Energy sector plays a major role in the management of situation created by a drought. There is a massive step up in the demand for energy in sectors like agriculture and transport during a drought period. Several policy initiatives were taken and efforts on unprecedented scale were mounted to meet the burgeoning demand generated for energy by the drought of 1987.

1.2 In the petroleum sector efforts were directed for maximising the crude throughput of refineries, transporting of petroleum, oil and lubricant (POL) products to the drought-affected area and toning up the entire distribution system in order to effectively meet the challenge posed by drought.

1.3 Besides petroleum products the other major balancing energy source required during drought was electricity. The situation with regard to power generation in a drought year is further compounded by the lower levels of the hydel reservoirs in the face of greater demand of electricity for irrigation. Effective steps for meeting the increasing demand with lower power availability in the hydel sector were further directed towards maximising power generation from the thermal stations earmarking higher allocations of power for the agriculture sector and towards energising additional irrigation pumps.

Petroleum Products

2.1 Under the guidance of Ministry of Petroleum and Natural Gas (MOPNG) and the Oil Coordination Committee (OCC), the oil industry responded in an admirable manner towards meeting its responsibility during the drought period. Despite the peaking of demand for petroleum products, equitable supplies were organised. However, had there been any shortcoming either in the conception or in the execution or even in monitoring of relief measures pertaining to the area of supply of essential petroleum products, the resultant impact would have been severe.

2.2 Among the petroleum products the most widely used product is the High Speed Diesel (HSD). This product alone accounts for nearly 40 per cent of the total demand of liquid petroleum products. HSD is used for road transportation, rail transportation, captive power generation, grid power

Table 24 : Demand for High Speed Diesel (HSD) in Northern Region, 1984-85 to 1987-88.

Sl.No.	Year	Demand (Actuals) (thousand tonne)	Percentage Growth
1.	1984-85	4365	—
2.	1985-86	4573	4.8
3.	1986-87	5118	11.9
4.	1987-88 (Original Anticipated)	5580	9.0
5.	1987-88 (Actual)	5838	14.1

generation (as support fuel), operation of irrigation pumps, operation of tractors, harvesting, the threshing equipments, coastal bunkers, and operation of barges.

2.3 The drought of 1987 did not affect only the northern part of the country. However, the magnitude of problems faced by the oil industry in maintaining supply line to the northern part of the country was by far more pronounced than faced in maintaining the supplies to the other parts of the country.

2.4 The western, southern and south-eastern parts of the country are served by major ports such as Kandla, Bombay, Goa, Mangalore, Cochin, Tuticorin, Madras, Visakhapatnam and Haldia which all handle petroleum products. Further, there are a number of coastal refineries located at Bombay, Cochin, Madras, Visakhapatnam and Haldia. The north-eastern part of the country is also well served by the availability of indigenous crude oil and adequate refining capacity through the refineries situated at Digboi, Bongaigaon, Guwahati and Barauni. Thus there are a large number of supply sources of petroleum products to cater to these areas and more importantly, the leads involved are relatively shorter both in terms of distance and time required for replenishment. This, however, does not mean that these areas do not suffer from infrastructural inadequacies, locational difficulties and also availability problems. The oil industry had to stretch itself quite far in maintaining the supply line to these areas also.

2.5 The problems faced for maintaining the supply line to the northern part of the country is far greater in magnitude. Further the energy demand in the northern part for agricultural inputs, density of population and variations in weather conditions is subject to a greater degree of variation than the other parts of the country. There is only one refinery, viz., Mathura in the northern region and the production from Mathura meets only a part of the northern region's requirements. Consequently inputs are required to be organised from far off supply sources such as Bombay, Kandla and Baroda. Supplies from these long lead sources involve not only the capability of oil industry but its devetailing with railway operations as well.

2.6 In view of various factors influencing the demand of HSD the demand is seen to grow at a rate of around 9 per cent per annum in the northern region as is evident from Table 24.

2.7 Thus under normal circumstances the demand during 1987-88 in the northern region would have grown at a level of around 9 per cent over 1986-87. Since the demand had been met in full in earlier years, the pattern noticed would have continued in 1987-88 also had there been no severe drought in 1987. Due to the drought, instead of a growth of 9 per cent in demand, the actual growth proved to be as high as 14 per cent in 1987.

2.8 The annual growth rate, however, does not fully reflect the problem caused by spurt in demand from month to month. The impact of the drought was felt in full measure during the period June 1987 to February 1988. During this period the monthly growth rate in demand noticed over the previous years was above normal during all the months with pronounced peakings during June to August, 1987 and February, 1988 as shown in Table 25.

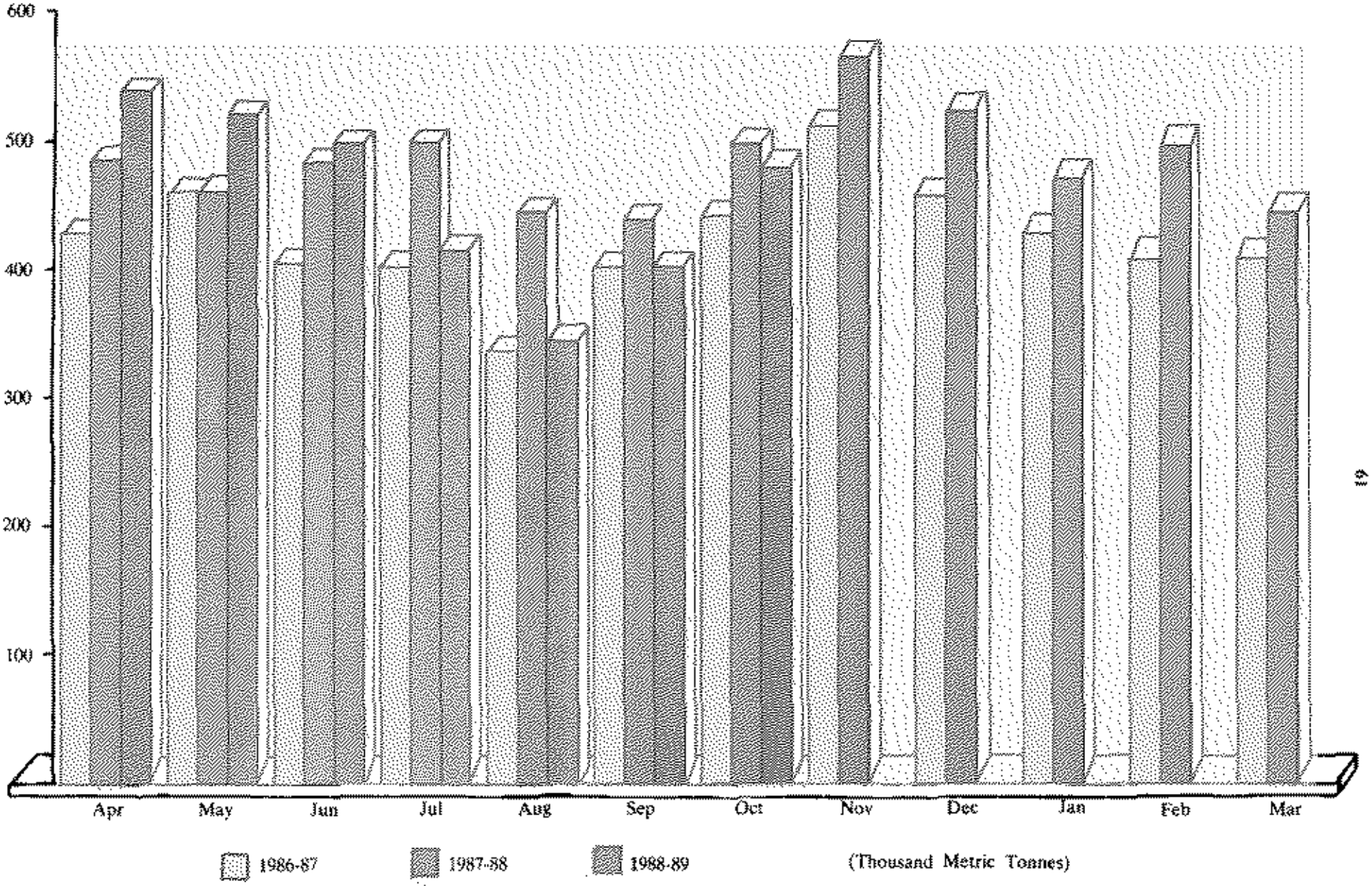


Figure 7: **High Speed Diesel (HSD) Demand Behaviour in Northern Region**

Table 25 : Monthly Demand for High Speed Diesel (HSD), June 1987 to February 1988.

S.No.	Month	Demand (thousand tonne)		Percentage Growth Rate
		1986-87	1987-88	
1.	June	408	486	19.1
2.	July	405	502	23.9
3.	August	339	447	31.8
4.	September	404	442	9.4
5.	October	444	500	12.6
6.	November	514	567	10.3
7.	December	459	525	14.4
8.	January	430	473	10.0
9.	February	409	497	21.5
	June to February	3812	4439	16.5

2.9 The peakings noticed in June, July and August represent the impact of failure of the monsoon and the subsequent peaking in February represents the impact of failure of winter rains. Thus during the period from June 1987 to February 1988, the average increase in demand over the corresponding period of previous year was as high as 16.5 per cent, an unprecedented massive increase in a period of nine months, by any standards, when it is noted that the total of actual demand in April, May and March in 1987-88 (viz. 1399 thousand tonne) was only 7 per cent higher than the total HSD demand of these months in 1986-87.

2.10 The demand noticed in May, 1987 did not give any indication about events to come at all. Normally the month of May is one of the highest selling months for HSD in northern region, as the demand behaviour analysis for the period 1977-78 to 1986-87 would reveal. However, during the month of May, 1987 the HSD demand stagnated consequent to early pre-monsoon showers. This abnormality can be noticed from the demand for the month of May during the last 5 years shown in Table 26.

2.11 The growth of 12.9 per cent in May, 1988 over May, 1987 would have actually been of the order of only 6 per cent to 7 per cent had the situation during May, 1987 been normal. The above pattern has been captured here only to highlight that no indication whatsoever was available for the severe drought that was about to set in June 1987. Thus the task of mobilising supplies to meet the peaking of demand in June, 1987 became a stupendous one.

2.12 The demand for the months of July, August and September in the northern region are normally far below the demand for the month of May. Thus the normal plan of the oil industry is to keep the stock levels at judiciously controlled levels at various stock points in the northern region so that adequate haullages are available for movement of products from Mathura refinery without forcing any reduction in crude processing at the refinery due to want of outlets for production during the lean season. Additionally the railways and the oil industry plan on a lower level of movement of

Table 26 : Demand for High Speed Diesel (HSD) in May, 1984-88.

S.No.	Year	Demand in May (thousand tonne)	Percentage Growth
1.	1984	397	
2.	1985	436	9.8
3.	1986	465	6.7
4.	1987	464	0.2
5.	1988	524	12.9

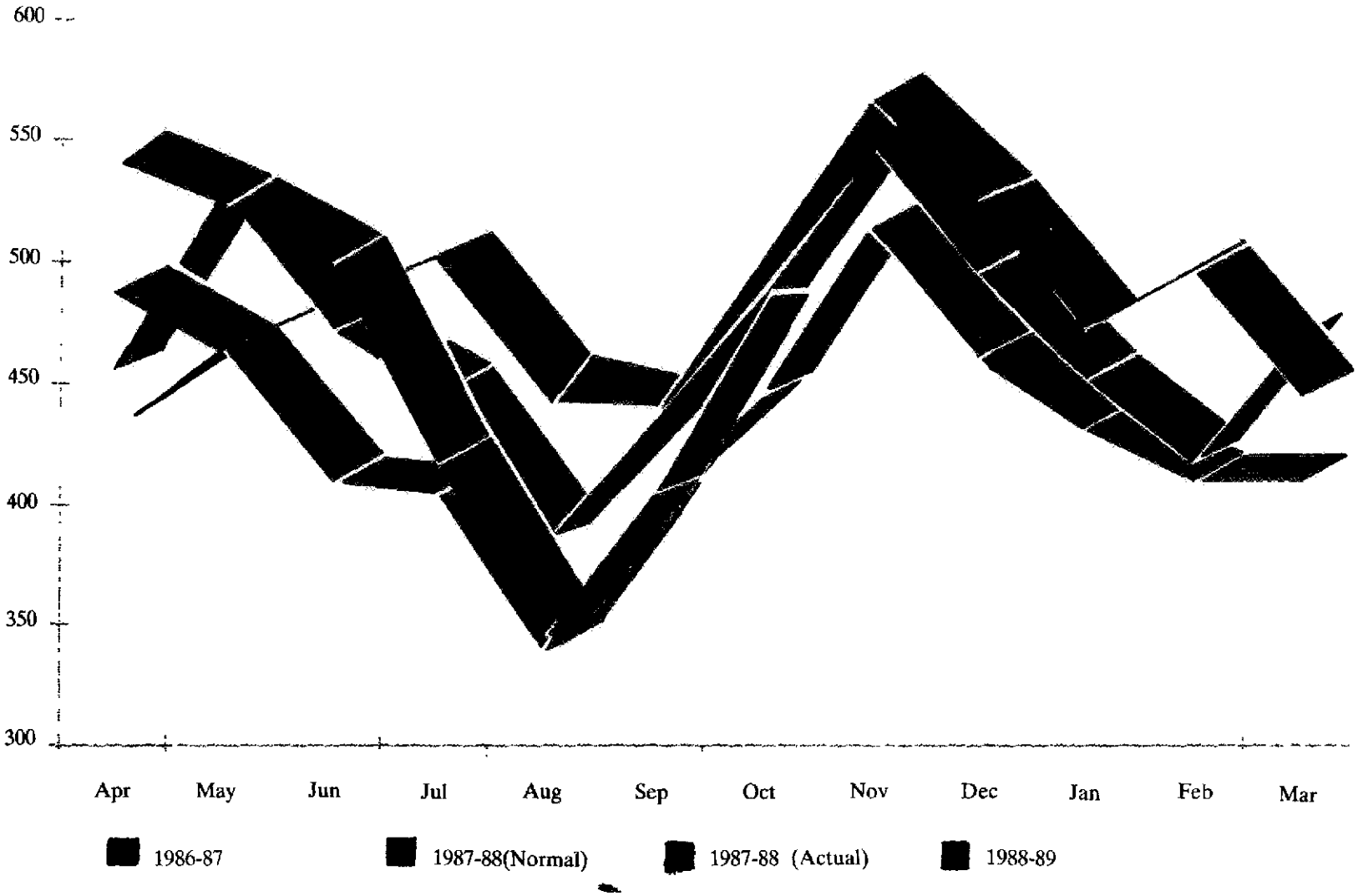


Figure 8: High Speed Diesel (HSD) Demand Behaviour in Northern Region. 1986-87 to 1988-89

(Thousand Metric Tonnes)

products during this period to the northern region to prevent rail tank wagons from getting detained at the depots of the oil industry and en route. If the stocks are maintained at high levels, then the tank wagons cannot be unloaded for want of space in storage tanks. This chokes the entire rail transportation system. Thus the stock management policies are radically different during the lean demand season.

2.13 While the oil industry had regulated the inventory position, import schedules and also evolved plans for maintenance shut downs of refineries during the lean season, the demand for HSD showed a sudden spurt in June. This pattern continued unabated throughout June to August. The growth rates in demand for HSD in the northern region during June, July and August were respectively 19.1 per cent, 24.0 per cent and 31.9 per cent over the off-takes of the previous year. This situation was abnormal.

2.14 Apart from upsetting the entire plans of the oil industry which are carefully designed taking due notice of the established behavioural pattern of demand, the situation actually posed big challenge to the oil industry to maintain the supply line. The confidence of public with regard to regular availability of diesel had to be maintained at a very high level. At the same time it was not known at what point of time would the monsoon which had failed would revive. Any revival of the monsoon would have brought down steeply the demand for diesel resulting in stocking problems. There was always a probability that the mobilisation of activities for concentrating on voluminous inputs of stocks into the northern region could become counter-productive if the demand were to drop.

2.15 At the same time, however, the demand was materialising at a very high level. The production of Mathura refinery meets only a part of the requirement of northern region. Supplies from alternate sources involved a long lead in terms of time. The product had to be positioned not only at a few pockets but at all over the north in step with the peaking of demand. The factor of time lag between upliftments from the depots and arrival of replenishments from alternate sources had to be counter-balanced.

2.16 The HSD demand continued to be at a higher level during the period September to January as well. During February, 1988 there was once again a quantum jump in demand, the demand recording growth of 21.5 per cent over the same month last year. Thus there was no respite to the oil industry or to the railways. All plans had to be continuously changed and the challenge grew stiffer. Normally, OCC and the oil industry review the stock position and evolve replenishment plan twice a week. During the period of this crisis, the frequency of the review meetings was increased. Daily monitoring was done for meeting the demand for HSD without any drop in the confidence level of the common man with regard to the availability of supplies.

2.17 The HSD demand behaviour monthwise for the years 1984-85 to 1988-89 (upto October) is given in Table 27. This shows as to how the demand was at abnormally high level during 1987-88. More particularly, the information reveals how the demand during July to October, 1986 and even in 1988 was far below the demand during the same period in 1987-88.

2.18 The bar chart at Figure 7 and the line graph at Figure 8 capture the peaking of demand during 1987-88. They show (1) how the demand during 1986-87 and 1988-89 was far lower than the actual demand during 1987-88; (2) how the demand during 1987-88 continued to be at a very high level; and (3) how the entire supply system which depends on gradual build up of stocks during lean season for meeting the demand during peak season was upset.

2.19 The details given in Table 28 and bar chart in Figure 9 reveal that even accounting for a high growth for HSD (say, 9 per cent) in 1987-88, how the actual demand outstripped the normal demand pattern month after month during the period June 1987 to February 1988. It would be noticed that during the period June, 1987 to February, 1988, the actual HSD demand was higher that normal HSD demand (with 9 per cent growth) in the northern region by as much as about 314,000 tonne. In other words the demand every month was on an average higher than normal demand by as much as 35,000 tonne. In actual effect the demand during the month of August, 1988 and February, 1988 was higher than the normal pattern of demand (with 9 per cent growth) to the extent of about 70,000 to 80,000 tonne per month.

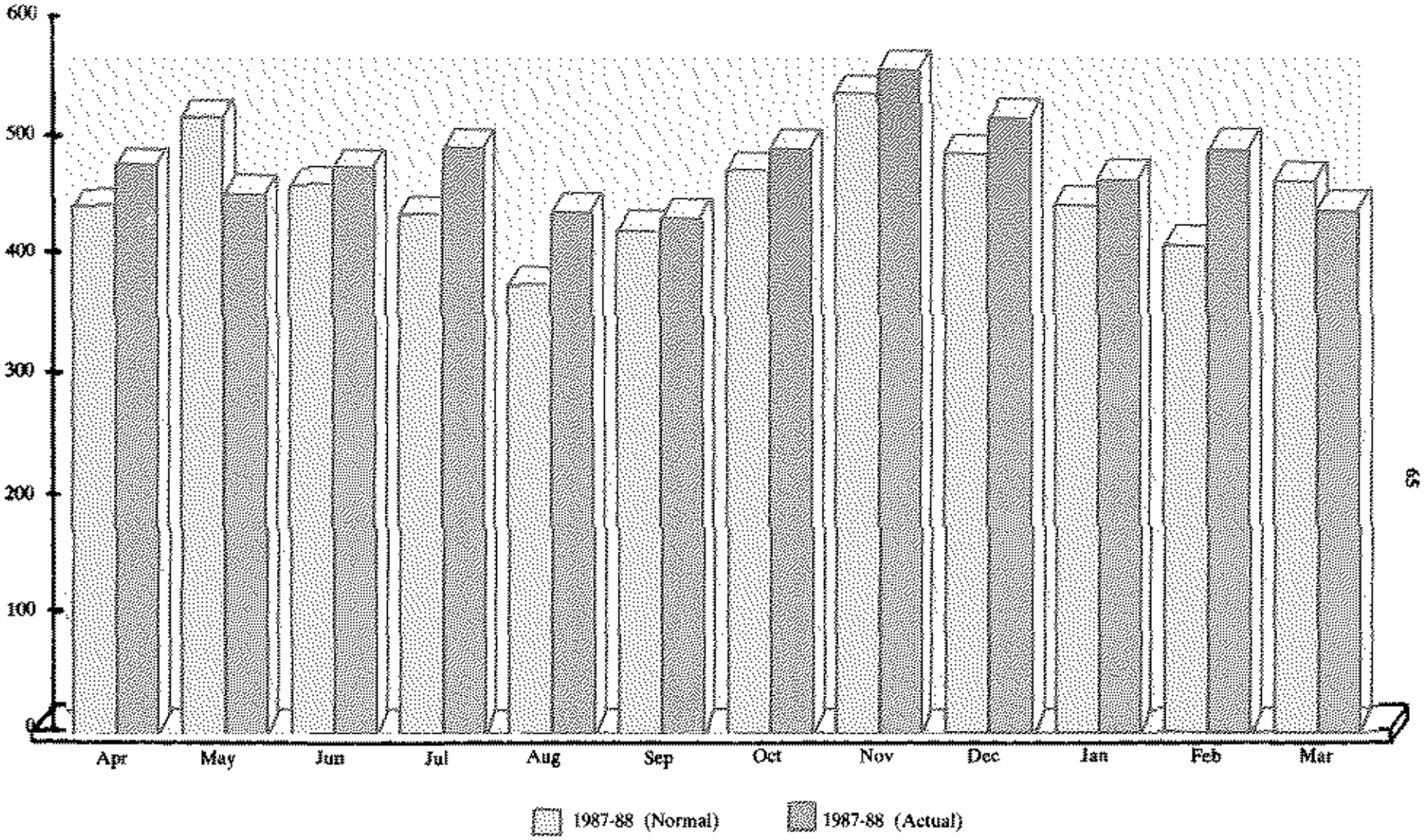


Figure 9: **High Speed Diesel (HSD) Demand Behaviour in Northern Region.**
(Thousand Metric Tonnes)

Table 27 : Monthly Demand for High Speed Diesel (HSD) in Northern Region, 1984-85 to 1988-89.

(thousand tonne)

S.No	Month	1984-85	1985-86	Percentage Increase	1986-87	Percentage Increase	1987-88	Percentage Increase	1988-89	Percentage Increase
1.	April	360.0	421.0	16.9	432.0	2.6	489.0	13.2	543.0	11.0
2.	May	397.0	436.0	9.8	465.0	6.7	464.0(−)	0.2	524.0	12.9
3.	June	358.0	399.0	11.5	408.0	2.3	486.0	29.1	501.0	3.1
4.	July	331.0	367.0	10.9	405.0	10.4	502.0	24.0	418.0(−)	16.7
5.	August	321.0	314.0(−)	2.2	339.0	8.0	447.0	31.9	346.0(−)	22.6
6.	September	279.0	322.0	15.4	404.0	25.5	442.0	9.4	404.0(−)	8.6
7.	October	366.0	365.0(−)	0.3	444.0	21.6	500.0	12.6	481.0(−)	3.8
8.	November	420.0	450.0	7.1	514.0	14.2	567.0	10.3		
9.	December	397.0	404.0	1.8	459.0	13.6	525.0	14.4		
10.	January	352.0	397.0	12.8	430.0	8.3	473.0	10.0		
11.	February	387.0	319.0(−)	17.6	409.0	28.2	497.0	21.5		
12.	March	397.0	379.0(−)	4.5	409.0	7.9	446.0	9.0		
	Total	4365.0	4573.0	4.8	5118.0	11.9	5838.0	14.1		

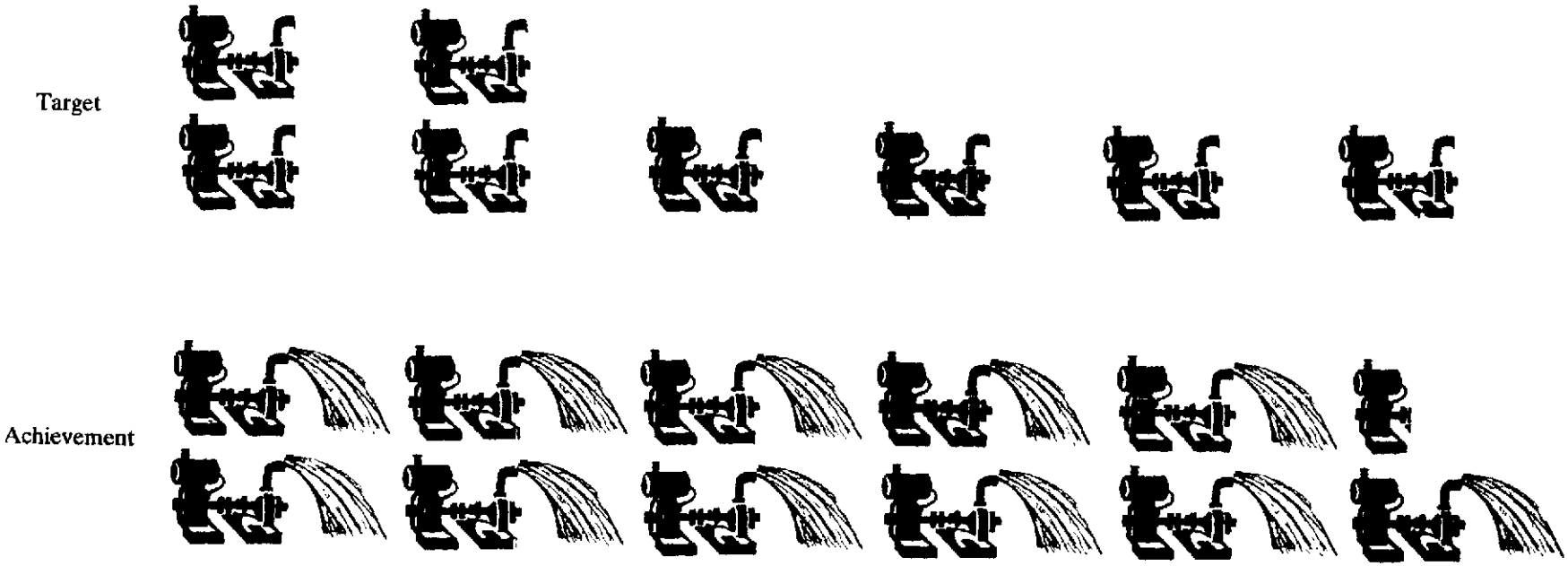
2.20 There were periods when the offtakes from some depots were registering increases of the order of 70 per cent over the same period last year. The average figure muffles these increases. The oil industry had to wage a continuous struggle for replenishment of stocks against depletion of stocks by keeping a very close watch on the daily demand behaviour and reinforcing supplies. The inherent difficulties due to the time lag between despatch from supply sources and receipt at long lead consumption centres had to be overcome.

2.21 The problem of the oil industry was not confined to HSD only; the demand for other products too was at a high level. Superior kerosene oil supplies had to be arranged in line with the allocations made by the Government from time to time, the demand of petrol shot up due to increase in vehicle population and there was a high level of demand for black oils too. The oil industry had to discharge its responsibility of meeting the demand in full and in an equitable manner for all products.

Table 28 : Actual and Anticiped Monthly Demand for High Speed Diesel (HSD) in Northern Region, 1986-87 and 1987-88.

(thousand metric tonne)

S.No.	Month	1986-87 (Actual)	Normal Level after providing for 9 per cent Growth (Anticipated)	1987-88 (Actual)
1.	April	432.0	455.0	489.0
2.	May	465.0	529.0	464.0
3.	June	408.0	472.0	486.0
4.	July	405.0	446.0	502.0
5.	August	339.0	385.0	447.0
6.	September	404.0	431.0	442.0
7.	October	444.0	482.0	500.0
8.	November	514.0	547.0	567.0
9.	December	459.0	495.0	525.0
10.	January	430.0	451.0	473.0
11.	February	409.0	416.0	497.0
12.	March	409.0	471.0	446.0
	Total	5118.0	5580.0	5838.0



Ref:—One symbol represents 50,000 pump sets.

Figure 10: Energisation of Pump Sets, 1987-88

Policy Initiatives

3.1 In the emerging drought situation, the MOPNG and OCC came out with specific policy initiatives in order to maintain the supply line all over the country in general and in the northern region in particular. The daily system of stock monitoring was brought into force. The OCC at New Delhi took total charge of the situation. Daily stocks, daily off-takes, stocks in transit, and daily despatches from loading bases were monitored with the involvement of all the oil companies Necessary corrective action was constantly taken for increasing inputs at various depot areas in tune with off-take levels.

3.2 Notwithstanding the earlier devised plans regarding maintenance schedules, in close coordination with IOC, the MOPNG and OCC evolved steps for maximisation of crude allocation to Mathura and Koyali refineries and enabled these refineries to operate at a far higher level than envisaged in the oil economy budget. This involved, *inter alia,* postponement of earlier planned maintenance shutdowns.

3.3 Increase in crude throughput of the refineries calls for a sequence of operational procedures, prevention of breakdowns in plant and machinery, high level of on line maintenance, prevention of untenable stock, build up with regard to surplus products such as naphtha, regular vigil on the operating conditions and parameters of every single strategic unit at the refineries concerned. The crude replenishments of the refineries also had to be arranged in tune with the increase in operating level. Notwithstanding the complexities involved in processing of various types of crude, the product yields were to be optimised while strictly adhering to the specifications laid down for each product during each period of the year.

3.4 The two refineries at Mathura and Koyali not only increased their crude intake but also operated their secondary processing facilities at far higher levels than designed capacities so as to optimise the yield pattern. Thus, for example, the fluid catalytic cracking units were operated at higher levels.

3.5 Provisions were made for the import of an additional one million tonne of crude over original plan to take care of increased processing of crude and also to increase the inventory of imported crude. In actual effect, as against the original plan for importing 17.336 million MTs of crude, the actual import was 18.045 million MTs, representing an additional import of 0.709 million MTs.

3.6 Simultaneously, efforts were made to increase indigenous crude production. The production from the north eastern fields did not materialise as per plan. The actual production was only 5.204 million tonne against the original plan of 5.64 million tonne. This shortfall, *inter-alia,* affected the plan to maximise the crude throughput of Barauni Refinery. On the other hand, the production from Gujarat oil fields and Bombay high off-shore fields was stepped up. Against an original plan to produce 24.824 million tonne from Gujarat/Bombay off-shore fields, the actual production was 25.153 million tonne, *viz.* an increase of 0.329 million tonne, enabling higher crude allocation to Mathura and Koyali refineries. Provisions were made for import of additional HSD in the event the deficit for HSD proving to be higher than originally projected even after implementation of plans for increasing HSD production from indigenous refineries.

3.7 The oil industry operates in close coordination with the railways. The movement plan on a month-to-month basis is arrived at in consultation with Railway Board. During the period of crisis, a system of regular interaction with railways was set in motion. The railways and the oil industry collaborated in maximising the availability of inputs in the northern sector as also in equitable movement of rail wagons to different depots of northern sector in accordance with the plans which were evolved/reviewed/modified from time to time.

3.8 There is a nominated senior officer in each State for interaction with the State Governments on behalf of the oil industry. During the drought-period, the state level coordinators of different States were in day to day contact with the civil supply authorities and the State Governments. A continuous feedback was given by the State level coordinators to the OCC and Ministry for ensuring replenishement in tune with the requirements. In other words, information, intelligence and daily situation control data available with each State Government was translated into the required mode, for arrangement of replenishments to various States.

3.9 The Central Government regularly interacted with the State Governments, *inter alia,* regarding

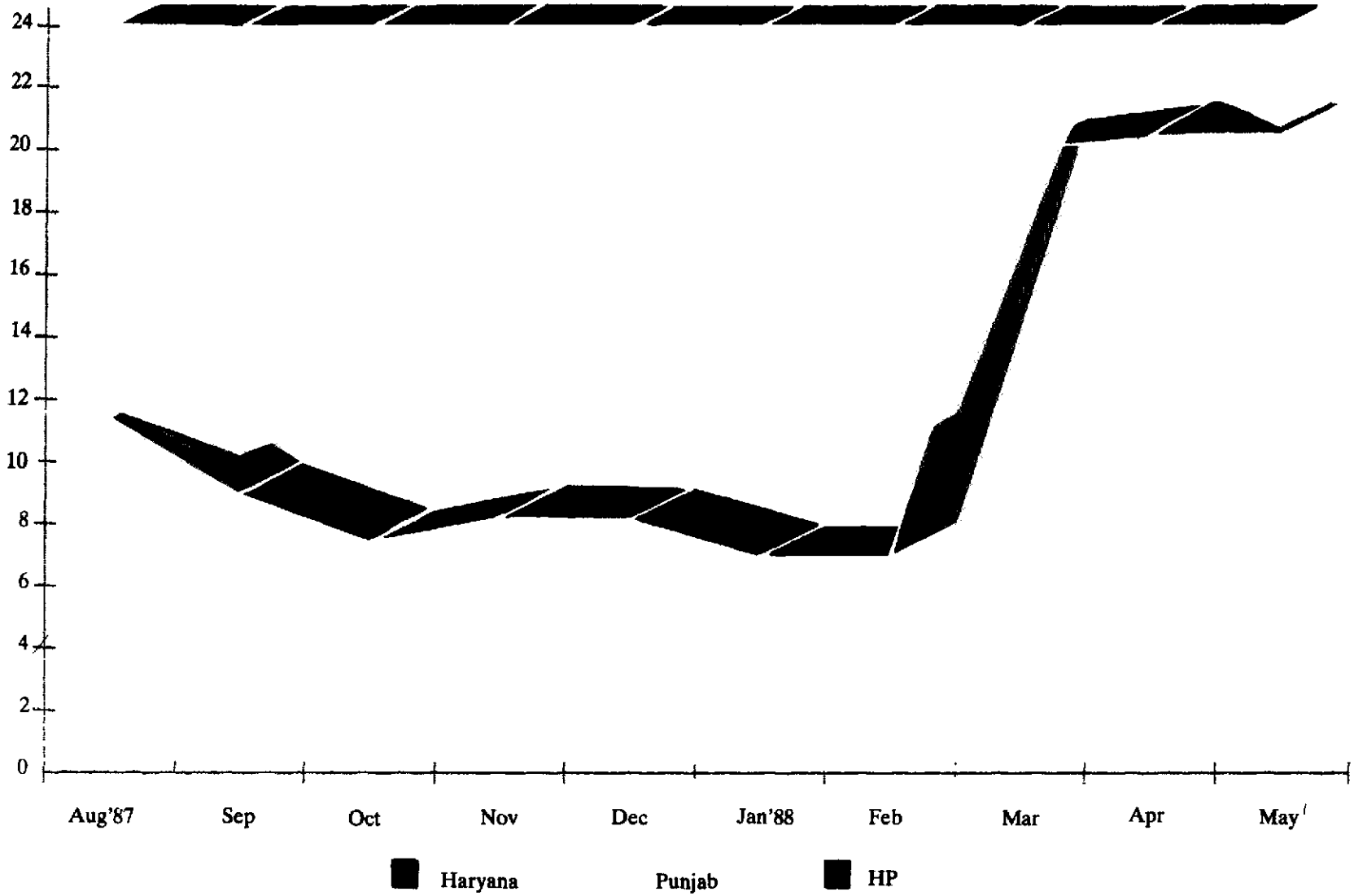


Figure 11: Average Hours of Power Supply to Agriculture

adequate availability of petroleum products and in particular HSD. Various State level coordination meetings were also organised chaired by senior officials of MOPNG with top level State Government officials, OCC and the oil industry to receive a first hand feedback from the concerned State Governments regarding the satisfaction level pertaining to supply of petroleum products in general and kerosene and HSD in particular. The chief executive of IOC had detailed meetings with the Chief Ministers and several State Government officials of the States. In these meetings, apart from assuring the State Governments about the efforts being made by the oil industry for arranging adequate availability of petroleum products, the views of the State Governments on various problem areas were also ascertained which were duly taken note of while making policy decisions regarding supply of petroleum products in industry coordination meetings and supply plan meetings.

3.10 Necessary instructions were issued by the MOPNG and OCC and implemented by oil companies for optimisation of operations at all terminals and depots to cope with the increase in workload. In particular, it was ensured that orders were executed in full within the stipulated time after receipt of indents, order execution was in line with the priorities set up by the GOI and also in strict conformity with the sequence of indents received. The terminals and depots worked on extended hours to prevent dry out at retail outlets and also consumer points. It was also ensured that the tank wagons (TWs) received at various depots were unloaded as quickly as possible so that turn round time for the TWs were reduced thereby increasing the transportation capacity for rail movement.

4.1 In step with the policy initiatives of MOPNG and OCC to maximise the crude throughput of Mathura and Koyali refineries, IOC responded admirably to the challenge and increased the operating level of both the refineries. In order to optimise the yield pattern, all secondary processing facilities such as the fluid catalytic cracking units were also operated at nearly 110 per cent to 115 per cent of the designed capacities.

4.2 Against the plan for processing of 5.77 million tonne at Mathura refinery during 1987-88, the actual throughput of Mathura refinery was as high as 6.535 million tonne representing an incremental processing of 765,000 million tonne of crude. Thus the actual throughput achieved was 13.3 per cent higher than the plan. With the help of additional crude processing as well as optimised operation of the secondary processing units, the HSD production was also at a substantially higher level than originally planned. Against the original plan for producing 20,13,000 tonne of HSD, the actual production was 23,68,000 tonne, representing an incremental production of 3,55,000 tonne. The actual production was 17.68 per cent higher than the planned.

4.3 Against the plan for processing of 7.85 million tonne of crude at Koyali refinery during 1987-88, the actual throughput of Koyali refinery was as high as 8.443 million tonne representing an incremental processing of 5,94,000 tonne of crude. Thus the actual throughput achieved was 7.6 per cent higher than planned. With the help of additional crude processing as well as optimised operation of the secondary processing units, the HSD production was also at a substantially higher level than planned. Thus against the original plan for producing 19,54,000 tonne of HSD, the actual production was 23,68,000 tonne, representing an incremental production of 4,14,000 tonne over the plan. The actual production was 21.2 per cent higher than the planned.

4.4 The main pipeline system which serves the northern region is the pipeline from Mathura to Jalandhar *via* Delhi and Ambala. Another pipeline from Barauni to Kanpur *via* Patna and Mugalsarai and Allahabad mainly caters to the eastern U.P. demand and also the demand at Kanpur and the markets in the vicinity of Kanpur. As against the throughput of 2.76 million tonne achieved in 1986-87, the pipeline was operated in 1987-88 at a throughput of 3.00 million tonne, representing an increase of 8.7 per cent. Similarly HSD pumping through the pipeline was increased from 1.63 million tonne in 1986-87 to 1.79 million tonne in 1987-88, representing an increase of 9.9 per cent. The Barauni-Kanpur pipeline is always being operated at its maximum capacity. The same was ensured in 1987-88 also. HSD pumping through the pipeline in 1987-88 was 1.02 million tonne, representing an increase of 2.2 per cent over the previous year. This was achieved despite difficulties in availability of Assam crude for Barauni refinery whereby the crude throughput at Barauni could not be maximised.

4.5 The oil industry and the railways interacted very closely for increasing the inputs of petroleum products in the northern region as also maintaining the supply line in other parts of the country. In

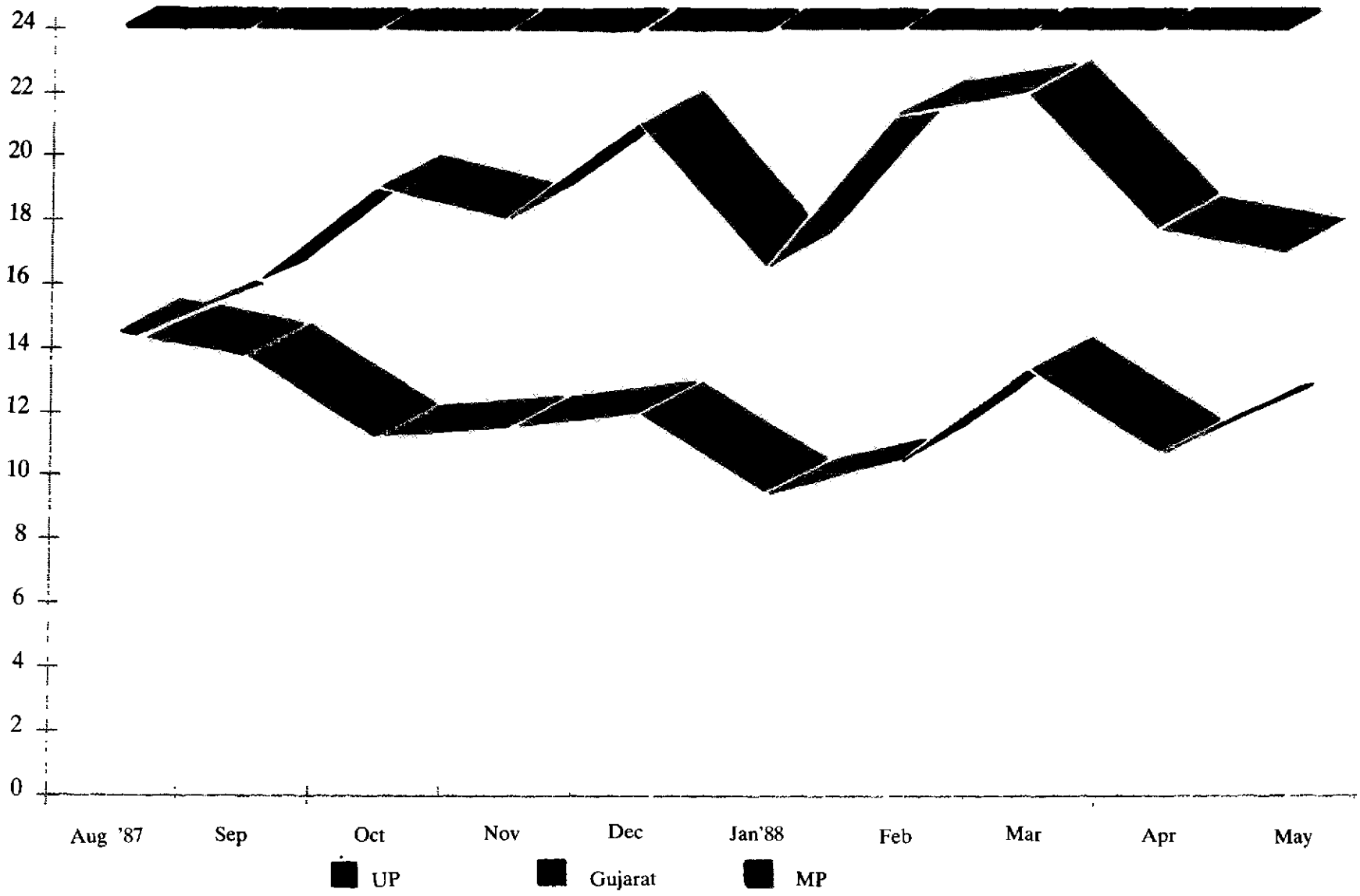


Figure 12: **Average Hours of Power Supply to Agriculture**

this regard there was close and regular coordination between OCC and the Railway Board almost on a daily basis. The oil industry members at the headquarters level were in close and daily contact with the chief wagon superintendent. Policies and procedures were jointly evolved by the oil industry and the railways for maximisation of tank wagon loading operations at the loading bases as well as speedy unloading of tank wagons at the depots. The implementation of decisions taken jointly by railways and OCC were constantly monitored by the OCC and reviewed in detail at the railway inland petroleum sub-committee meetings as well as at the supply plan meetings.

4.6 The Railways do not have surplus tank wagon (TW) fleet for catering to sudden increases in demand of the levels required in 1987-88. Nevertheless with the help of regular augmentation in fleet being carried out by them and more particulary through the optimisation of the TW movements resulting in better turn round time, the overall TW inputs in the northern sector were increased. The limitations due to non-availability of surplus fleet capacities did result in the inventory levels depleting in December 1987 and January, 1988 due to continuous unabated high level of demand for HSD. However, it must be noted that but for the wholehearted and dedicated involvement of the railways in increasing movement of petroleum products in the northern sector, the total normalcy in availability of petroleum products in general and HSD, in particular, could not have been achieved.

4.7 The Railway Board in close coordination with OCC issued instructions to the local railways for implementation of the priorities being evolved for movement of petroleum products by OCC. Thus there was an orderly execution of the priorities and strict adherence by all concerned agencies in the implementation procedure. In respect of all high throughput locations, wherever there was heavy stock depletion, the TW rakes were moved on top priority by the railways so as to ensure that the replenishments arrived on time. A regular watch on the movement of rakes in transit was kept, estimated arrival times taken note of and plans for further replenishments evolved ensuring avoidance of over-shipments to any particular location. At the same time it was ensured that the stocks at any location were not allowed to be depleted to critically low levels. Thus the issue tackled was not of merely average inventory in the northern sector but the inventory position at each and every stock point and equitable replenishment.

4.8 The northern region is catered to by railway broad gauge loading bases at Kandla, Bombay, Koyali, Mathura, Kanpur and Jalandhar. The Rajasthan area is fed by the metre gauge tank wagon loading bases at Mathura, Sabaramati and Kandla. Products such as petrol, naphtha, kerosene, aviation turbine fuel, and high speed diesel oil are loaded in tank wagons, known as TP and TK wagons, jointly classified as white oil tank wagons. Products such as furnance oil and low sulphur heavy stocks (LSHSs) are loaded in black oil or TOH tank wagons. In this regard, while dealing with the efforts and achievements in feeding HSD to the northern region it was felt worthwhile to highlight the overall achievements in white oil tank wagon loadings at the major broad gauge bases at Koyali, Kandla and Bombay. In the white oil TW loadings the dominant component was HSD tank wagons. The TW loadings were at a far higher level than the previous year. On an average the TW loadings during 1987-88 were higher than 1986-87 by 47 wagons per day.

4.9 Kandla is a major balancing source of supply for the northern sector. During 1987-88 the railways spared no effort to increase TW loadings *ex* Kandla. However, though the oil industry had fully greared itself to load about 270 TW per day, the railways were able to increase white oil TW loadings from a level of 50 TWs per day through most part of 1986-87 to about 160 TWs per day during peak drought months. On an average the improvement in TW loadings *ex* Kandla was 63 TWs per day.

4.10 Due to the limitations in handling of TWs through the congested railway system within the Bombay port complex, the facilities available with the oil industry for loading of TWs in the Bombay port complex was not used by the railways. The facilities available with the oil industry at Trombay viz. at BPC refinery and at HPC refinery suffered from certain limitations. A major gantry expansion programme at BPC refinery, though on hand, was not slated for completion during 1987-88. Nevertheless, after a series of discussions and implementation of optimisation procedures, the average TW loadings per day for white oil *ex* Bombay (from BPC and HPC) during 1987-88 was achieved at a level of 304 TWs per day vis-a-vis 224 TWs per day in 1986-87, representing a remarkable improvement of 80 TWs per day.

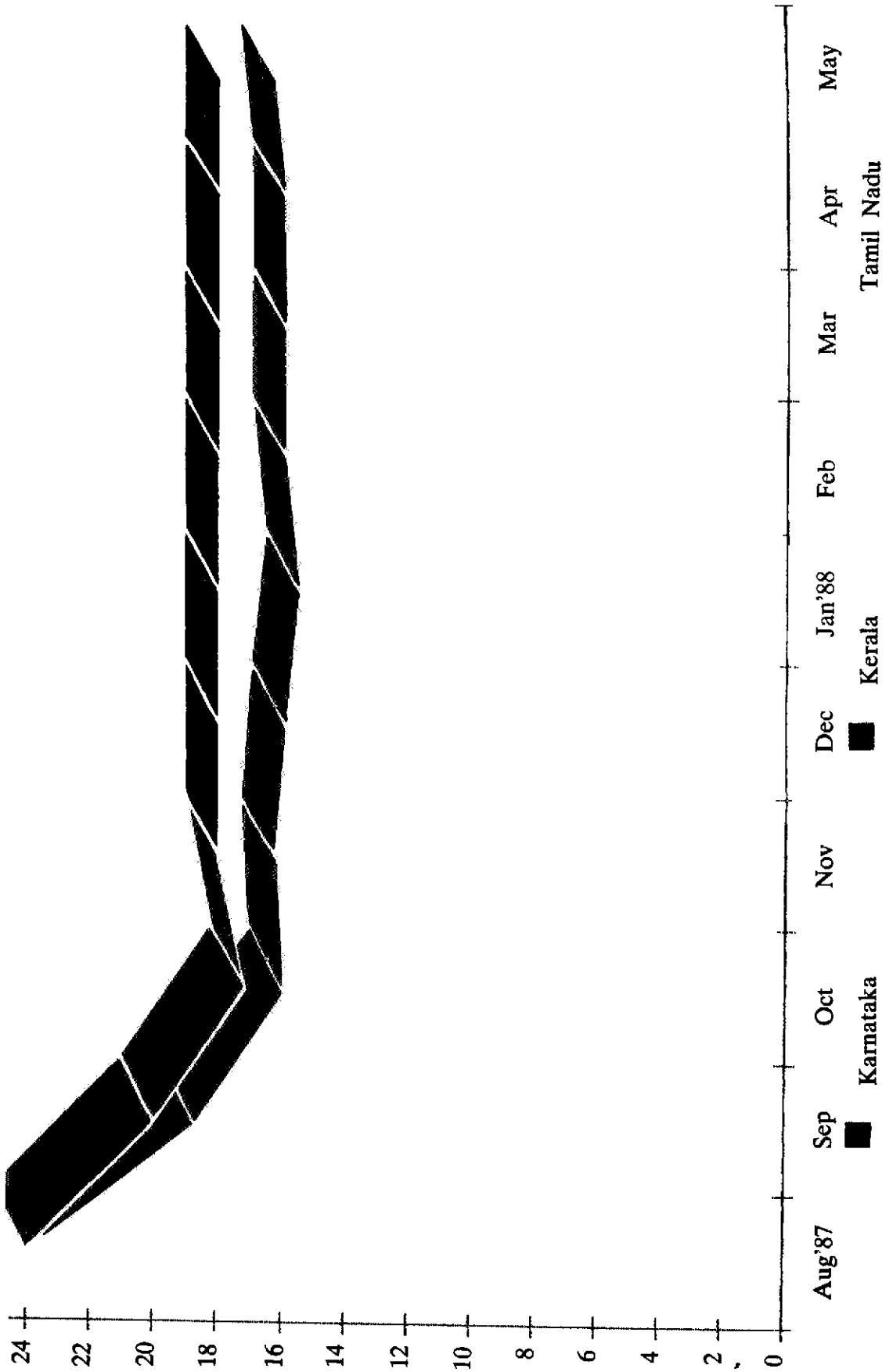


Figure 13: Average Hours of Power Supply to Agriculture

4.11 Due to sustained high level of demand during 1987-88 and pronounced peakings during several months, the inventory management had to be radically changed. Further, not only was the overall inventory of northern region of interest but also the actual inventory in each and every supply point. To achieve the objective of meeting the demand for HSD in full, necessary operational arrangements and monitoring systems were designed and implemented by MOPNG, OCC and the oil industry. Day to day inventory position, upliftment pattern and stock in transit position for various depots and terminals in the northern region were compiled, analysed and necessary course corrective action taken. The coordination work in this regard was carried out by OCC at New Delhi who were submitting daily situation reports to MOPNG on stock positions/upliftments.

4.12 Despite peaking of demand, the inventory levels were not allowed to deplete below 70 per cent of the tankage level during the period June to July 1987. By arranging massive inputs of products in the northern region, in line with the steep rise in upliftments, it was ensured that not only was the demand met in full but the inventory position was also kept at comfortable levels. In August 1987, the inventory improved. By September 1987, the inventory position improved to 111 per cent of the effective tankage (vis-a-vis 79 per cent in September, 1986). Further in anticipation of the need for high level of demand expected to prevail in October, November and December, special concentrated efforts were made to boost the inventory level to 330,000 tonne (116 per cent of effective tankage) by the first of October, 1987 which represents one of the peak inventory levels maintained in the northern region even during normal years. That this position was obtained during a drought year and despite continuous high level of off-takes throughout all the months by itself illustrates the magnitude of success achieved by the oil industry with regard to maintaining normalcy of supplies in the northern region.

4.13 With the help of inventory thus built up by 1st October, 1987 not only was the high level of demand during the months of November, December and January was met in full but the actual inventory levels were maintained at higher level than was achieved during 1986 which was a normal year. Further the inventory level was built up to 85 per cent of the effective tankage by the beginning of November, 1988. It is with the help of such an inventory level and massive inputs of products that the unprecedented peaking of demand in February, 1988 was met in full. It may be mentioned here that the demand in February, 1988 registered an increase of 21.5 per cent over the off-take in the previous year. By the 1st of March, 1988, the inventory position had been brought at par with effective tankage and further improved in April, 1988 so as to meet what could have been a peak demand in May, 1988.

4.14 The demand instead of increasing in May, 1988 registered a decline due to the onset of monsoon. Due to excellent monsoon in May, June and July, and consequent reduction in off-takes, the demand dropped sharply leading to very high inventory level. The position reverted to the normal pattern. It was now necessary to reduce the inventory level by reducing movements from far of ports and reserving space in storage tanks at depots for accomodating the production from refineries to prevent crude cuts. In line with the normal inventory management routine, the stocks were gradually built up to full tankage level by October, 1988.

4.15 Substantial inputs had to be organised far above normal level from alternate supply sources such as Koyali, Kandla, Sabarmati and Bombay. The depots and terminals in the northern region had to receive and supply larger quantum of products than normal. Even a marginal delay in receipt of inputs could have rendered the concerned locations vulnerable to dry outs/stock outs. In order to maximise inputs in the northern region various operational arrangements were made not only in the northern region but in other regions as well. Bottlenecks in TW loading capacities were identified and immediate action was taken at all loading bases in improving the capacity of oil industry to load TWs both in terms of number of TWs as well as speed in TW loadings. Special care was taken to ensure that the coastal movement and import programmes were properly evolved and implemented for ensuring adequate product availability at the port terminals for loading of tank wagons *inter alia* to the northern region. Since a tank receiving product from tanker cannot be used for loading of TWs. necessary tankage reallocations were carried out so that even when the tankers were under receipt, the oil industry was able to undertake TW loadings in an uninterrupted manner.

4.16 All tank wagon loadings were done on industry basis and on account of all oil companies and that too in proportion of the demand from the depots of each oil company at each location. Specific measures were implemented for equitable share of each oil company in each rake being despatched

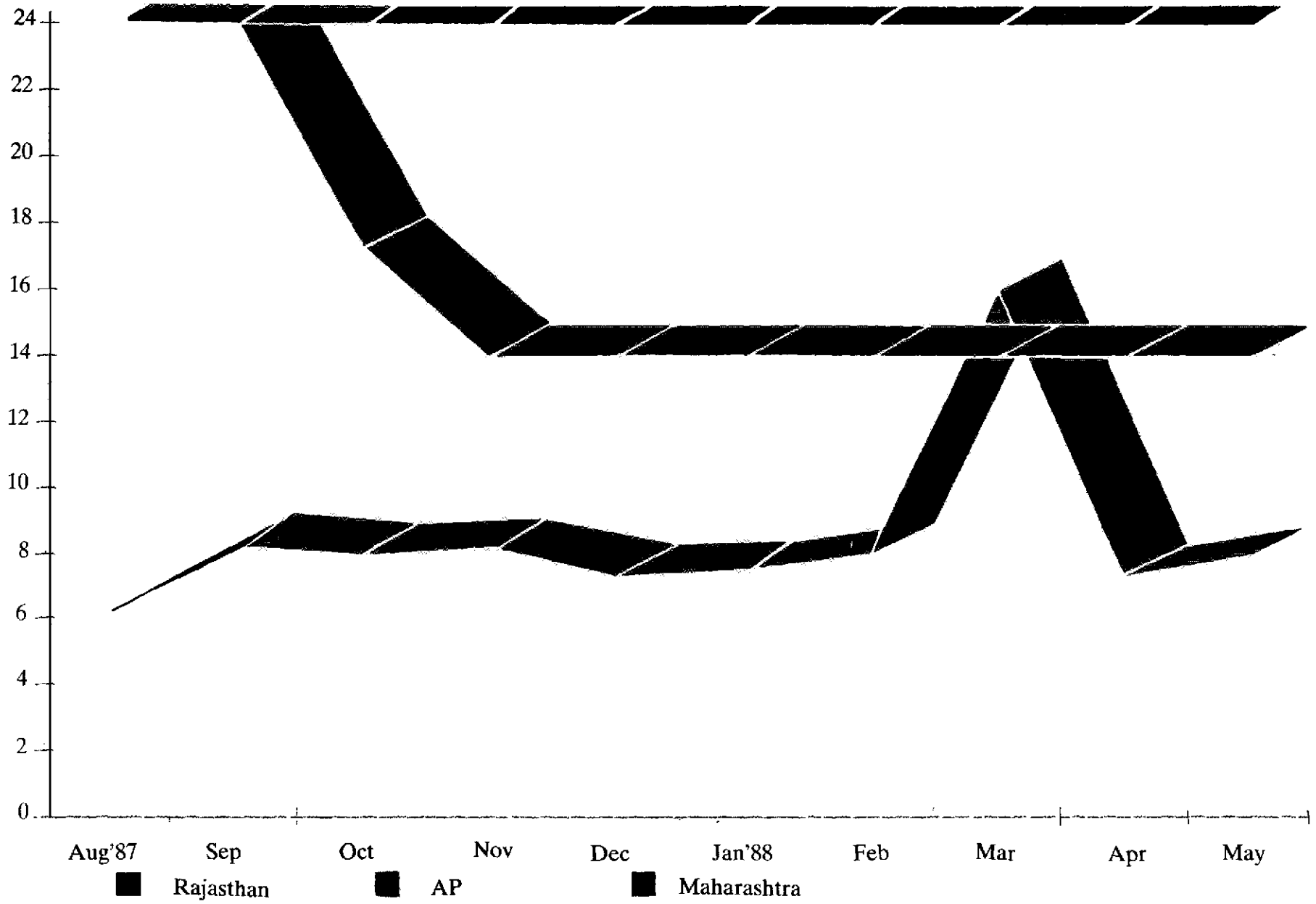


Figure 14: **Average Hours of Power Supply to Agriculture**

from each loading base. Priorities for movement of rakes to various destinations were decided on a centralised basis based on data collected from each depot in the northern region and suitable systems evolved for implementation of loading/despatch by the oil companies and railways in accordance with the priorities. After studying the lay out and capability for handling of TW at each and every depot/ location in the northern region, formation of rake for each destination and also the manner of clubbed loading of TWs on each oil company's account was worked out and given to the loading locations. This was done so as to prevent the need for sorting out of TWs at the receiving locations between the oil companies and to enable quick reformation of full rakes after unloading at the receiving locations. To the extent possible HSD despatches were organised in fully dedicated single product rakes.

4.17 Necessary arrangements were made at the receiving locations for speedy unloading of TWs to avoid detention to TWs. Procedures were evolved for unloading of TWs, by different oil companies on the basis of ullage availability rather than being strictly in accordance with booking particulars. This arrangement led to speedy decentation and release of rakes. Selected high throughput locations worked round-the-clock so that the successive rakes arriving at the locations were not detained and at the same time the stock releases from the depots could match the peak level demand that was prevailing. Necessarly arrangements were made to ensure that as long as at a given location adequate product was available with any oil company, the entire industry demand was met in full.

4.18 It was necessary not only to monitor the actual stock position but also the actual level of upliftment from each and every depot/terminal in the northern region. To ensure adequate product availability it was also necessary to monitor the product in transit, expected arrival, expected depletion rate and required replenishment rate so that no specific location went low on stocks. The OCC at New Delhi established the monitoring cell which comprised representatives of oil companies. The daily situation at each and every stock point was reviewed and priorities were jointly evolved for replenishment from alternate supply sources. The cell also monitored the stock positions at the alternate supply sources such as Kandla, Bombay, Koyali and Sabarmati. A daily check was kept on despatch schedule drawn vis-a-vis actual despatches made from the alternate supply sources so as to ensure that the evolved plans were implemented in full. Thus the monitoring was not confined only to northern region but was on a much broader scale. Regular daily feedback on the situation was given by the cell to the MOPNG. Similarly the oil companies constituted monitoring cells within their organisations through which the managements of the oil companies were also kept duly apprised of the day to day situation.

4.19 Barauni Refinery feeds Bihar, Eastern UP, Kanpur and markets in the vicinity of Kanpur. In order to increase the inflow to Kanpur, the MOPNG decided on maximising the crude throughput of Barauni. However, despite the plan to allocate additional north-eastern crude to Barauni refinery, this refinery could not be operated at its maximum possible capacity due to shortfall in availability of north-eastern crude vis-a-vis plan. Since the railways operationally find it inconvenient to provide surplus tank wagons to meet peaking of demand as was witnessed in the drought period, there is an urgent necessity to set up support transportation network such as product pipelines. During the later half of 1987, the demand for furnace oil and low sulphur heavy stocks also reached very high levels. Thus out of the available rail transportation capacity and TWs, it had become necessary to allocate additional TWs for black oil movement resulting in an additional constraint on white oil movement.

4.20 Throughout the drought period the Bombay-Pune pipeline remained under shut-down for reasons beyond the control of oil industry. Had this line been operational, it would have been possible to arrange additional inputs in the north from Bombay. This shutdown posed a very heavy strain on the logistics. A major part of the Rajasthan area is covered only by metre gauge. Since the availability of metre gauge TW fleet is limited, it was a very difficult task to meet the peaking of demand in the Rajasthan area. The constraints in feeding this important area need to be removed as quickly as possible. In this regard, there is a proposal to lay a product pipeline from Kandla to Bhatinda which is under active consideration of the GOI. This pipeline will pass through Rajasthan where tap off points will be provided at Sidhpur, Jodhpur and Sanganer to meet the requirement of Rajasthan.

Future Plans

5.1 There is a proposal for construction of a new 6 million tonne per annum capacity refinery at Karnal. Early commissioning of the proposed additional refining capacity is desirable so that the

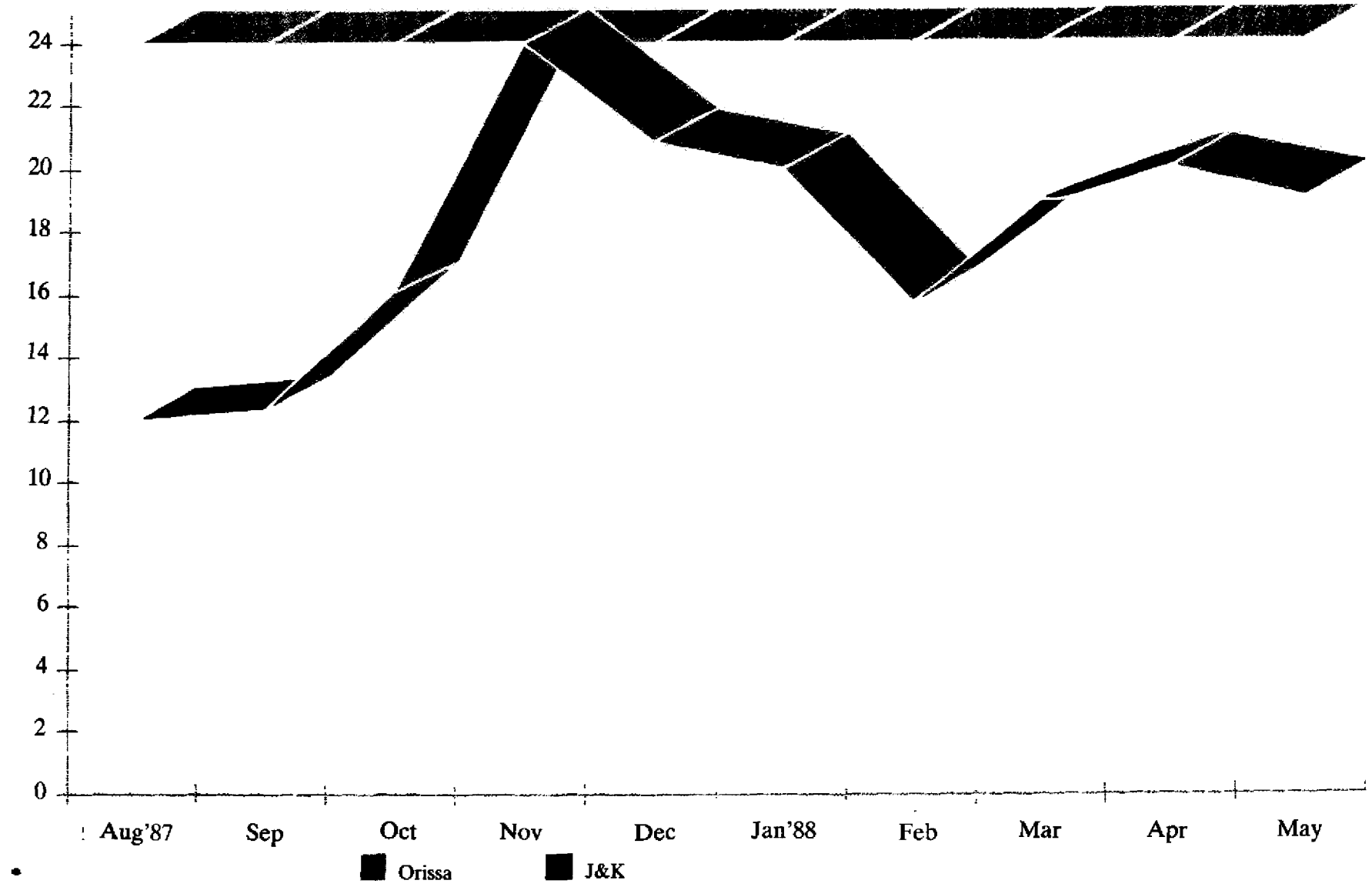


Figure 15: **Average Hours of Power Supply to Agriculture**

increase in demand of the northern region can be met with a higher degree of reliability and confidence level. In order to meet the increasing demand of the north-west region and the limitations in transportation capacity for arranging inputs from alternate sources, a proposal has been developed by the oil industry for putting up a product pipeline from Kandla to Bhatinda *via* Rajasthan. Several tap off point terminals have been proposed along the route of the pipeline. Timely execution of this proposal will go a long way in meeting satisfactorily the demand in the north west region. The demand growth profile and the estimates for the northern region reveal that even after the commissioning of the proposed Karnal refinery, the Kandla-Bhatinda pipeline would be required for meeting the demand of the northern region.

5.2 There would be an inevitable time lag before the proposed Kandla-Bhatinda pipeline and Karnal refinery are commissioned. In the intervening period the requirements of northern region can be met only through increase in rail inputs from Kandla and Bombay, apart from Mathura and Koyali. The TW loading facilities at Bombay with BPC refinery have been augmented. The MOPNG has studied in detail the augmentation of TW loading facilities by the oil industry and TW movement requirements by the railways *ex* Kandla. Unless the railways gear up their facilities to meet the full demand *ex* Kandla, it would be difficult to maintain the supply line.

5.3 The oil industry constructs additional tankage as a part of regular programme in order to meet the growth in demand for petroleum products. Keeping in view the importance of the northern region and also the long lead involved in supplies from Kandla and Bombay, the oil industry is now evolving plans for further improvement in the tankage cover in the northern region so that adequate inventory can be kept for meeting various requirements. This additional tankage programme needs to be implemented as per schedule. The crisis during 1987-88 could be met only through a well conceived and executed inventory management programme. Though such a programme continues to be in constant operation, it is important that notwithstanding various constraints, every effort is made to keep the inventory upto required levels so that whenever peaking of demand takes place, support can be drawn from the available inventory till augmented rescue inputs can be organised.

Electricity

6.1 To meet the situation created by drought, it was necessary to maximise the generation from thermal stations since there was no possibility of increasing hydel generation. It was also necessary to energise additional irrigation pumpsets in the drought affected area and to bring back into service pumpsets which were out of order. Besides, it was necessary to curb the consumption of power for ostentatious purposes. With a view to achieve the above objectives a contingency plan to meet the drought situation was formulated. This plan involved rescheduling the planned shut-down of thermal plants and expediting the commissioning of new plants as well as recommissioning of existing plants under forced shut-down, energisation of additional pumpsets in drought-affected States, regulating the water releases from hydel reservoirs for optimal use of the available water for generation of power and irrigation purposes to give high priority for supply of power to agricultural sector, reducing transmission and distribution losses and saving of energy through energy conservation measures.

6.2 For implementation of contigency plan to meet the drought situation following steps were taken:—

(i) For maximising thermal generation, power authorities were advised to postpone the scheduled maintenance of the plants unless very essential. The down-time of the units which was already under outage was reduced by expediting works. The scheduled maintenance of about 1,000 MW of the capacity was postponed;

(ii) The coal supply to thermal stations was closely monitored. Adequate quantity and quality were ensured for increased thermal generation;

(iii) The Rural Electrification Corporation (REC) implemented a crash programme for energisation of 1.5 lakh agricultural pumpsets in the drought affected States during August to November, 1987. Against the target of 1.5 lakh pumpsets, 2.27 lakh pumpsets were energised. In addition, 2.8 lakh pumpsets were made operational during the same period under the REC's programme of replacement of burnt out transformers. In this connection Figure 10 may be seen;

(iv) The State Governments of all the drought affected States were requested to give highest priority for supply of electricity for minimum 8-10 hours daily preferably during the day

light hours to the agricultural sector. All the drought affected States more or less ensured minimum 8 hours of power supply to agriculture sector during day light hours. In this connection Figure 11 to Figure 15 may be seen;

(v) The State Governments of all the drought affected States were requested to regulate the water releases from the hydel reservoirs for optimal use of the available water for generation of power and irrigation purposes;

(vi) Guidelines were issued to all the drought affected States and the concerned Electricity Boards to divert water and power from power intensive industries for agricultural purposes and for drinking water. It was also suggested that industries may be asked to run their captive units;

(vii) The monitoring of the projects under construction was also intensified to expedite the commissioning of additional generating capacity. The capacity commissioned during 1987-88 was about 5,000 MW, which is the highest ever achieved so far in the country;

(viii) The measures like staggering of load and programme shedding were adopted to have a better load management;

(ix) During the year 1987-88, the hydel generation was 9 billion units less than the target due to decline in reservoir levels. A contingency plan to augment thermal generation was implemented. By successfully implementing this plan, thermal generation was augmented by 6.4 billion units; and

(x) Increased productivity from thermal power plants was ensured during 1987-88.

6.3 The increased thermal generation required increased supplies of coal which was by and large acheived with cooperation of Coal India Ltd. and railways. All the drought affected State Governments and State Electricity Boards were requested to take necessary steps to meet the drought condition and send daily reports on action taken to Central Electricity Authority/Department of Power. The position was constantly monitored on the basis of the daily reports received from the drought affected States and periodical status reports were sent to Department of Agriculture and Cooperation, Cabinet Secretariat and Prime Minister's Office for their information.

6.4 All the power surplus States fully cooperated by diverting their surplus power to the deficit States. Since the contingency plan drafted by the Department of Power was successful in meeting the drought situation in the country during 1987-88 it is proposed that any future contingency plan, should be based on the same pattern, taking into account the requirement of the magnitude and geographical spread of the affected area.