addition in the Eleventh Plan.

15.68 Availability of gas for capacity addition in the Twelfth Plan is uncertain unless additional gas production becomes available from the new discoveries and the LNG import capacity is fully utilized. Hence, policy interventions will need to be initiated to support establishment at LNG-based power plants.

TRANSMISSION & DISTRIBUTION

TRANSMISSION

15.69 The Eleventh Plan had targeted for development of transmission lines at High-Voltage Direct Current (HVDC), 765 kV, 400 kV, and 220 kV both in the central and state sectors, in addition to expansion of sub-stations for meeting power transmission requirements. The present status of transmission lines and sub-stations is given in Tables 15.11 and 15.12. As can be seen from Table 15.11, the likely achievement for HVDC and 765 kV would fall short substantially by over 70 per cent and nearly 48 per cent respectively. The main reason for the shortfall is the delay in associated generation projects, which suggests that the development of transmission capacity is not a critical constraint in power development in the Eleventh Plan.

TABLE 15.11
Targets and Achievements of
Transmission Capacity Addition

(in CkM)

Voltage	Programme of Eleventh Plan	Achievement (up to October 2009)	Anticipated Achievement (at the end of Eleventh Plan)
HVDC	5,400	1,480	1,600
765 kV	5,273	1,088	2,773
400 kV	47,446	16,982	40,000
220 kV	30,396	10,813	24,300

TABLE 15.12
Sub-stations: Achievement of
Capacity Addition up to October 2009

(in MuA)

Voltage	MVA	Target (up to October, 2009) (MVA)	Achievement (up to October, 2009) (MVA)
HVDC	8,500	500	500
765 kV	24,500	4,500	4,500
400 kV	51,960	28,190	21,095
220 kV	72,731	32,578	27,788

DEVELOPMENT OF THE NATIONAL GRID

15.70 Development of a national grid facilitates optimal utilization of resources by bulk transfer of power from surplus regions to deficit regions in the country as well as facilitating scheduled/unscheduled exchange of power between regions.

15.71 The inter-regional transfer capacity currently available is 20,800 MW, which will go up to 32,650 MW by the end of the Eleventh Plan period. During the first two years of the Eleventh Plan, Power Grid Corporation of India Limited (PGCIL) has added 5,900 MW transmission capacity. There is a need to reassess the position to ensure that there are no bottlenecks in power transmission as open access gets operational.

ISSUES CONCERNING EVACUATION OF POWER FROM THE NORTH-EASTERN REGION

15.72 Currently four projects, Lower Subansiri (2,000 MW), Kameng (600 MW), Bongaigaon TPS (750 MW),

and Palatana (Tripura) gas (750 MW) aggregating about 4,100 MW are under implementation in the North-Eastern region. A number of hydro projects in Arunachal Pradesh and Sikkim are also likely to come up in the near future. Since only a part of the power from these projects will be utilized in the North-Eastern region, a major portion of this power will have to be exported to power deficit regions like the northern and western regions. Considering the contingency and reliability needs and total power evacuation from the North-Eastern region through the chicken neck area, five to six HVDC lines (800 kV) and three to four Extra High-Voltage Alternating Current (EHVAC) lines (400 kV) would have to be established to eventually evacuate about 50,000 MW from the North-Eastern region and 15,000 MW from Sikkim/Bhutan from all such future projects. The MoP would be responsible for the evacuation of power from the North-Eastern states.

PRIVATE SECTOR IN TRANSMISSION

15.73 Although the power transmission segment was opened to private investment in 1998 there has been limited success in attracting private investment. The only Public-Private Partnership (PPP) project—the Tala transmission system—has been operational since May 2007. The MoP had identified 14 transmission projects for 100 per cent private investment with the approval of all standard bidding documents in 2008; of these only six are being taken up for private investment. The bidding process for the first three projects has been completed and the contracts have been awarded. Bids have been invited for the remaining three projects. It is recommended that the state governments take up projects in the PPP mode. Recently, Haryana has successfully bid out a PPP transmission project and this experience needs to be replicated.

DISTRIBUTION

15.74 The weakest part of the power sector remains distribution, which is incurring large losses. While

T&D losses at the national level are expected to decline from 29 per cent in 2006–07 to 27 per cent in 2007–08, AT&C losses are reported to be over 30 per cent.¹ This leads to high financial losses. The total losses incurred by the distribution companies, taken together were estimated at about Rs 40,000 crore in 2009–10. These are likely to rise to even higher levels because of the increasing share of short-term purchase of power at high prices. Unless urgent steps are taken to overcome this problem it is difficult to imagine a healthy expansion of the power sector.

15.75 Distribution performance varies considerably across states. Among the major states, Andhra Pradesh, Tamil Nadu, and Himachal Pradesh have reported AT&C losses below 20 per cent. However, in states like Orissa, Madhya Pradesh, Assam, Haryana, Rajasthan, Uttar Pradesh, Uttarakhand, Karnataka, and Maharashtra AT&C losses are reported to be over 30 per cent. State utilities are incurring huge losses due to the unsustainable level of technical and commercial losses caused by pilferage and because of inefficiencies in metering, billing, and collection of revenue.

15.76 Because of these inefficiencies, the power utilities are not able to recover the cost of supply through tariff. While the average cost of supply is likely to increase from Rs 3.68 per unit in 2005–06 to Rs 4.29 per unit in 2009–10 (an increase of 16.2 per cent), the average tariff increased from Rs 2.89 per unit to Rs 3.38 per unit in the same period (about 17.4 per cent). The gap between the two had increased to around 91 paise per unit in 2009–10.

15.77 Although the average tariff charged from consumers in India is one of the highest in the world, the utilities are not able to recover the cost of supply. This can be attributed to two reasons: first, tariff charged from domestic and agricultural consumers is less than the average tariff for all consumers, though cost to supply to such consumers is generally higher;

¹ While T&D losses are the technical losses incurred in transmission and distribution of electricity to the consumer, AT&C represents aggregate technical and commercial losses, which captures commercial losses (covering theft and deficiencies in billing and collection) besides T&D losses and is a true indicator of total losses in the system. It is calculated as $(1 - \text{billing efficiency} \times \text{collection efficiency}) \times 100$.

and second, poor governance and low investment in the distribution network leads to power theft and low recovery. Some state governments partly compensate the utilities by providing a subsidy towards supply to domestic and agriculture consumers. However, the level of subsidy provided in most of the cases is not adequate to make good the losses of the utilities. Poor regulatory practices lead to state regulators being unwilling to fix reasonable tariff rates often reflecting pressure from state governments. This suggests that the independence of the regulatory system is not what it should be. Table 15.13 gives the gap between the average cost of supply and average tariff for 20 major states. State-wise details are given at Annexure 15.4.

15.78 Application of GIS and effective Management Information System (MIS) can help in carrying out load demand–supply analysis and demand forecasting; improve network planning and execution skills; identify the high AT&C loss level areas, and improved billing and revenue collection. MIS would facilitate quick decision-making and improve governance of the distribution sector both in terms of operational and financial performances. This will lead to improved customer services and overall reduction in service costs of the utility.

PAYMENT OF SUBSIDY TO STATE POWER UTILITIES

15.79 Section 65 of the Electricity Act, 2003, provides that state governments may give subsidy in consumer tariffs as determined by the regulatory commission but would be required to pay the amount of subsidy in

advance to the concerned power distribution utilities. However, there is little compliance of these provisions. The subsidy amount in many cases is not being paid in advance. In some states, the subsidy committed has either not been paid at all or has been paid partially. Though, the state commissions generally provide the consequences of non-payment of advance subsidy in line with Section 65 of the Act in their regulations, the provision is generally not implemented in true spirit in the tariff orders passed by them. In some cases, it is also adjusted against interest due or against electricity duty thereby affecting the liquidity of the discoms.

15.80 Under the provision of the Act, power tariff for all categories of consumers was supposed to be brought within 20 per cent of the average cost of supply. This has not happened. A great deal of effort is required for the revision of agriculture tariff and timely payment of the committed subsidy by the states to ensure healthy power utilities.

RESTRUCTURED APDRP IN THE ELEVENTH PLAN

15.81 The Accelerated Power Development Programme (APDP), which was renamed the Accelerated Power Development and Reform Programme (APDRP) in 2002–03 aims at tackling the problems of the distribution sector in a holistic manner. The focus of APDRP is bringing down T&D losses from an unsustainable level of over 30 per cent, to an acceptable level of around 15 per cent, besides improving the distribution chain. As the grant under APDRP was guaranteed, the states did not make efforts to reduce

TABLE 15.13
Financial Performance of 20 Major States, excluding Delhi and Orissa

Particulars	2005–06	2006–07	2007–08	2008–09	2009–10
	Actual	Actual	Actual	Provisional	RE
Energy sold (MU)	3,51,200	3,90,232	4,29,709	4,69,427	5,25,140
Energy sold/energy available (per cent per cent per cent)	65.40	65.41	72.42	74.72	76.27
Revenue from sale of electricity (Rs crore)	1,01,366	1,17,267	1,32,130	1,54,242	1,77,664
Total expenditure (Rs crore)	1,29,140	1,52,933	1,74,021	2,03,097	2,25,282
Commercial losses without subsidy (Rs crore)	20,790	28,356	33,772	40,910	38,420
Average cost of supply (Paise/Kwh)	367.71	391.90	404.97	432.65	428.99
		(6.58)	(10.13)	(17.49)	(16.18)
Average tariff (Paise/Kwh)	288.63	300.51	307.49	328.57	338.32
		(4.12)	(6.77)	(14.22)	(17.47)
Gap between average cost of supply and average tariff (Paise)	79.08	91.40	97.49	104.07	90.68

Note: Figures in the bracket represents increase over 2005–06. See state-wise details in Annexure 15.4.

AT&C losses to the desirable levels and, hence, the APDRP scheme fell short of expectations.

15.82 Recognizing the shortcomings in APDRP, the programme was redesigned and the restructured APDRP scheme was approved in July 2008, with the aim of restoring the commercial viability of the distribution sector by putting in place mechanisms that lead to a substantial reduction in aggregate AT&C losses with demonstrable performance in terms of sustained loss reduction with definite end-points and delivery time lines. Projects under the scheme are to be taken up in two parts. Part A focuses on establishing reliable and automated systems for sustained collection of accurate baseline data, and the adoption of IT in the areas of energy accounting and auditing and consumer base services. Part B includes projects to strengthen the distribution system, including activities like automation and validation of baseline data systems, project evaluations, capacity building, and development of franchisees in the distribution sector, and consumer attitude surveys. Projects under Part B would be taken up after the baseline data is established.

15.83 The total programme size is Rs 51,577 crore over a period of five years. It is expected that Rs 10,000 crore would be spent for Part A projects aimed at developing baseline data and about Rs 40,000 crore for Part B projects. Power Finance Corporation Limited (PFC) would be the nodal agency for operationalizing the programme. As on 31 December 2009, Rs 1,094 crore was released under this scheme, out of which Rs 1,068.57 crore is the loan to PFC to disburse to utilities and Rs 25 crore is a grant to PFC as rolling advance against fee to the nodal agency. PFC in turn has released Rs 692 crore to various states.

15.84 The restructured APDRP has just started and most of the states have yet to complete Part A of the programme. Since losses can reduce only after investment in distribution begins, one will have to watch out for losses to go down in the remaining part of the Plan.

PRIVATE SECTOR IN DISTRIBUTION

15.85 Utilities wishing to involve private sector efforts in reducing distribution losses may either go

in for the privatization of certain areas, or resort to franchise arrangements for services, such as metering, billing, and revenue collection. Some of the major cities, where distribution has been privatized are Kolkata, Mumbai, Delhi, Greater Noida (Uttar Pradesh), Ahmedabad, Surat, and Orissa. T&D losses in some of the cities managed by private companies are noticeably lower than in the publicly managed utilities. Reported loss levels in these cities in 2008 were: CESC Kolkata 14.3 per cent; AEC, Ahmedabad 11 per cent; North Delhi Power Limited (NDPL), Delhi 18.5 per cent; and CESC, Noida 8 per cent (only distribution losses). Initial results of the franchising process in difficult areas like Bhiwandi in Maharashtra are encouraging. Uttar Pradesh recently decided to hand over distribution in Agra and Kanpur to a private company on a franchise basis. Other states should try to replicate similar models in their areas. Some of the best practices adopted by various utilities in the distribution sector are given in Box 15.1.

RAJIV GANDHI GRAMEEN VIDYUTIKARAN YOJANA (RGGVY)

15.86 The level of village electrification varies considerably across the country. While 85 per cent of the villages have been electrified at the national level, the level of village electrification in the states of Orissa, Uttar Pradesh, Bihar, and Jharkhand has been far below the national average. Similarly, the level of household access to electricity in these states was far below the national average of 50 per cent in 2001. In order to accelerate rural electrification and enhance household access, the RGGVY, scheme was started for expanding rural electricity infrastructure in March 2005. The scheme provides 90 per cent capital subsidy for the projects from the Central Government and the balance 10 per cent of the project cost is to be contributed by the states through own resources/loan from financial institutions. A Rs 5,000 crore outlay was provided for the last two years of the Tenth Plan. The government approved the continuation of RGGVY in the Eleventh Plan in order to meet the goal of providing access to electricity to all households, electrification of about 1.15 lakh un-electrified villages, and electricity connections to 2.34 crore BPL households by 2009.

Box 15.1
Best Practices Adopted by Various Utilities in the Distribution Sector

State	Name of the Utility	Theme	Best Practice	Key Description and Benefits
Business Strategy				
Delhi	North Delhi Power Limited (NDPL)	Revenue Management and Monitoring	SAMBANDH (Solution for All Modules in Billing System at North Delhi Power Limited)	This is an IT-based application designed to provide a comprehensive and centralized record of the billing and revenue recovery from various consumer segments. It enables NDPL to assess the performance of the company, zone-wise, district-wise, and at the overall company level.
Andhra Pradesh	Southern Power Distribution Company Limited (SPDCL)	Customer Information Management and Analysis	Consumer Analysis Tool (CAT)	This tool is used to monitor metering, billing, and collection. The reports generated include abnormal consumption, non-functional/ abnormal units, inaccurate billing, non-collection of dues, revenue leakages due to unbilled, inaccurate declaration of tariff categories, multiple connections and under-declared load details that help the management take urgent action on critical issues.
Functional Performance				
Maharashtra	Torrent Power AEC Limited	Distribution Management (Franchisee)	Urban Distribution Franchisee— Bhiwandi Experience	Bhiwandi is a part of Thane district in Mumbai with a total consumer base of 1.4 lakh consumers and a geographical area of 721 sq. km. The consumer base in Bhiwandi largely comprises of power-looms. The area was known for high distribution losses, poor collections, and poor state of infrastructure. It has approx. Rs 800 crore pending arrears to the utility. Torrent Power took over this area in December 2006 and has made a significant impact in terms of improving collections and reducing losses in this area.
Assam	Three distribution companies in Assam	Distribution Management (Franchisee)	Single Point Power Supply (SPPS) Scheme	The scheme termed as the SPPS, under which rural consumers are provided with quality supply and quality services through rural distribution franchisees operating on behalf of the three distribution companies. The scheme led to improvement in revenue collection and management, reduction of administrative overheads, and regularization of unauthorized connections.

(contd...)

(Box 15.1 contd...)

State	Name of the Utility	Theme	Best Practice	Key Description and Benefits
Karnataka	Bangalore Electricity Supply Company Limited	Rural Load Management (RLM)	RLM using Programmable Logic Controllers (PLCs)	The usage of irrigation pumping loads is controlled by using Programmable Logic Controllers (PLCs). PLCs are used for alternate switching in or out IP loads as per demand schedule. The consumers on distribution transformers were split into industrial and rural irrigation categories to facilitate continuous three-phase power supply to non-IP loads.
Karnataka	Bangalore Electricity Supply Company Limited	Energy Audit	Energy Audit at Distribution Transformer Level	DTRs are treated as separate profit centres. Some of the benefits of the scheme were: leakage identification; focused action plan for loss reduction; scientific and reliable loss estimation; and increase in metered consumption.
Uttar Pradesh	Noida Power Company Limited (NPCL)	GIS Implementation	GIS System	NPCL formulated an end-to-end GIS solution for analysing and optimizing the power distribution network. Apart from developing typical facility management applications, an innovative application to detect power pilferage via GIS was developed and deployed to detect network as well as commercial losses (power thefts), a common problem in India and some Asian countries. The implementation of GIS at NPCL provided substantial business benefits to NPCL.
Gujarat	Gujarat Electricity Board (GEB)	Inventory Management	Integrated Inventory Management System	GEB developed a comprehensive plan to solve inventory related problems, including codification of all items and computerization of all records. The measures resulted in a host of benefits to the Board. Based on the success of the programme launched in 13 locations, it was extended to other areas as well.
Maharashtra	Maharashtra State Electricity Distribution Company Limited (MSETCL)	Procurement	e-Tendering	MSETCL implemented process of e-tendering that involved automation of steps involved in the tendering process. The system involves electronic preparation and exchange of tender documents and includes inviting, receiving, and opening of offers from suppliers.

(contd...)

(Box 15.1 contd...)

State	Name of the Utility	Theme	Best Practice	Key Description and Benefits
Customer Service				
Andhra Pradesh	Central Power Distribution Company Limited	Consumer Billing Process	Spot Billing	Spot billing is one alternative for reducing the billing and collection cycle time. The spot billing process helps in integrating various activities being handled by several people at multiple locations into a single-window operation. Initially introduced only in selected pockets of Hyderabad and Secunderabad, it was later extended to the entire towns of Hyderabad, Secunderabad, and Rangareddy.
Delhi	North Delhi Power Limited	Web Portal for hosting Consumer Details	Sugam—Web-hosting of Customer Records	NDPL makes available its billing database to its consumers through the internet. For this effort it was presented with the 'SUGAM' award by the Delhi Government for transparency in its billing database.

15.87 A total amount of Rs 28,000 crore for capital subsidy has been approved for the Eleventh Plan period. The Rural Electrification Corporation (REC) is the nodal agency for the scheme. The cumulative status (Tenth and Eleventh Plans) of implementation of RGGVY as on 1 September 2009 is given in Table 15.14.

15.88 Out of 5,93,732 villages (as per Census 2001), 4,39,800 villages (74 per cent) had been electrified up to 31 March 2005. With the electrification of 64,331 villages under RGGVY, the total villages electrified was 5,04,131 (85 per cent) as on 1 September 2009. It is to be noted that a village is deemed electrified when 10 per cent of the households have electricity. The year-wise targets and achievements are given in Table 15.15.

15.89 MoP is now focusing on the electrification of villages in the four states of Assam, Bihar, Jharkhand, and Orissa, in which 81 per cent of the villages remain to be electrified under sanctioned RGGVY projects. Similarly, for providing electricity connections to BPL households, the ministry is focusing on the 12 states of Andhra Pradesh, Assam, Bihar, Jharkhand, Orissa, Chhattisgarh, Gujarat, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, and West Bengal, which have about 90 per cent of the balance BPL connections under RGGVY.

15.90 While progress on village electrification has been satisfactory, there is clearly very slow progress in providing connections to BPL households (38.3 per cent). A number of habitations in the villages remain uncovered. There is a need to reassess the

TABLE 15.14
Status of Implementation of RGGVY

No. of Projects Sanctioned	Cost of Projects (Rs crore)	Subsidy Released (up to March 2009) (Rs crore)	No. of Villages to be Electrified (Nos)		No. of Free Connections to be Provided (in lakh)	
			Target	Achieved	Target	Achieved
567	26,256.64	13,913.45	1,18,499	64,331	246.06	68.97

TABLE 15.15
Year-wise Targets and Achievements under RGGVY

Year	Un-electrified Villages (no.)			BPL Households (lakh)		
	Target	Achievement	Per cent Achievement	Target	Achievement	Per cent Achievement
10th Plan						
2005–06	10,000	9,819	98.2	3	0.17	5.0
2006–07	40,000	28,706	71.0	40	6.55	16.4
Total	50,000	38,525	77.1	43	6.72	15.6
11th Plan						
2007–08	10,500	9,301	88.6	40	16.21	40.0
2008–09	19,000	12,056	63.5	50	30.85	61.7
2009–10 (as on 1.9.2009)	17,500	4,449	25.4	47	15.18	32.3
Cumulative (as on 1.9.2009)	97,000	64,331	66.3	180	68.96	38.3

programme in consultation with the states on two counts: first, access to power in uncovered habitations, and second, providing power to BPL households. The Programme Evaluation Organization (PEO), Planning Commission has planned a comprehensive evaluation of the scheme and expects that this would be completed by December 2010. Impact of RGGVY on village and household electrification is given in Box 15.2.

Box 15.2
Impact of RGGVY

- RGGVY was launched in March 2005 with the aim of providing access to electricity to all households, electrification of about 1.15 lakh un-electrified villages, and electricity connections to 2.34 crore BPL households by 2009. The scheme provides 90 per cent capital subsidy for the projects. RGGVY was approved for continuation in the Eleventh Plan.
- Under Phase I of the proposed target, 65,140 (56 per cent of the proposed target) un-electrified villages have been electrified and intensification of 90,726 (26 per cent) villages has been achieved. Similarly, 83.25 lakh (21 per cent) households have also been provided connections out of which 72.69 lakh (31 per cent) BPL households have been provided free connections. This has resulted 4.16 crore rural people with access to electricity.
- It is important that the households electrified under the scheme should also get energized at the earliest so as to avoid de-electrification of infrastructure created under the scheme.
- Non-availability of adequate sub-transmission systems in states like Bihar, Jharkhand, and Orissa would delay the implementation of the scheme.

STATUS OF IMPLEMENTATION OF OPEN ACCESS

15.91 A robust trading system is very important for free and fair competitive electricity market operations. Though most of the electricity supply is under long-term contracts, electricity is also traded on a short-term basis. The volume of such trading has increased substantially and trades are occurring at very high prices. The Unscheduled Interchanges (UI) mechanism, meant to ensure grid discipline, is being used by many state power utilities as a trading platform and this is one of the reasons for trading at high rates. Trading of power at high rates has a distortion effect since state utilities are paying very high prices for such purchased power and not reflecting this in the tariff charged from consumers. This will lead to large financial losses, which will have negative consequences on the sector. This problem needs to be tackled by state governments on a priority basis. Ideally, surplus power available with merchant plants should be sold to large consumers via open access. However, the open access provision in the Electricity Act has not been effectively operationalized.

15.92 The Electricity Act, 2003, mandates that non-discriminatory open access for inter-state as well as intra-state transmission and distribution networks be provided by the utilities. In the case of distribution utilities, open access was to be introduced through regulations in a phased manner by the State Electricity Regulatory Commission (SERC) and the act mandated that by January 2009 open access would be available to all the consumers who require supply of electricity,

with the maximum power to be made available at any time exceeding 1 MW.

15.93 Effective implementation of open access is crucial for opening up consumer choices as well as encouraging that a healthy trading function is operational in the country. This is also expected to facilitate: (i) a desired market signal for investment; (ii) inducting improved service from the existing utilities; and (iii) enabling consumers to get power from any source of their choice.

15.94 In order to make open access operational, one of the first requirements is for the appropriate commission to issue relevant regulations and specify related charges, such as the cross-subsidy surcharge, wheeling charge, and transmission charge. Central Electricity Regulatory Commission (CERC) has issued detailed regulations for open access and 23 SERCs too have issued relevant regulations. Most of these SERCs have also notified charges relevant to open access.

15.95 While these regulations have been issued, actual transmission of power through this mode to individual consumers has been negligible. One way of incentivizing open access would be for the Central Government to support the process by allocating 25 per cent of the discretionary power from the central sector generating projects, which is available with the government exclusively for open access. This proportion should be raised to 50 per cent gradually. A committee was formed to consider and operationalize open access under Member (Energy), which has finalized its recommendations. Subsequently, a further set of measures are being planned. There is need to implement these recommendations early.

National Mission on Enhanced Energy Efficiency (NMEEE)

15.96 NMEEE is an initiative proposed to address national problems of inefficient energy use. It is one of the eight missions created by India's National Action Plan for Climate Change and falls within the ambit of the Energy Conservation Act, 2001. The Prime Minister's Council on Climate Change has given an in principle approval to NMEEE. The mission will enable worth about Rs 75,000 crore in energy efficiency.

In doing so, it plans to save about 5 per cent of the country's annual energy consumption by 2015.

15.97 The initiative outlines several actions needed, including the following:

- Perform, achieve, and trade
- Market transformation for energy efficiency
- Financing of energy efficiency
- Power sector technology strategy
- Strengthening of state designated agencies
- Strengthening of the Bureau of Energy Efficiency
- Awareness programmes

15.98 This strategy also includes specific energy consumption decreasing in large energy consuming industries as well as a system for companies to trade energy savings certificates.

15.99 The initiatives taken in reducing the energy intensity of our growth will also reduce the carbon intensity of our growth. This will have a beneficial impact on our emissions trajectory. The most innovative and challenging new initiative to be introduced under the Mission is Perform, Achieve, and Trade (PAT) mechanism which will assign energy efficiency improvement targets to the country's most energy intensive industrial units, with the provision for allowing them to retain any energy efficiency improvements in excess of their target in the form of Energy Savings Certificates, called ESCerts. Units will also be allowed to use purchased ESCerts to meet their targets.

15.100 The other Mission initiatives include expanded use of the carbon market to help achieve market transformation towards more energy efficient equipment and appliances and the creation of funds to help channel investment into energy efficiency projects.

15.101 Another major goal of the Mission is the promotion of the Energy Service Companies (ESCOs), which would upgrade energy efficiency in buildings, municipalities, and agricultural pump sets. Through this business model, ESCOs will invest in energy efficiency investment and will be paid over several years from the resulting energy savings.

FINANCIAL PERFORMANCE

15.102 The Eleventh Plan projected outlay for the power sector is Rs 5,72,648 crore, representing 15.71 per cent of the total public sector outlay. Table 15.16 indicates the progress on Plan expenditure (Centre and states). It may be seen that whereas the Tenth Plan realization of the Plan expenditure was only 67 per cent of the approved allocation, the percentage is likely to increase to 91 per cent in the Eleventh Plan.

WAY FORWARD

15.103 The MTA points to a number of areas where policy initiatives or mid-course corrections are needed in the electricity sector.

GENERATION

- i. It is clear that achieving a quantum jump in capacity addition in the remaining Plan period is going to be a major challenge. Presently, the monitoring is done at the level of the CEA. The Power Project Monitoring Panel (PPMP) with MoP should be used for periodic review of the programme on a zone-wise basis for quick removal of bottlenecks.
- ii. The web-based MIS used by NTPC for its Dadri plant should be used for monitoring project implementation of all new plants.

- iii. There should be indigenous manufacturing capacity for supercritical unit suppliers, both in the public and private sectors and this should be incentivized. The bulk order system envisaged should be implemented in a time-bound manner.
- iv. Policy measures need to be initiated to encourage the setting up of open cycle gas-based plants for meeting peak demand. Differentiated tariff for peak and off-peak supply will encourage the investors to build such plants.
- v. Considering the uncertainty of availability of adequate gas for projects in the Twelfth Plan, policy measures need to be taken to encourage LNG-based power plants.
- vi. Training of skilled personnel should be promoted through the adoption of one ITI per plant.
- vii. One hundred sites should be identified for environmental clearances and acquisition of land initiated to make these ready for future power projects to reduce time taken in pre-project activities.

Transmission

- i. The project for the evacuation of power from the North-Eastern region should be immediately processed by MoP. Land for laying high-voltage transmission lines in the chicken neck area should be immediately acquired.

TABLE 15.16
Financial Performance of the Power Sector

		(Rs crore)		
S. No.	Year	Central	State	Total at Current Prices
1	10th Plan approved	1,77,050.6	93,225.7	2,70,276.4
2	10th Plan realization	91,242.0	90,209.5	1,81,451.6
3	11th Plan projected outlay	3,47,263.4	2,25,384.7	5,72,648.0
4	2007–08 Actual/RE	29,701.0	28,484.8	58,185.8
5	2008–09 Actual/RE	39,817.5	33,413.9	73,231.5
6	Likely achievement in first two years	69,518.6	61,898.7	1,31,417.3
7	2009–10 Approved/Estimated	57,878.7	36,755.3*	94,634.1
8	Likely investment for remaining two years of the 11th Plan period	2,11,311.7#	84,915.6*	2,96,227.3
9	Anticipated investment during the 11th Plan	3,38,709	1,83,569.6	5,22,278.6
10	Utilization (per cent)	97.54	81.45	91.20

Note: # As forecast by the concerned ministries/departments.

* Assumes a 10 per cent growth in nominal terms (for the remaining three years) over the approved level 2008–09.

- ii. Establishing gas-insulated sub-stations should be promoted to bring down the pressure on land acquisition.
- iii. Transmission of power requirements should be reassessed in view of open access requirements.
- iv. Private investment in transmission projects should be actively promoted.

Distribution

- i. The distribution sector requires a robust and reliable MIS to overcome existing information and capability deficiencies. Distribution utilities that have taken proactive measures for measurability, accountability, and governance have been significantly better than others in terms of financial and operational performance.
- ii. The Planning Commission will institute an independent study of the balance sheet situation of public sector discom/SBEs to ascertain their real financial situation as an input into the Twelfth Plan.
- iii. The distribution sector requires substantial improvements in business planning and forecasting to manage its finances and operations better. This would require facilitating Multi-Year-Tariff (MYT) frameworks, as mandated by the Electricity Act, 2003, in the states.
- iv. The distribution sector needs to urgently enhance power procurement and portfolio optimization skills. Many of the present cost problems are on account of poor planning in power procurement and contract management.
- v. The distribution sector needs to improve its network forecasting, planning, and execution skills on an accelerated pace. Networks need to be strengthened to ensure that power distribution capabilities are adequate and efficient. Studies demonstrate that the present levels of technical losses in the networks are unacceptably high in some of the large states.
- vi. Customer service and management methods need to be improved substantially for greater consumer satisfaction and overall reduction in service costs. This would also facilitate implementing cost reflective tariffs and timely payments from consumers.

- vii. Adequate emphasis needs to be placed on quality and monitoring of the restructured APDRP programme's interventions and outputs.
- viii. There should be greater focus on the rights of the customer. There are documented cases of distribution utilities switching off supplies to their own customers to sell power at profit in short-term power market sales. Supply obligations should be enforced and utilities should not be allowed the discretion of cutting off customers to sell in the power market.

POWER REFORMS

- i. Trading of power at very high rates has a distortion effect and threatens to jeopardize the financial viability of distribution companies. Urgent steps are needed to bring the practice under appropriate discipline.
- ii. Open access facility to consumers is presently ineffective due to the reluctance of state utilities. The recommendations of the Open Access Task Force Committee should be implemented. In particular, Load Despatch Centres should be made independent and open access promoted by providing one-fourth of unallocated CPSUs power to incentivize states. In case of all new CPSU plants, it should be increased to 50 per cent.
- iii. Differential peak power tariff rates should be notified to restrict demand at peak hours.
- iv. Energy audit of power utilities using IT.
- v. Free power to farmers needs metering and upfront subsidy by states. The programme for separation of feeders in rural areas as in Gujarat, Rajasthan, Haryana, and Andhra Pradesh should be implemented.

PETROLEUM AND NATURAL GAS SECTOR

15.104 The central feature of the petroleum and natural gas sector is that domestic availability of oil resources is limited and rapid economic growth means that demand will rise rapidly. India's import dependence has, therefore, been rising and is currently 78 per cent for oil. This is bound to increase in the future unless there is some unexpected domestic oil discovery. Such high import dependence inevitably raises concerns about energy security. It also raises

concerns about the volatility of oil prices. Domestic policy must be formulated to reflect these concerns.

15.105 Currently, the share of natural gas in the energy basket is only 12 per cent which is quite low compared with the global average of 24 per cent and efforts need to be made to increase this share progressively to 20 per cent. Large discoveries of natural gas resources in KG basin and creation of LNG import capacities in the country have been helpful in increasing the share of natural gas in energy basket permitting replacement of liquid fuels by natural gas in transport, power, fertilizer, petrochemicals, refineries, households and many other fuel intensive sectors.

THRUST AREAS IN ELEVENTH PLAN

15.106 The policy issues that needed to be addressed and identified as such in the Eleventh Plan are oil and gas security, pricing of petroleum products, pricing of domestically produced natural gas and its allocation, ensuring competition and open access in the pipeline transportation and distribution grid and conservation of petroleum products and natural gas. Some of the specific areas for action in the petroleum sector are as follows.

- **Attaining Energy Security**
 - Enhanced exploration and production (E&P) of domestic oil and gas sources
 - Acquisition of equity oil and gas abroad
 - Development of Alternative Fuels—CBM, Gas Hydrates, Underground Coal Gasification, Ethanol for Blending with petrol and bio-diesel
 - Developing gas/LNG import infrastructure to meet the growing demand
- **Reforms in Pricing and Rationalization of Taxes**
 - Full price competition at refinery gate and retail level aligning fuel prices with global trends
 - Phasing out subsidies on domestic LPG and PDS kerosene
 - Unified State Taxes and Removal of Tax Anomalies
 - Natural gas prices to market parity
- **Infrastructure Development**
 - Strategic crude oil storage
 - Development of product pipelines

- Marketing and distribution facilities
- Development of natural gas pipelines

PRODUCTION AND IMPORTS

15.107 Achievement of oil production against the Eleventh Plan target is expected to be 91 per cent for ONGC and 95 per cent for Oil India Limited (OIL). There would be an overall shortfall of about 10 per cent in crude oil production mainly due to delayed implementation of Cairn India's oil field project in Rajasthan and delays in the execution of other projects. Natural gas production is likely to be 4.5 per cent lower than the target because of delay in the completion of the KG basin gas discovery by Reliance. Corrective measures for oil production need to be taken to enhance the production by ONGC and OIL to meet the targets. While the gas production targets during the balance period of the Eleventh Plan could be enhanced by Reliance India Limited (RIL) to cover the shortfall, a matching transportation infrastructure would be necessary. However, crude oil and natural gas production in the Eleventh Plan is likely to be higher by 11.2 per cent and 53 per cent respectively over the Tenth Plan production. An overview of the physical performance of the petroleum and natural gas sector is given in the Table 15.17.

EXPLORATION EFFORTS—NEW EXPLORATION LICENSING POLICY

15.108 There has been a sharp increase in the exploration activity after the launch of the New Exploration Licensing Policy (NELP) in 1997–98. Only 50 per cent of the total sedimentary area has been explored, out of a total area of 3.14 million sq. km. in 26 sedimentary basins, including the deep water area of 1 million sq km. Expansion of domestic resources is being done through award of NELP blocks to discover oil and gas reserves. So far, 203 blocks have been awarded, 70 blocks were offered under the NELP 8th round. Currently our reserve replacement ratio is 1.3, which is higher than the current production levels of ONGC and OIL. The trend is likely to remain the same during the rest of the Eleventh Plan period.

15.109 The production from the KG basin D-6 field has already started and many other blocks are under

TABLE 15.17
Physical Performance of the Petroleum and Natural Gas Sector

S. No.	Item	11th Plan Target	Actual 2007–08	Actual 2008–09	Projected			Total Anticipated in 11th Plan
					2009–10	2010–11	2011–12	
1	Crude oil production (MMT)	206.73	34.13	33.51	35.95	40.40	42.88	186.86
2	ONGC	140.06	25.94	25.37	25.76	25.43	26.58	129.08
3	OIL	18.99	3.10	3.47	3.57	3.65	4.3	18.09
4	PVT. JVC	47.71	5.08	4.67	6.62	11.32	12.00	39.69
5	Gas prod. (BCM)	255.76	32.39	32.85	50.24	60.02	68.02	243.52
6	ONGC	112.39	22.33	22.49	22.29	21.48	25.16	113.76
7	OIL	16.43	2.34	2.27	2.51	2.62	3.56	13.30
8	PVT. JVC	126.45	7.72	8.09	25.43	35.92	39.30	116.46
9	Refining capacity (MMT)	240.96	148.97	177.97	210.97	225.87	255.83	255.83

the appraisal and development phase. Budget 2009–10 provided for tax holidays for the blocks offered under the 8th round award. While this is a positive step, the allottees of previous rounds are also demanding similar benefits.

15.110 Improvement in oil recovery is one of the major areas in which efforts are being made by both ONGC and OIL as these companies have been producing oil and gas for the last 30–40 years from a number of major oil fields which are now on a decline. This requires an understanding of the sub-surface (reservoir characterization). The decline in production is being arrested by several Improved Oil Recovery (IOR)/Enhanced Oil Recovery (EOR) programmes. A number of water injection schemes and gas lift and air injection programmes have been taken up by ONGC and OIL to maintain production levels and arrest decline in production. At the current level the recovery factor of oil from various reservoirs is estimated at 30–32 per cent. However, with the continued implementation of IOR/EOR programmes the ultimate oil recoveries up to 40 to 45 per cent and more could be achieved depending on the reservoir characteristics in the different basins.

15.111 Drilling of horizontal wells and well stimulation technologies would continue to be the key to improved recoveries of oil and gas. New products and technologies would need to be developed not only for ensuring drilling of healthy wells but also for future interventions for corrective action (work-over)

to enhance the recovery of oil from various existing producing fields.

15.112 The accretion of reserves during the first two years of the Plan by ONGC is 182.23 and 284.81 MMTOE representing 114 per cent and 178 per cent achievements of the Annual Plan targets. ONGC has made 25 new discoveries during the first two years of the Plan. Reserve accretion target by OIL has been achieved to the extent of 47 MMTOE (89 per cent) during the first two years of the Plan period.

Consumption of Petroleum Products

15.113 The consumption of petroleum products as per the Eleventh plan was estimated to reach 131.8 mt (Base Case) and 141.8 mt (Upper Case) by the terminal year of the Eleventh Plan against a consumption of 120.74 mt in 2006–07. However, the consumption of petroleum products saw growths of 6.7 per cent and 3.5 per cent during 2007–08 and 2008–09 respectively and has surpassed the consumption level projected during the first two years of the Eleventh plan period. The growth in demand of petroleum products is expected to be 3.5 per cent during 2009–10 as per the estimates of the Petroleum Planning and Analysis Cell (PPAC). The decline in demand of liquid fuels is largely due to the fact that large quantities of liquid fuels like naphtha and FO/LSHS have been replaced by natural gas. The Table 15.18 gives the estimates for the Eleventh Plan and the actual consumption levels. The industry imported 121.67 mmt per annum (MMTPA) and 128.15 MMTPA of crude oil during

2007–08 and 2008–09, while product exports were 40.77 MMTPA and 36.93 MMTPA respectively during the same period.

REFINING CAPACITY BUILD-UP

15.114 The total refining capacity in the country at the end of the Tenth Plan was 148.97 mmt, which was projected to be in 255.83 mmt by 2011–12. The current refining capacity is 182.09 MMTPA, reflecting about 36 per cent realization of the Eleventh Plan target in the first two years and four months of the Eleventh Plan period. This includes Reliance's second refinery (export-oriented unit) at Jamnagar with a capacity of 29 million tonnes, which started operations in December 2008.

15.115 Currently three grassroot refineries in JV at Bhatinda refinery of 9 MMTPA, Bina of 6 MMTPA, and Paradip of 15 MMTPA with an aggregate refining capacity of 30 mt are under construction. These refineries are being constructed with state-of-the-art technologies to process any quality of crude and yield maximum distillates at benchmark efficiencies. Besides this, some refineries are implementing expansion of

existing capacities in Panipat, Mangalore, and Koyali in Vadodara. The refining capacity targets of 255.83 MMTPA are expected to be achieved by the end of the Eleventh Plan.

FINANCIAL PERFORMANCE

15.116 The total public sector outlay for the petroleum and natural gas sector is Rs 2,29,278.72 crore for the Eleventh Plan. As against this, the revised total outlay proposed is Rs 2,69,461.28 crore, after accounting for mid-course adjustments in the planned projects proposed to be taken up during the Plan. The revised outlay is 17.5 per cent higher than the approved outlay. The actual expenditure during the first two years and four months was Rs 1,08,625.91 crore, which is 47.38 per cent of the Plan approved outlay. Activity-wise and company-wise outlay and expenditure during the first two and a quarter years of the Eleventh Plan is given in the Table 15.19.

15.117 It may be observed that there has been an increase in anticipated investment in E&P activities aggregating Rs 1,75,263.82 crore, as against the Eleventh Plan outlay of Rs 1,50,932.49 crore (16 per cent

TABLE 15.18
Consumption of Petroleum Products

Case	2007–08	2008–09	2009–10	2010–11	2011–12
Base	116.1	119.10	122.00	127.0	131.8
Upper	117.6	122.00	127.80	136.6	141.8
Actual/Anticipated consumption	128.94	133.40	138.11**	145.02*	152.2*
Net imports	103.33	109.51	111.50	114.50	120.00

Note: * Assumed 5 per cent growth for 2010–11 and 2011–12 over the consumption level of 2009–10.

** Provisional.

TABLE 15.19
Eleventh Plan Outlay/Expenditure for Petroleum and Natural Gas Sector

Activities	11th Plan Outlay	Total Exp. (up to August 2009)	Per cent Exp.	11th Plan Outlay Now Proposed
Exploration & production	1,50,932.49	81,071.56	53.71	1,75,263.82
Refinery & marketing	62,582.10	18,502.37	29.60	78,321.09
Petrochemical	15,321.00	9,014.91	58.82	15,678.37
Engineering	236.00	37.07	7.12	198.00
Total	2,29,071.59	1,08,625.91	47.38	2,69,461.28

increase). The increase is mainly due to drilling and other operational costs for maintaining the production of oil and gas. The refinery and marketing sector also expects an increase in outlays by 29.6 per cent due to increase in refinery and other pipelines infrastructure project costs.

15.118 The total Plan outlay is funded from internal and extra budgetary resources of oil PSUs. GBS is limited to Rs 285 crore for setting up the Rajiv Gandhi Institute of Petroleum Technology (RGIPT) and Rs 50 crore was provided during 2008–09 and 2009–10.

REGULATORY REGIME

15.119 The Integrated Energy Policy approved by the government in December 2008 has made the following recommendations on strengthening the regulatory system in the oil and gas sector:

- i. To ensure effective competition in the oil and gas sector it is important to establish independent oversight of both upstream and downstream activities. The role of the regulator in a competitive market is not to fix prices but to ensure open access to common infrastructure and to regulate user charges for infrastructure, such as gas pipelines and port facilities. The regulator should also ensure that markets, such as those for city gas distribution, are not cornered to prevent competition.
- ii. On the upstream side, Directorate General of Hydrocarbons (DGH), an arm of the ministry, currently oversees allocation and exploitation of oil and gas reserves and enforces profit sharing with E&P companies. It is essential for DGH to be strengthened and made independent of the ministry.
- iii. The Petroleum and Natural Gas Regulatory Board (PNGRB), created by the government in 2007 to regulate downstream operations has initiated activities on grant of authorization for natural gas pipelines and city gas distribution systems. However, it is yet to be authorized to create full-scale competition for supply of petroleum products in the domestic market, as petroleum product prices are still controlled by the government and are yet to be notified to be handled by PNGRB.

PRICING REFORMS OF OIL PRODUCTS

15.120 Currently, the prices of four sensitive products, petrol, diesel, PDS kerosene, and domestic LPG are controlled by the government and continue to be regulated. As a result, prices paid to the refineries for these products are significantly below world market prices. The discrepancy is made up by a deliberate ‘under-recovery’ by upstream crude oil producers as well as by the refineries, and by support from the government in the form of cash and bonds. Recognizing that this system was not viable, the Ministry of Petroleum and Natural Gas (MoP&NG) constituted a high level committee under the chairmanship of Dr Kirit Parikh to examine the pricing policy and to recommend a transparent system of subsidies. The committee submitted its report on 2 February 2010 and has made recommendations for bringing petroleum product prices, especially petrol and diesel prices, at market price parity. The committee has observed that the present system of price control has resulted in major imbalances in the consumption pattern of petroleum products in the country, and has put undue stress on the finances of the PSU Oil Marketing Companies (OMCs) as well as on the government. It has also led to the withdrawal of private sector OMCs from the market. This has also affected competition of petroleum product marketing by OMCs in the country.

15.121 Persisting with a system of petroleum pricing that is not aligned with world prices is fundamentally unviable for a commodity which is 78 per cent imported. There is a clear need to ensure that prices of petroleum products are based on market price parity, and subsidies are given to BPL families only.

OIL SUBSIDIES AND UNDER-RECOVERIES

15.122 The total under-recoveries and subsidy provided for the petroleum sector during the first two years of Eleventh Plan are given in Table 15.20.

Recommendations made by the Kirit Parikh Committee

15.123 Several recommendations were made by the Kirit Parikh Committee on freeing petroleum product prices to align them with market price parity.

TABLE 15.20
Under-Recoveries on Petroleum Products

	(Rs crore)		
	2007–08	2008–09	2009–10
1 Under-recovery	77,123	1,03,292	46,163
(a) Borne by upstream	25,708	32,000	14,520
(b) Oil bonds/Cash subsidy to PSUs	35,290	71,292	12,000
2 Fiscal subsidy	2,640.60	2,688.42	2,770
3 Assistance for far-flung areas	28.27	22	22
4 Gap			19,643
Total	80,012.38	1,06,011.9	48,955

15.124 Petrol is largely an item of final consumption. An analysis of the trend of petrol consumption by automobile owners reveals that increase in prices of petrol can be borne by motorized vehicle owners.

15.125 The impact of the retail price of diesel on various groups of consumers does not find any compelling reason to subsidize them. Diesel prices should, therefore, be adjusted to market parity. Under-recoveries in both petrol and diesel should be nil.

15.126 The higher excise duty on petrol compared to diesel encourages use of diesel cars. While greater fuel efficiency of a diesel vehicle should not be penalized, a way needs to be found to collect the same level of tax that petrol car users pay from those who use a diesel vehicle for passenger transport. An additional excise duty should be levied on diesel car owners.

15.127 A transparent and effective distribution system for PDS kerosene and domestic LPG can be ensured through the UID/smart cards framework.

15.128 There is disparity in per capita allocation of PDS kerosene amongst states, as also a decline in the percentage of households using kerosene. PDS kerosene allocation across states should be rationalized to bring down the all-India allocation by at least 20 per cent. Further reduction in PDS kerosene allocation can be done on the basis of progress made in rural electrification and the availability of LPG and piped gas.

15.129 The price of PDS kerosene needs to be increased by at least Rs 6 per litre. The price of PDS kerosene needs to be raised every year in step with the growth in per capita agricultural GDP at nominal prices.

15.130 For calculation of the under-recoveries incurred by the OMCs on sale of PDS kerosene and domestic LPG, the methodology based on import parity pricing may be continued so long as the country remains a net importer of kerosene and LPG.

15.131 OMCs marketing PDS kerosene and domestic LPG should be compensated fully for their under-recoveries based on this mechanism. A market-determined pricing system for petrol and diesel can be sustained in the long run by providing a level playing field and promoting competition among all the players, both public and private, in the oil and gas sector. Adequate regulatory oversight is critical for ensuring effective competition.

15.132 The recommendations made by the Kirit Parikh Committee will have the following implications on under-recoveries:

- Under-recoveries due to petrol and diesel will be nil
- Kerosene allocation will be reduced by 20 per cent and periodically revised downwards
- The reduction in under-recovery would be Rs 5,390 crore if the PDS kerosene price is increased by Rs 6 per litre
- Raising LPG price by Rs 100 per cylinder to reduce under-recovery by Rs 7,580 crore

15.133 If product prices at the 2009–10 international parity are applied, the total reduction in the under-recovery will be Rs 30,451 crore. The current estimate for under-recoveries in 2009–10 is around Rs 45,571 crore. Thus the under-recoveries will come down by 67 per cent to Rs 15,120 crore which should be quite manageable.

Un-utilized Infrastructure of Private Companies

15.134 The private oil companies have developed a large marketing infrastructure throughout the

country and had achieved a market share of about 20 to 22 per cent as long as the product prices for MS and diesel in the country were close to the import parity. Subsequently, in 2007, when the import parity price for petroleum products became higher than the government notified price, marketing operations for sale of petroleum products were closed down by these private companies. Currently, the marketing operations of these companies are idle as they do not form a part of the subsidy sharing mechanism, which applies only to PSU marketing companies.

15.135 A policy to ensure effective use of this infrastructure needs to be evolved.

Policies for Security and Investment

15.136 Enhanced exploration and development of oil and gas blocks through NELP is a continuous process. The Eleventh Plan envisaged bringing more and more acreage under exploration, especially those in the frontier areas/basins, adoption of state-of-the-art E&P technology, faster development of discovered reserves, and development of marginal fields and continuation of IOR and EOR schemes. Besides 203 NELP blocks awarded under seven rounds of bidding, CBM blocks have also been awarded under four CBM rounds of bidding. The production from some of the CBM blocks has already started and is likely to pick up during the Eleventh Plan. An estimate of 38 MMSCMD of peak production has been estimated by MoP&NG from CBM blocks.

Acquisition of Oil and Gas Assets Overseas

15.137 ONGC Videsh Limited (OVL) holds 40 assets overseas in 16 countries and produces about eight MMTPA of oil and gas. The exploration blocks being developed by OVL would further add to the production of oil and gas.

15.138 At present, OVL, the front runner in this regard has a presence in 16 countries—Sudan, Syria, Vietnam, Myanmar, Brazil, Iraq, Cuba, Congo, Libya, Russia, Colombia, Venezuela, Egypt, Iran, and Nigeria and has 40 projects in hand. Other PSUs, such as IOCL, OIL, BPCL, and HPCL have also acquired some E&P assets abroad in the recent past. OVL had utilized 49.89

per cent of its Eleventh Plan outlay of Rs 45,334 crore up to June 2009.

15.139 OVL is likely to achieve the Eleventh Plan target of 30.045 MMTPA for oil production and 9.278 BCM of gas production for the entire Plan period. The year-wise targets and achievements of O and OEG produced by OVL during first two years and four months are given in Table 15.21.

TABLE 15.21
Oil and Oil Equivalent Gas Produced Abroad by OVL
(in MMTOE)

Year	Target	Achievement
2007–08	7.988	8.802
2008–09	8.65	8.776
2009–10	8.48	8.140*

Note: *Achievement for 2009–10 (RE).

Developing a Nation-wide Gas Grid

15.140 There is an urgency for developing a country-wide gas pipeline transportation infrastructure for making gas available in major parts of the country. In 2008, the MoP&NG authorized Gail India Limited to lay six major pipelines covering a 5,500 km gas grid in the southern and eastern parts of the country. Besides this, private players were also authorized to lay about a 2,600 km long pipeline network in the southern region mainly on the east coast. As gas availability in the country is likely to increase due to production coming from the new discoveries, there is an urgency to develop these gas pipeline networks by the end of the Eleventh Plan.

WAY FORWARD

15.141 The petroleum and natural gas sector needs the following immediate policy initiatives and infrastructure development measures to make the sector globally competitive:

- i. Decontrol the price of petroleum products and progressively bring prices of all petroleum products at market price parity.
- ii. Subsidies on LPG and kerosene should be for targeted groups and should be need-based.

- iii. There is an urgency to provide unified tax on petroleum products as well as natural gas. The more rational approach would be to put both petroleum products and natural gas under the declared goods status so that the price of natural gas and petroleum products in all parts of the country is uniform.
- iv. The proposed major gas pipelines in the southern, eastern, and northern regions need to be completed during the Eleventh Plan facilitating the completion of the national grid.
- v. Efforts to enhance exploration of oil, specifically natural gas, under NELP should be intensified and bidding for CBM and underground coal gasification projects should be further explored. Fiscal incentives similar to those for exploration of oil need to be extended to all forms of natural gas exploration and exploitation.
- vi. Developing the full potential of CBM, shale gas, underground coal gas, gas hydrates, and bio-fuels to reduce the import dependence of hydrocarbons.
- vii. Enhancing efforts to acquire overseas oil and gas assets, sourcing of natural gas through LNG imports and pipelines.
- viii. Strengthening the role of the regulators in the upstream and downstream oil and gas sector.

NEW AND RENEWABLE ENERGY SECTOR

INTRODUCTION

15.142 As per a detailed exercise carried out in consultation with the Planning Commission in the beginning of the Eleventh Plan the Ministry of New and Renewable Energy (MNRE) grouped various programmes of the ministry under six major programmes on the basis of the objectives of the programmes:

- i. Grid-Interactive Renewable Power
- ii. Off-Grid/Distributed Renewable Power
- iii. Renewable Energy for Rural Applications
- iv. Renewable Energy for Urban, Industrial, and Commercial Applications
- v. Research, Design, and Development
- vi. Supporting Programmes

THE THRUST AREAS IDENTIFIED FOR THE ELEVENTH PLAN

15.143 The following thrust areas in renewable energy were identified in the Eleventh Plan:

- Meeting basic energy needs in the rural areas through locally available renewable energy resources like biomass, solar, small hydro, and wind projects.
- Identifying remote areas where power supply from the conventional grid will be prohibitively expensive and providing off-grid supply from renewables for these areas on a priority basis.
- Clarifying the framework for supply of power from renewable energy resources to the main grid by providing regulatory certainty on tariff, off-take agreements, and directly contracted sale to bulk users.
- Maximizing the benefits from renewable energy investments by promoting a bidding process for available subsidies.
- Optimizing energy plantations by raising plants on degraded forest and community land.
- Conducting a comprehensive review of programme objectives, achievements to date, and efficacious use of funds by all concerned.

CLIMATE CHANGE CONCERNS

15.144 Renewable energy sources—solar, wind, small hydro, and bio-power—have an important role to play in supplementing conventional power generation and meeting basic energy needs, especially in rural and remote areas. The distributed nature of renewables can provide many socio-economic benefits. The Integrated Energy Policy approved by the government assesses that the contribution of renewable energy sources in the energy mix would be 5–6 per cent by 2032.

15.145 With the issue of climate change gaining momentum, the prospects for adopting renewable energy have become more favourable. The National Action Plan on Climate Change (NAPCC) has also one mission dedicated to the promotion of solar energy. Some renewable energy projects like hydro, wind, solar, and biomass-based projects have mitigated their technology and/or financial risks by using the clean development mechanism. The government

is trying to push the Programme of Activities (PoA) under CDM. The first PoA of distribution of CFL lamps on a large scale by the Bureau of Energy Efficiency (BEE) has already been registered by the CDM executive board and is operational. India, along with other developing countries, has been pushing for reforms in CDM under the United Nations Framework Convention on Climate Change (UNFCCC) so that the process can be simplified and transaction costs lowered.

15.146 The government intends to make use of clean technologies and financial resources on a large scale as soon as the mechanism for their transfer from developed countries is finalized and adopted by the parties under the UNFCCC.

15.147 This should result in a revenue stream whereby repayments can be made. In this context, it is necessary for a fundamental re-examination of the approach to the renewable energy sector to derive maximum benefits resulting out of CDM initiatives. All renewable energy initiatives are environment-friendly and thus become eligible under CDM funding.

GENERATION TARGETS AND ACHIEVEMENTS— ANALYSIS OF SHORTFALLS

15.148 In terms of physical achievements, grid-interactive electricity generation capacity of 5,526 MW (up to 31 January 2010) had been achieved against the Eleventh Plan target of 11,829 MW, which is 46.7 per cent of the target. This means that a major proportion of the target, that is, 53.3 per cent is to be achieved in the remaining two years of the Eleventh Plan (programme-wise details are given in Table 15.22).

15.149 With respect to wind power, the shortfall in achievement in 2008–09 was due to regulatory issues in a few states and local problems, such as Maharashtra preventing wind power development in the potential areas and a non-conducive investment environment due to the global economic recession. The delay in introducing Generation Based Incentive (GBI) was also a constraint. The delay in announcing an appropriate tariff to absorb wind power by the utilities also acted as a constraint in many states.

TABLE 15.22
Progress of Renewable Energy Programme

Programme	Eleventh Plan Target	(in MW)	
		Achievement (as on 31 January, 2010)	Anticipated Achievement (at the end of Eleventh Plan)
Wind power	10,500	3,857	9,000
Small hydro	1,400	620	1,000
Bio-power	1,700	1,026	1,700
Waste-to-power	400	20	79
Solar power	—	3	50
Total	14,000	5,526	11,829

15.150 In the case of small hydropower development, the main constraint was the process of allotment of sites by the states. Statutory clearances, including land acquisition, forest clearance, and irrigation clearance take a lot of time. Non-availability of adequate evacuation facilities (transmission lines) is also a constraint in developing small hydropower in the North-Eastern states.

15.151 Studies initiated by the ministry on the performance of grid connected biomass projects have indicated that suitable fuel supply linkages for biomass collection and management need to be encouraged for ensuring continuous availability of biomass in a sustainable manner. The MNRE is taking necessary steps to incentivize the same. Further, in order to resolve the issues being faced by cooperative sector sugar mills, MNRE is taking necessary steps to support implementation of co-generation projects in the cooperative sector sugar mills through the BOOT model.

Solar power projects face the constraint of high initial costs as well as high costs of electricity from such projects. These projects are being promoted under the National Solar Mission recently approved by the government.

POLICY INTERVENTIONS

- a. MNRE programmes have been supported through a number of financial, fiscal, physical, and institutional initiatives for a little over two and half decades. Lack of involvement of end-beneficiaries, developing viable integrated resource plans for

Box 15.3 National Solar Mission

Salient Features

- i. To create an enabling policy framework for deployment of 20,000 MW solar power by 2022 of which 1,000 MW would come by 2013.
- ii. To promote off-grid applications starting with 200 MW by 2013 and reaching 1,000 MW by 2017 and 2,000 MW by 2020–22.
- iii. To deploy 20 million solar lights by 2022.
- iv. To install 20 million sq. m of solar collector area for solar thermal applications by 2022.
- v. To establish a National Centre of Excellence (CoE) for promoting R&D activities under the Solar Mission.
- vi. To set up an 'Industry Advisory Council' under the Solar Mission to advise on matters relating to industrial development, technology transfer/absorption/joint ventures, incentives, and investments.
- vii. To set up a 'Research Advisory Council' to advise on vision and technology related matters and coordination with other S&T ministries/organizations.
- viii. To provide fiscal incentives by way of 5 per cent of basic custom duty for manufacture of solar equipment and components and 'nil' CVD on goods for solar energy-based power projects.
- ix. To put in place a suitable policy and regulatory framework, including modification of the existing tariff policy to require state electricity regulators to fix a percentage of energy purchase from solar power under the Renewable Purchase Obligation (RPO).
- x. Total financial outlay for Phase 1 of the National Solar Mission is approved at Rs 4,337 crore.

end users, engaging utilities, and service providers into the MNRE programmes, and integrating multiple efforts both in MNRE and in other ministries have all prevented the mainstreaming of non-conventional energy programmes.

- b. The success of the programme to electrify remote villages entirely depends on the creation of a 'revenue model', which would ensure the sustenance of the programme in the long run. The role of grassroots institutions like PRIs, NGOs, and cooperatives is very important from the point of view of revenue collection, local management, and O&M. As of now such institutional mechanisms are absent in many remote areas and concerted efforts are needed to set up such institutions.
- c. The financial review of the first three years of the Eleventh Plan reveals that the budgetary allocations are not a constraint since actual expenditure is always well below the provisions made. Crafting a programme as proposed under paragraphs (a) and (b) above, creating a demand pull, developing an efficient institutional framework, improving coordination within the various MNRE programmes, the various central ministries, the Centre, and the states, are the overriding needs for achieving desired objectives/goals.
- d. Evaluation of renewable energy programmes is necessary for improving their effectiveness. A change in the incentive regime is necessary such that it targets the real barriers to renewables and links them to the desired deliverables from such programmes. Progress needs to be made on regulatory regimes that ensure necessary support to the renewable energy sector in terms of tariff fixation, wheeling, banking, and third party sale of power from renewable sources.
- e. The subsidy pattern needs to be uniform both for government as well as private projects. This would ensure providing a level playing field to promote competition.
- f. The village energy security initiative of MNES through biomass should be dovetailed to the ongoing programmes under MoP. MoP has developed a Decentralized Distributed Generation (DDG) initiative under the RGGVY programme that includes both grid-based and stand alone solutions. The two efforts need to be better coordinated.
- g. A national policy on rural electrification and stand alone systems (including renewable and

non-conventional energy systems) is already in place. The MoP and MNRE need to work together to frame appropriate policies governing the issues mentioned above.

ENERGY AND EMISSION INTENSITY OF GDP

15.152 The demand for commercial energy has been growing with the growth of the economy. However, India's energy intensity has been declining and is lower than most emerging economies, including China.

15.153 The indicator of energy-GDP elasticity captures both the structure of the economy as well as its energy efficiency. The consumption of commercial energy increased from 95.81 mtoe in 1980–81 to 434.41 mtoe in 2008–09. The GDP growth rate over this period was around 6.3 per cent yielding a commercial energy-GDP elasticity of 0.91.

15.154 India's emissions intensity of GDP² was 1.785 kg per dollar in 1990. Over the 15-year period from

1990 to 2005, India's economy grew at an annual average rate of 6.1 per cent and emissions intensity declined by 17.6 per cent, from 1.785 in 1990 to 1.471 in 2005. The implicit elasticity of emissions with respect to GDP in this period was 0.83. Using this elasticity, and projecting for the next 15 years with a faster GDP growth of 8 per cent per annum, we can expect a further decline in the emissions intensity to 1.216, i.e., a reduction of 17.3 per cent by 2020 over the 2005 base.

15.155 However, with concerted efforts, we can do even better. The Planning Commission has constituted an expert group under the chairmanship of Dr. Kirit Parikh to develop a roadmap of low carbon strategies for inclusive growth. The recommendations of the expert group will feed into the Twelfth Plan to formulate a growth strategy that is sustainable, ensures energy security, and is consistent with the NAPCC.

² Emissions intensity is taken as kg of CO₂ per dollar of GDP. Emissions data is taken from International Energy Agency (IEA). GDP is taken at constant 1990 prices converted to US\$ at 1990 exchange rates from UN Stats database. Based on IRADe (Integrated Research and Action for Development) analysis.

ANNEXURE 15.1
Company-wise Coal Production-MTA of the Eleventh Plan (Coal Sector)

(in million tonne)

S. No.	Company	X Plan		Eleventh Plan							
		2006-07		2007-08		2008-09		2009-10		2011-12	
		Target	Actual	Target	Actual	Target	Actual	Target	RE	Original Target	MTA Revised
1	ECL	31.00	30.47	33.41	24.06	31.00	28.14	31.00	31.00	46.00	36.00
2	BCCL	33.00	24.21	25.20	25.22	26.50	25.51	28.00	28.00	30.00	30.00
3	CCL	43.30	41.32	44.00	44.15	47.00	43.24	48.00	48.00	78.00	54.00
4	NCL	52.00	52.16	58.00	59.62	61.25	63.65	66.50	66.50	70.00	76.00
5	WCL	37.50	43.21	42.40	43.51	43.05	44.70	45.00	45.00	45.00	47.00
6	SECL	84.55	88.50	91.50	93.79	96.00	101.15	106.00	106.00	111.00	117.00
7	MCL	68.00	80.00	88.00	88.01	99.00	96.34	109.30	109.30	137.00	125.10
8	NEC	0.65	1.05	2.00	1.10	1.20	1.01	1.20	1.20	3.50	1.40
	Sub-total CIL	350.00	360.92	384.51	379.46	405.00	403.74	435.00	435.00	520.50	486.50
	Category:										
	Existing mine	25.50	34.80		32.90	31.80		30.90			
	Completed projects	200.80	230.94		207.27	229.17		196.82		185.97	
	Ongoing projects	44.59	95.95		129.53	155.58		180.58		165.31	
	New projects	79.11	0.23		9.76	28.45		26.70		169.22	
	Total	350.00	361.92		379.46	445.00		435.00		520.50	
9	SCCL	36.13	37.71	38.04	40.60	38.30	44.54	44.50	44.50	40.80	47.00
	Category:										
	Existing mine	3.87	1.89	1.74	1.86	1.60	2.17	1.79	1.90	1.20	1.41
	Completed projects	19.03	32.86	25.70	33.93	25.48	28.74	24.88	25.23	17.66	24.33
	Ongoing project	9.22	2.96	10.34	4.81	10.07	13.63	17.80	17.87	13.62	20.78
	New projects	4.01	0.00	0.25	0.00	1.15	0.00	0.03	0.00	8.33	0.49
	Total	36.13	37.71	38.04	40.60	38.30	44.54	44.50	44.50	40.80	47.00
10	Others Pub. Sec#		1.77	1.92	2.10	2.02	1.83	1.92	1.92	2.52	2.52
11	Pvt TISCO		7.04	6.50	7.21	6.50	7.28	7.30	7.30	6.50	6.50
11	Captive		17.60	23.93	21.16	36.22	29.85	37.11	37.11	104.08	80.89
12	Meghalaya		5.79	5.60	6.54	5.60	5.69	6.50	6.50	5.60	6.50
	Total	18.87	32.20	37.95	37.01	50.34	44.66	52.83	52.83	118.70	96.41
	All-India Total	405.00	430.83	460.50	457.08	493.64	492.94	532.33	532.33	680.00	629.91

Note: # Includes IISCO, DVC, JSMDCL, JKML, and APMDTCL.

Production from other private sector, TISCO, and Meghalaya for 2011-12 is taken as actual production from these sectors in 2008-09.

ANNEXURE 15.2
Sectoral Coal Demand/Off-take—MTA of the Eleventh Plan (Coal Sector)

(in million tonne)

S. No.	Sector	2006-07	2007-08	2008-09	2009-10		2011-12	
		Actual	Actual	Actual	BE	RE	Original target	MTA revised
I	Coking coal							
	Steel/Coke oven (indigenous)	17.37	17.99	15.95	20.29	17.26	23.78	26.02
2	Import	17.88	22.03	21.08		27.26	44.72	42.48
	Sub-total coking	35.17	40.02	37.03	20.29	44.52	68.50	68.50
II	Non-coking							
3	(i) Power utilities (gen. req.)	307.84	332.09	361.10	397.54	401.00	483.00	473.00
4	Cement	19.74	19.32	19.39	25.59	25.59	31.90	33.35
5	Steel DR	17.47	20.92	19.71	44.33	28.80	28.96	28.96
7	Fertilizers	2.96	2.94	2.48	3.00	58.07	61.58	61.58
8	LTC/Soft coke*	51.57	56.42	71.97	55.07			
9	Cokeries/Coke oven (NLW)*							
10	BRK & others							
11	Captive power	28.13	31.58	33.18	57.66	40.00	57.06	47.00
12	Colly. consumption	0.99	0.93	0.86	0.86		—	0.85
	Sub-total non-coking	428.70	464.20	508.69	584.05	553.46	662.50	644.74
	Grand total (I + II):	463.87	504.22	545.72	604.34	597.98	731.00	713.24
	Note (i) *Included in BRK & others							
	Import of coking coal	17.88	22.03	21.08		27.26	40.85	42.48
	Import of non-coking coal	25.20	27.77	35.00		38.39	10.15	40.85
	Power sector	9.66	10.15	17.21				
	Cement sector	4.96	6.08	5.73				
	Others	10.58	11.53	12.06				
	Sub-total non-coking coal	25.20	27.77	35.00		38.39	10.15	40.85
	Total imports	43.08	49.80	56.08	72.01	65.65	51.00	83.33
	Sectoral Physical Targets							
	Coal-based power gen. (BU)	431.13	453.01	480.36	511.00	515.00	690.00	630.00
	Cement production (MT)	155.66	168.31	181.61	185.00		251.23	262.61
	Hot metal production (MT)		36.76	36.78	42.86	42.86	70.30	70.21

ANNEXURE 15.3
Company-wise/Scheme-wise Outlay/Expenditure—MTA of the Eleventh Plan (Coal Sector)

(Rs crore)

S. No.	Company/ Scheme	X Plan 2002-07 Actual Exp.	XI Plan Approved Outlay 2007-12	2007-08 Actual Exp.	2008-09 Actual Exp.	2009-10		Cumulative Exp. 2007-10	Cumulative as per cent of Approved XI Plan Outlay	XI Plan MTA Revised Outlay	Revised Outlay per cent of as Approved Outlay
						BE	Ant.				
I. CIL											
1	ECL	609.53	1,849.68	161.79	191.88	210.00	250.00	603.67	32.64	1,503.67	81.29
2	BCCL	677.54	1,250.00	133.82	221.16	230.00	300.00	654.98	52.40	1,424.98	114.00
3	CCL	1,290.66	1,990.00	297.84	334.84	420.00	350.00	982.68	49.38	1,832.68	92.09
4	NCL	1,399.53	4,000.78	404.71	266.52	730.00	600.00	1,271.23	31.77	3,071.23	76.77
5	WCL	955.13	1,374.50	176.05	277.92	230.00	350.00	803.97	58.49	1,623.97	118.15
6	SECL	1,389.29	4,600.11	560.42	855.98	730.00	700.00	2,116.40	46.01	3,316.40	72.09
7	MCL	828.46	2,125.00	276.16	321.26	200.00	400.00	997.42	46.94	2,547.42	119.88
8	NEC	9.23	20.00	1.86	3.92	10.00	10.00	15.78	78.90	45.78	228.90
9	Others (CIL/ DCC/ IICM/ CMPDIL)	48.00	180.00	20.86	33.69	140.00	140.00	194.55	108.08	724.55	402.53
	Total CIL	7,207.37	17,390.07	2,033.51	2,507.17	2,900.00	3,100.00	7,640.68	43.94	16,090.68	92.53
II. SCCL											
III. NLC											
1	NLCL (Mines)	1,251.90	2,826.00	578.54	650.44	524.09	386.40	1,364.99	45.61	2,334.39	77.99
2	NLCL (Power)	1,063.32	12,218.00	1,188.17	1,159.10	1,369.75	844.94	3,192.21	26.49	6,140.61	50.96
	Total NLCL	2,315.22	15,044.00	1,766.71	1,559.15	1,893.84	1,231.94	4,557.20	30.29	8,475.00	56.33
	Total (Coal PSUs)	1,0973.18	35,774.07	4,374.19	4,716.76	5,374.81	4,965.28	14,056.23	39.29	28,367.75	79.30
IV Central Sector Schemes											
	R&D PROGRAMME (S&T)	47.02	75.35	12.86	10.00	20.00	111.00	33.86	56.88	75.35	
	Regional explo.	206.19	164.02	34.99	30.00	30.39	30.39	95.38	58.15	305.82	
	Detailed drilling non-CIL blocks	93.85	472.94	40.00	15.00	60.00	60.00	115.00	24.32	523.08	
	EMSE (incl. RCFS/ RFRP)	51.12	155.34	18.04	10.00	15.00	10.53	38.52	27.67	1,713.75	
	Conservation & safety in coal mines	211.56	170.67	150.38	132.00	135.00	135.00	417.38	244.55	690.75	
	Development of transport infra. in coalfield area	61.16	277.63	23.58	0.00	22.00	0.01	23.59	16.42	930.92	
	VRS funded through DBS	252.05									
	Coal controller Information tech.		1.22	0.23	0.49	3.31	0.58	1.30		16.13	
	NEC component		8.84			14.30	12.49	12.49		4225.80	
	Total central sector schemes	922.95	1326.01	280.03	197.49	300.00	260.00	737.52	55.62	4225.80	
	Total MOC	11,896.13	37,100.08	4,654.22	4,914.25	5,674.81	5,225.28	14,793.75	39.87	32,593.55	

ANNEXURE 15.4
Details of Financial Performance of 20 Major States

S. No.	State	Commercial Loss w/o Subsidy		Subsidy		Cost of Supply		Average Tariff		AT&C Losses (Discoms)		Agriculture Consumption		Agri. Tariff	
		2008-09 (Provi.)	2009-10 RE	2008-09 (Prov.)	2009-10 RE	2008-09 (Prov.)	2009-10 RE	2008-09 (Prov.)	2009-10 RE						
1	Andhra Pradesh	6,354.95	5,639.25	N. A	N. A	379.13	355.16	251.31	256.22	18.81	18.04	30.14	31.88	0.19	0.47
2	Assam	43.98	107.81	0.00	0.00	526.47	505.15	491.56	450.76	37.03	33.55	0.72	0.91	4.89	4.98
3	Bihar	1,809.52	2,095.77	720.00	720.00	691.36	684.94	314.29	332.04	43.28	40.53	14.96	14.74	0.64	0.67
4	Gujarat	949.00	875.00	1,100.00	1,100.00	464.25	441.00	417.84	394.65	25.46	23.81	27.30	28.62	1.97	1.82
5	Haryana	4,120.62	5,103.69	2,636.99	2,803.76	556.00	572.28	327.22	344.28	30.13	26.08	38.06	39.00	0.40	0.32
6	Himachal Pradesh	43.11	127.06	0.00	0.00	421.59	407.06	405.98	381.99	19.55	18.24	0.41	0.40	5.56	3.68
7	Jammu & Kashmir	1,518.08	1,895.24	0.00	0.00	677.71	789.98	234.45	322.01	70.69	69.09	5.79	5.79	1.51	2.47
8	Karnataka	3,085.31	2,683.08	1,490.35	2,795.00	417.51	420.82	303.30	328.85	25.09	23.61	35.81	34.56	0.82	0.65
9	Kerala	531.75	1,711.24	749.17	1,928.66	456.73	480.45	379.96	326.69	34.98	24.89	1.75	1.72	1.35	0.93
10	Madhya Pradesh	3,440.48	5,122.45	906.34	1,358.64	492.49	529.89	319.56	289.06	45.78	45.36	29.12	29.99	2.06	2.06
11	Maharashtra	1,248.32	750.01	0.00	0.00	450.05	453.24	403.69	420.26	28.75	25.02	21.89	20.45	1.94	2.02
12	Meghalaya	-55.79	11.78	11.70	13.68	359.39	483.84	371.02	432.59	35.36	38.93	0.05	0.06	1.60	1.71
13	Punjab	3,894.35	4,767.80	2,601.73	3,144.25	397.73	444.98	267.21	289.80	21.37	20.96	28.65	31.00	0.00	0.00
14	Rajasthan	8,241.10	10,249.53	1,203.33	1,320.41	636.32	680.65	314.68	312.36	32.78	30.53	36.75	37.12	1.33	1.34
15	Tamil Nadu	8,963.55	8,555.38	1,831.61	2,068.55	464.89	459.55	288.75	299.29	19.22	19.06	21.69	18.09	0.00	0.00
16	Uttar Pradesh	6,620.77	5,592.53	1,532.00	1,832.00	457.30	450.67	284.51	313.01	33.30	29.98	17.00	15.44	1.68	1.94
17	West Bengal	-217.09	-343.75	0.00	0.00	490.79	434.98	390.85	430.68	31.59	34.44	4.80	5.91	1.69	4.55
18	Jharkhand	1,319.55	1,854.10	1,080.00	1,174.20	672.54	698.56	319.06	285.99	54.41	50.86	1.49	1.24	0.52	0.51
19	Chhattisgarh	-699.25	1036.41	52.00	150.10	335.64	409.65	370.66	324.01	37.78	37.92	13.16	15.52	0.38	0.56
20	Uttarakhand	457.88	400.53	0.00	0.00	363.83	391.19	289.78	330.50	30.20	31.06	4.84	4.21	1.17	1.71

Source: FR Document of SPUs.

Note: The AT&C losses includes transmission loss for the states of Assam, Bihar, Himachal Pradesh, Jammu & Kashmir, Kerala, Madhya Pradesh, Meghalaya, Punjab, Tamil Nadu, Jharkhand, and Chhattisgarh.