REPORT ON BOMBAY

ANNEX II:

THE PUBLIC UTILITIES

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Some Common Terms

In this presentation the phrase 'the public utilities' is taken to refer to those services only, which in the Bank's organization are the province of the Public Utilities Projects Department: electric power, telecommunications, water supply and sewerage. Occasionally also the gas service will be mentioned as it, for certain purposes, can be a close substitute for electricity.

The definitions of the geographical terms 'Bombay City', 'Greater Bombay' and 'Bombay Metropolitan Region' are given in the main report (para. 4).

The Indian financial year runs from April 1 through March 31. In this text an expression of the type '1969/70' thus refers to the financial year beginning April 1, 1969 and ending March 31, 1970, etc.

The monetary equivalents to the rupee are also given on the frontsheet of the main report.

Abbreviations

BEST - Bombay Electricity Supply and Transport Undertaking
BMC - Municipal Corporation of Greater Bombay
CIDCO - City and Industrial Development Corporation
CIDC - Maharashtra Industrial Development Corporation
MSEB - Maharashtra State Electricity Board

This Annex was prepared by Messrs. Thomas W. Berrie and Percy Bargholtz from the Public Utilities Projects Department, who visited Bombay as members of an Urban Mission in November-December 1970.
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'MAP:

Bombay Metropolitan Region; Public Utilities
SUMMARY OF MAIN FINDINGS AND CONCLUSIONS

i. When it comes to the problems and prospects for the public utilities, Bombay is not unique. An examination of any big city in the developing world is likely to show a picture that is in many ways similar, although the emphasis on particular features may vary. Likewise, the difficulties are often not specific to the public utilities; as can be seen in the main report the same pattern prevails in most sectors of public responsibility. It is, however, well worth spelling out some of these general features, particular instances of which will be found in this report:

(a) Responsibility is fragmented. Several levels of government are often involved in the same problem; in addition there may be public or private bodies with varying degrees of autonomy. On the municipal level the metropolitan region is divided among a large number of municipalities.

(b) In some sectors the problems of the metropolitan region have to be solved in a wider context, statewide or even national. It is often hard for the region to get its particular conditions and needs fully appreciated, as they may differ radically from the 'average' elsewhere.

(c) The municipal level of government has a weak financial base. When growth and modernization lead to increasing investment demands the traditional sources of funds often prove inadequate.

(d) The rapid growth that the area experiences, in itself gives rise to a very heavy investment burden just to keep pace with the population increase.

ii. In addition to these general features, there are also some findings that are more concerned specifically with conditions in Bombay and the actual state of the public utilities there. Sometimes, however, these give rise to questions which can clearly be framed so as to have again a more general relevance. The actual answers to the questions may well be found to vary with the circumstances in different countries and cities; what is true for Bombay need not be true for every city, but it is likely that the technique for finding the answers can be generalized.

iii. While the present level of service in the power sector must be considered as adequate, projections for the future show a growing deficit between maximum demand and generation capacity. The basic question therefore must be whether to try to increase capacity more rapidly to accommodate the peak or not. To this end a study is necessary of, on the one hand, the possibility over the next few years to change the load curve by suitable pricing policies and/or the consequences of different degrees of load-
shedding, and on the other hand of the economics of installing additional generation capacity. 1/ In this connection the overall economic penalty of the present virtual ban on all types of generation equipment that need imported fuel (e.g. gas turbines) should be evaluated.

iv. At present there is a long waiting list for telephones in Bombay and this is in spite of the fact that practically only the demand under the so-called Own-Your-Telephone scheme, where the customer has to make a substantial cash contribution, is recorded. In addition existing exchanges frequently get overloaded, which limits the service even for those who are connected. In spite of the investment planned for the Fourth Plan period, the waiting list is expected to grow substantially rather than get shorter. In the face of this a study of the importance of telecommunications as a factor of production, and the consequences for industry and business of a drastic rationing of the kind prevalent in Bombay, would seem to be warranted.

v. The water supply situation in Greater Bombay is bad and has been deteriorating for a number of years. Generally, this sector is the one where the consequences of fragmented responsibility and inadequate financial arrangements are most apparent. A unified strategy and a coordinated investment program for the long run supply of water in the entire metropolitan region should be established. Better organization and project management practices will also be needed to carry out the large construction programs foreseen.

vi. Plans for the Twin City have not yet reached such a stage that it is possible to evaluate the impact of their requirements on the public utilities in detail. On the face of it, however, the question for telecommunications and power seems to be primarily the straightforward one about investment resources, while for water the question of the overall supply strategy for the metropolitan region (referred to above) should be settled before final decisions are taken.

vii. It would be of value for the discussions of urban development strategies 2/ in general and for Bombay in particular, to make a study of the relative variations in cost of investment for the public utilities as compared with other sectors, such as transport and housing. The object of the study would be to help to see whether considerations of the public utilities normally can be expected to be important when it comes to decisions about development strategies; in other words whether or not the possible cost variations in these sectors are dwarfed by the variations in other sectors.

1/ Or capacity of interconnecting transmission from outside the region.

2/ High density vs. low density, new towns vs. additional development in the existing urban area, etc.
I. INTRODUCTION

1. The responsibility for the public utilities services within the Bombay Metropolitan Region rests with all three levels of government: the national, the state and the municipal. The telecommunications are wholly national: the Indian Posts and Telegraphs Department is directly responsible. For electric power the situation is more complicated. The national level is engaged in at least two ways: through the Central Water and Power Commission it closely scrutinizes the expansion plans of the State Electricity Board, and through the Atomic Energy Department it is engaged in power generation. The state level is engaged both in generation and distribution through the State Electricity Board; further it is primarily the state that wields the regulatory power over the private utilities in the sector. The existence of a municipally owned distribution undertaking also means that the municipal level is directly engaged. For water supply and sewerage the primary responsibility rests with the municipalities, but the state level is also engaged in several ways. It gives financial assistance to municipalities for investments in the sector, it carries out the construction of new facilities for all municipalities but the largest and it constructs and operates dams. Through the medium of a state owned industrial development corporation it is even directly engaged in water supply and distribution in some areas.

2. The implication of the foregoing is that there is a considerable difference between the different utility sectors as to where the responsibility for the service rests. The consequence of this in turn is that one would not expect to find a common spatial organization, either for planning or for operations, and, indeed, there is none. Furthermore for none of the services is there a body which is responsible for exactly the metropolitan region, this latter being a recently designated area which does not coincide with any prior administrative units.

3. One can note, that the public utilities were given only a very superficial treatment in the recent Metropolitan Regional Plan. Again, this is to be expected: this was the first regional planning exercise in Bombay and it is both common and reasonable that the scope of the plan in such a case is restricted to cover only those sectors which are most strongly interrelated with land use. As a first approximation then, it seems safe to assume that the framing of the basic questions as to the future pattern of metropolitan development were not decisively influenced by consideration of the public utilities sectors.

4. It is hard to make general judgments about the importance of the public utility services for the metropolitan development. It is often claimed, however, that the availability of cheap and abundant (hydroelectric) power historically has been an important factor behind the exceptional industrial growth in the Bombay region, which in turn has been one of the driving forces in the general expansion in the area. As will be argued later (para. 60) it would now seem that this comparative advantage may well

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1/ See main report, para. 10.
be lost in the future. The low level of service in the telecommunications sector would on the face of it seem to preclude any strong influence on the development in the area. There might well be an effect, though: that in the almost total absence of telecommunications facilities elsewhere in the state, the relative attractiveness for business of other locations vis-a-vis the metropolitan area might be decreased. In the same sense it will be argued later (para. 43) that the standard of telecommunications service may prove to be of crucial importance for the success of the proposed Twin City development. Considerations about the critical water supply position have led the authorities not to grant permission for new activities inside Greater Bombay that are large water users, and it is obvious that this will have some influence on the pattern of development in the metropolitan area. On the other hand, it is also obvious that the deteriorating water supply situation in Greater Bombay over the years has not been sufficient to stop a rather rapid population growth.

5. The present level of service in the power sector must be considered reasonably adequate. Due to the consequences for hydro-power of a failing monsoon, rationing had to be introduced in the region during parts of 1963 and 1969, but when normal conditions were restored in the reservoirs this was lifted. The supply situation is, however, in a very delicate balance, and projections show that over the next few years it will become increasingly strained and that available reserves at maximum demand will get smaller and smaller, with an increasing risk of acute shortages in the event of plant outages. As regards distribution, again the present situation is good, with no excessive waiting times for new connections (this applies to presently electrified areas, rural electrification being another matter) and, as far as the mission could ascertain, a reasonable degree of reliability.

6. There is a long waiting list for telephones in Greater Bombay and the projections show, that despite the investment foreseen in the present Five Year Plan this list is likely to grow substantially. There are about 3 telephones per 100 inhabitants, which internationally is a low figure, but still more than ten times the Indian average. In the metropolitan region outside Greater Bombay the density is of the low order of the national average. Probably as a consequence of the small number of telephones available in relation to the demand for service, the average number of calls per line in Bombay is much higher than what is considered normal in the design of exchange equipment, which leads to fairly frequent overloading of exchanges and an ensuing low level of service from the system.

7. The water supply situation in Greater Bombay is bad, with limited supply hours (varying from perhaps 2 to 6 hours per day) and low per capita availability. The total supply has been constant for a number of years and meanwhile there has been a substantial increase in the population connected to the system. Also indications are that the losses in the distribution system are large and the portion of the total water unaccounted for is of the order of 40%. Outside Greater Bombay there generally are water supply systems in the urban municipalities of the region, but not in the rural areas.
8. As is to be expected, the sewerage system is less developed than the water supply. In Bombay City there is a collection system which is reasonably adequate for the amount of water supplied at present, and primary treatment is given before the effluent is discharged into the sea. For the rest of Greater Bombay, the sewerage system does not extend everywhere, and substantial areas depend on septic tank arrangements and discharge effluents into the open storm drains. 1/ Outside Greater Bombay there exists virtually no closed sewerage system or sewerage treatment anywhere in the metropolitan region.

9. In Bombay City there is an old town gas system, which provides gas for some industries and also for domestic cooking purposes. Its importance is rather limited due to the fact that there are only a very small number of connections. Bottled gas from the oil refineries has also made its appearance, and is distributed throughout the area.

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1/ This is especially so in the parts known as the Western Extended Suburbs (Extended Suburbs being those areas incorporated with Greater Bombay in 1957.)
II. THE INSTITUTIONAL FRAMEWORK

Electric Power

10. The Maharashtra State Electricity Board (MSEB) is responsible for generation, transmission and distribution of electric energy in the state of Maharashtra. There are, however, also a number of licensees operating and notably so in the Bombay area. Prominent among these are the Tata Electric Companies 1/, which operate both generation and transmission facilities, and historically have been the sole power suppliers in the Bombay area. Tata only supplies in bulk, however, and so there are within its license area a number of sub-licensees, which concentrate on distribution only: Bombay Electricity Supply and Transport Undertaking (BEST), Bombay Suburban Electric Supply Ltd. and Thana Electric. Of these the last is small and will not be given much consideration in what follows. The distribution in the metropolitan region outside the license area of Tata is the responsibility of the MSEB (see Map 3 for distribution areas).

11. For power supply purposes there are two subregions of Maharashtra state, the Western Maharashtra region and the Vidarbha region, between which the transmission facilities at present are very limited. From the power supply point of view these regions are far from equal: Western Maharashtra, where Bombay is, has about 75% of the total power demand in the state and more than 90% of the total energy consumption. Again, in the Western Maharashtra region the dominating part is the Bombay metropolitan region, which alone accounts for a good deal more than half of the power and energy consumption in the state. The supply to this region comes from a 220/110 kV grid owned in part by MSEB and in part by Tata. Connected to this grid are generation facilities of Tata (about 620 MW installed capacity), of the MSEB (about 550 MW) and of the railways (about 100 MW). Further the nuclear power station at Tarapur, which is owned and operated by the Indian Atomic Energy Department, is connected to the grid and delivers half its output to it (about 190 MW). Finally there is a tie-line which permits some small power import from the neighboring state of Mysore to the grid. The responsibility for load dispatching on the grid at present rests with Tata.

12. The MSEB in the financial year 1969/70 sold just under 4,500 GWh of energy, and the rate of growth of sales over a five-year period has been about 14% per year. About half the energy is sold in bulk to licensees (almost exclusively Tata) and most of the remainder is for industrial use; residential consumption is a very small fraction. Peak load, expressed as the arithmetic sum of the individual peaks in the two subregions, was

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1/ There are three companies that jointly own the Tata system: Andhra Valley Power Supply Company Ltd.; Tata Power Company Ltd.; and Tata Hydro-Electric Power Supply Company Ltd.
about 900 MW and this has been growing even faster than the energy sales; the five-year growth rate has been 17% per year. (For further figures see Appendix 1.) The operations of the Board in only the metropolitan region cannot be separated out, but it is reported that the Bombay Circle of the MSEB, which covers an area that contains the entire region but not too much more, has been experiencing a load growth of about 20% per year. Total installed capacity of the Board was 875 MW at the end of 1969/70 and investment in new facilities was of the order of Rs 550 million during that year.

13. The regulation of the utilities that operate under licenses is carried out according to the Indian Electricity (Supply) Act of 1948, as later amended. In broad terms the utilities are restricted to earn on their capital base, what is called a "reasonable rate of return". This limit to the allowable rate of return is given as 7% on that part of the capital which existed on March 31, 1965 and as 2 percentage points above the current reserve bank interest rate for later additions to the capital base. The Act lays down the rules for how the capital base is to be calculated, how depreciation should be applied etc., and also provides for the control that only allowable expenses are incurred. The original licenses were given for a 50-year period and the Act provides that, when this period is up, the licensees can be bought by the state electricity board, the state government or the concerned municipality in that order of opportunity. If none of these authorities wants to take over the license, it is renewed automatically for a 10 or 20-year period.

14. The primary licensee in the metropolitan region is the Tata group of companies, which supplies power mainly to Greater Bombay, but also to some areas outside this in Salsette Island and to an industrial enclave near Kalyan (see map 3). Their supply, as mentioned before, is only in bulk and at high tension. Consequently their customers (besides the sub-licensees BEST, Bombay Suburban and Thana Electric) are only industries that are fairly large power users. Their total energy sales in 1969/70 were 4.750 GWh of which more than half was to industries and somewhat more than one third to sub-licensees, the remainder being sales to the other partners on the grid: MSEB and the Railways. On the other hand, the Tata companies could only generate 62% of the energy which they sold in their own power stations and had to buy the rest from MSEB. As it is unlikely that Tata will get any additional generating capacity in the foreseeable

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1/ This figure is estimated, as the exact one was not available. For the year 1968/69 the peak was 785 MW.

2/ To be able to put in new plant, Tata would need a permit from the state board which it is doubtful that they would get. Moreover Tata's license expires in 1980 and at present there is a large measure of uncertainty about their future development. (But see para. 39.)
future the growing energy requirements will in principle have to be met by growing purchases from MSEB. Their increase in sales from 1963/69 to 1969/70 was only at the rate of 4.5%, this being explained by a shortage of hydro-electric energy due to a failing monsoon in 1968, and the historic annual increase has been about 7%. Investment (mainly in new transmission equipment and replacement of items of generating plant) was about Rs 35 million. (See also Appendix 1 for further figures.)

15. The municipally owned BEST is responsible for power distribution in Bombay City, that is within the municipal limits as they were before 1950 (and also for operating the buses in Greater Bombay). It started as a private company in 1905 and the municipal takeover came in 1947. BEST now is no longer a company, but a semi-autonomous part of the operations of the Bombay Municipal Corporation. It has a financial and accounting organization of its own, but its budget appears as a part in the overall BMC budget and its loans are raised on the general security of the revenues of the BMC. The former board of directors has been replaced by a committee which is appointed by the city council. It should be noted that BEST has a general manager who reports to this committee and that it does not come under the responsibility of the municipal commissioner, who is appointed by the state government and who is for all other matters the head of the municipal administration.

16. In 1969/70 BEST sold 920 GWh of energy, which represented an increase of little more than 3% over the preceding year. Unlike what was said about Tata, this figure is not much lower than the normal growth rate: BEST operates under conditions of a rather small growth in demand, which basically is due to the fact that, as Bombay city is all built up, there is no substantial new development in the area. Residential, commercial and industrial consumption take approximately equal shares of total energy sales. System peak demand was 185 MW and the average annual load factor about 52%. Investment in electricity distribution facilities during the year was about Rs 22 million. (See Appendix 1 for further figures.)

17. Bombay Suburban has a license area that covers (roughly) the so-called Eastern and Western Suburbs and the Western Extended Suburbs in Greater Bombay and, in addition to this, part of Salsette Island outside the municipal limits (see Map 3). It is a private company, but over 40% of its equity is owned by public institutions like the Indian Life Insurance Corporation. In 1969/70 total energy sales were 540 GWh, which represented an increase of more than 16% over the preceding year. In earlier years the annual growth of sales seems to have been of the order of 10%. Industrial and residential consumption are the major categories accounting for two-thirds and one-quarter of the total energy respectively. System peak demand was 110 MW and the average annual load factor a high 67%. Investment for the financial year 1970/71 is budgeted at about Rs 33 million, where the higher figure as compared with BEST reflects the much higher growth rate. (See Appendix 1 for further figures.)
18. Finally Thana Electric has a license area that comprises Thana municipality and those parts of the Extended Suburbs in Greater Bombay that are not in the license area of Bombay Suburban (see Map 3). Until recently the two companies were cooperating so closely as to have a common 'managing agency', but this is no longer permitted under the law. Thana Electric is much smaller than BEST and Bombay Suburban as can be seen from the fact that system peak demand is only a little over 30 MW.

Telecommunications

19. For design, construction and operations the Posts & Telegraphs Department of the Indian government (P&T) has a regional organization, where normally each state is covered by one so-called circle for P&T; thus there is a 'Maharashtra Circle. But for the telecommunications part of the operations there is a further division in that cities where the number of telephones is sufficiently large are made into districts of their own. This means that while the Maharashtra Circle is responsible for the postal operations in the entire state, there is a Bombay Telephone District that takes care of the telecommunications in Bombay. In point of fact, Bombay Telephones is responsible for the service in an area that is slightly larger than Greater Bombay, namely all of Salsette Island (see Map 3).

20. Bombay Telephones as of October 1, 1970 had a total equipped exchange capacity of 143,000 lines and a total of 118,000 working lines (direct exchange services). The relatively low exchange occupancy is due to the very high calling rate and consequent congestion (see para. 6) which prevents the equipment being worked at its normal utilization level. The number of telephones installed was 180,000 and the present rate of new installation is about 13,000 per year. At the end of 1969/70 there was a waiting list for telephones of about 72,000, out of which 60,000 were under the so-called Own-Your-Telephone (OYT) scheme, where the applicant has to make the substantial capital contribution of Rs 3,000 (US$400 equivalent) on installation. This waiting list presumably gives only a rather vague indication of the unmet demand for telephones as the normal waiting time is still 4-5 years and for a long time applications for telephones outside the OYT scheme were only accepted for certain priority cases. The investment level throughout the Fourth Plan period is shown as about Rs 50-60 million per year.

21. The telecommunications operations of the Maharashtra Circle are on a smaller scale altogether than those of Bombay Telephones. At the end of 1969/70 the total equipped exchange capacity in the whole state (excluding the telephone district of Bombay and Poona) was about 56,000 lines and the number of connected telephones about 45,000. Shortage of cable is one of the reasons for the very low exchange occupancy. The growth rate is 5,000 new telephones per year and the recorded waiting list is 12,000.

1/ There is also a Poona Telephone District, but this is entirely outside the metropolitan region and thus of no concern here.
If one restricts attention only to the metropolitan region, there are at present only about 2,700 connections and a waiting list of some 3,600. There is no breakdown that shows the investment level for this area only, but it is obvious that it must be low (presumably less than Rs 1 million per year).

Water Supply and Sewerage

22. The responsibility for the water and sewerage services rests primarily with the municipalities, but the state also plays an important role in this sector. The municipalities normally are responsible for operation and maintenance of existing systems but, except in the case of BMC, it is the state through its Public Health Engineering Department that does the design and construction work for anything but very small improvements. The state also gives substantial financial assistance to the municipalities for water and sewerage projects, again with the exception of BMC (see Appendix 2 for the terms of this assistance). Further the state is responsible for the construction and operation of dams and has a controlling influence on water supply schemes by the fact that the state has to give a permit for every significant new water abstraction.

23. The BMC operates by far the largest water supply system in the region. Its main water sources are the Tansa and Vaitarna rivers to the north of the region, where storage dams catch part of the water from the monsoon period. The water is brought from there to Bombay in five pipelines, ranging from size 96" downwards in diameters, and the combined yield is about 190 Mgd 1/ (see Map 3). To this is added water from small lakes inside Greater Bombay also about 20 Mgd which, under an emergency scheme dating from 1968, is abstracted from the Ulhas river and pumped into the same pipelines. For this last supply BMC, however, has no permanent permit, and so it may have to be discontinued when other sources have been brought in. The total water available for BMC to distribute in Greater Bombay is about 210 Mgd. 2/ As almost all of the population gets its water from the public system, either by house connections or from public taps, this works out to a per capita gross figure of some 40 Ig/d; but, after taking into account the high losses in the distribution system, the net figure probably is not much higher than 20 Ig/d. Investment by the BMC for water and sewerage has for the last two years been of the order of Rs 40-50 million annually, where the priority is very much given to water supply. The largest part of the investment is for a dam on the upper Vaitarna river plus a pipeline to the city which will yield an additional 120 Mgd.

1/ Million Imperial Gallons per day.

2/ BMC also supplies some areas outside Greater Bombay with water from its transmission system (notably Thana and Bhivandi), which has been deducted in arriving at this figure.
24. Outside the area served by the BMC system there are at present four large systems of water supply in the metropolitan region. The largest urban zone in the region, outside Greater Bombay, the Kalyan-Ulhasnagar complex, is served from the government-run Badlapur waterworks and also by the Shahad system, which is operated by the government controlled Maharashtra Industrial Development Corporation (MIDC). The source in both cases is the Ulhas river, and the capacities of the two systems are 7.8 Dmgd and 10 Dmgd, respectively. The capacity of the Shahad waterworks is just in the process of being increased to 12.5 Dmgd, in order to make it possible to give a temporary supply to industrial areas in Thana where, due to the precarious position of the BMC water supply, the present supply is unsatisfactory.

In the south of the region there is a water supply system for Uran and some military and industrial establishments around there (the Kansai system) with a present capacity of 4.5 Dmgd. Finally there is the MIDC/Trans-Thana system, which is based on abstraction from the Patalganga river in the south of the region, and which serves (besides the Hindustan Organic Chemicals plant on the river) the industrial areas in Trans-Thana. Production in this system is about 9.5 Dmgd and the capacity is around 12 Dmgd. The two last-mentioned systems are both operated by MIDC. (See Map 3 for location of the various water supply systems in the region.)

25. As has been said before, the state Public Health Engineering Department normally is responsible for the design and construction of the municipal water supply and sewerage systems. The level of activity can be judged from the fact that the annual investment in all the state in projects is of the order of Rs 100-120 million, of which the state grant is 40-45 million. In the metropolitan region, work is at present in progress on 5 urban and 6 rural water supply systems and on 4 sewerage schemes. The annual investment in the area is estimated to be Rs 15-20 million. Besides the construction activity, the department also is responsible for the running of the Badlapur water works mentioned above.

26. The state-owned MIDC (see para. 24) was set up in 1962 basically to be a tool for the industrial dispersal policy of the state government. It manages various industrial areas (by now 24 in the whole state) where it creates the infrastructure in the form of roads, water distribution system, sewerage and drainage etc. and leases plots and/or buildings to various industries. Because there was no adequate water supply available near several of these industrial areas, MIDC has gradually evolved as a large-scale water supplier and now operates three systems in the Bombay region. The investment by MIDC in 1969/70 for water supply (in all the state, but most of it in the metropolitan region) was about Rs 13 million, but this will be stepped up to 40 million and 43 million respectively in 1970/71 and 1971/72, mainly due to investment in a new large project in the region, Barvi (see Map 3 for location, and paras. 47-48 for further discussions).

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1/ These figures all exclude projects by the BMC.
Gas Supply

27. The Bombay Gas Company has been in existence for over one hundred years, supplying town gas in Bombay City. It is a privately owned company, incorporated in London. Since the street lighting was converted to electricity a few years ago, domestic use for cooking and some heating is the largest consumption category, about 60% of the total sales. The number of domestic consumers is about 28,000, and industrial 110. The plant is rather old and operating at (or over) capacity to produce about 6 million cu. ft. per day, sales increasing about 3% per year. There is a long waiting list for new connections, some 40,000, and the average waiting time has been 3-5 years.

28. BMC produces some sewage gas in their largest sewage treatment plant, some 50,000 cu. ft. per day. This is used primarily in hospitals, but some is also sold to domestic consumers.

The Utilities in the Twin City

29. The area that has been designated for development of the Twin City is at present rather thinly populated, the only urban municipalities there being Panvel and Uran with 18,000 and 10,000 inhabitants respectively according to the 1961 census. This means that the utilities services are not very developed so far, and that the kind of rapid growth which is foreseen will put a great strain on the authorities responsible. The general responsibility for the implementation of the Twin City project has been entrusted to the state-owned City and Industrial Development Corporation (CIDCO), which was set up in 1970, but they will have to cooperate with the existing authorities in the various sectors.

30. For electric power, the Twin City area is entirely in the distribution region of the MSEB, and, although no formal decisions have been taken, it can safely be assumed that the power distribution will be undertaken by them. There is no reason to expect particular technical problems, the high voltage bulk supply grid passes right through the area and there are in fact already two main receiving and switching stations in Panvel and Kalva. Quite another matter is that there is no money allocated as yet in the state Five Year Plan for large investments in a distribution system for the Twin City, and that the financing for at least the first few years might pose a problem.

31. Telephones are few and far between in the area, which is entirely within the territory of the Maharashtra Circle of P&T. There are about 400 working connections at the two exchanges in Uran and Panvel together, and in addition the industries in the Trans-THana industrial area of MIDC are at present served from the Thana exchange of Bombay Telephones with about 100 lines. Up till recently any planning for the telecommunications development in the Twin City has been done by the district of Bombay telephones, where there obviously exists an experience with metropolitan network planning, and there could be advantages in continuing this arrangement.
in some form. Here again the Five Year Plan (this time the national plan) does not yet contain provisions for a large-scale investment in facilities for the Twin City.

32. CIDCO, as the new town development agency, will hold most of the normal municipal powers and responsibilities with regard to the new development. In line with this, CIDCO will design, construct and operate the water distribution and sewerage facilities there. For the first period of development bulk water will undoubtedly be bought from MIDC, which operates several supply systems in the general area. For the longer run water supply, when requirements get larger, there is either the possibility of CIDCO's trying to obtain water rights and developing a source of their own, or their coming to an agreement about continuing bulk supply from the BMC and/or the MIDC systems. (A set of proposals for supply from MIDC will be described in Chapter III.) In due time it can be expected that the Twin City will be established as a municipality in its own right, and from that time on it is reasonable to assume that the municipal government will take over the responsibility at least for the operation of the water distribution and sewerage system.
III. PLANS AND PROSPECTS FOR THE FUTURE DEVELOPMENT

33. All the various entities which have been described in Chapter II naturally have plans of one kind or another for the future development of their services. There is little reason, however, to examine all these plans in detail as they to a large extent can be considered as 'routine'. In the following only the more important investment programs and problem areas will be commented upon.

Electric Power

34. Probably the most significant trend in the future development of the power sector in the region is an anticipated growth of a power shortage. This shortage will apply to the whole of the Maharashtra state, but will be felt most in Bombay and the west of the state, where there is the largest demand for electricity. The Fourth Plan was originally drawn up under the assumption that the total installed generating capacity in Maharashtra would be increased by 1,225 MW to a total of about 3,000 MW during the five-year period of financial years 1969/70 through 1973/74. 1/ This would already have meant a deteriorating supply situation, as the load growth was expected to be such as to draw the reserve generation capacity 2/ down to only 12% of maximum demand at the end of the period. It was expected, however, that it would be possible to make up for this shortage (a 20% margin or even higher was considered necessary to give a reasonable guarantee of power availability at peak times) through imports from the neighboring states of Mysore and Madhya Pradesh.

35. The actual development up to the end of calendar 1970 has been such as to make the picture a lot darker than before. The program of expansion of generation capacity is running late, so that additions during the plan period of only 745 MW are now expected. This means that, even though the official demand forecast has also been revised downwards, there will be virtually no reserve margin at all left at the end of the period. In effect, one can say that the entire program is one year late compared with the original Fourth Plan, and this means that there is a steadily increasing gap between forecast demand and available capacity. Some power can be imported from the state of Mysore, but it is not clear how much. In any case, the entire deficit cannot be covered in this way and already some load has had to be shed on occasion in the Bombay region.

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1/ This was in the draft plan. By the time the plan was finalized, already one project of 240 MW was characterized as a "spill-over" into the Fifth Plan period.

2/ Reserve capacity here equals the installed capacity (net) less maximum demand, expressed as a percentage of installed capacity.
36. One of the important reasons for the delay in the construction program has been the lack of funds. This can now have repercussions far into the future, as any effort to catch up with the demand will mean a stepping up of the investment rate above the already high average level that is needed just to keep pace with the rapid growth, around 14% per year. Also, due to the long lead-times prevailing in power generation, any power plants where construction has not yet been started cannot come into operation before 1975/76 at the earliest (this refers to thermal stations, hydro power would take even longer). It is in this rather long perspective that one must judge the situation.

37. A large part of the current construction program of the MSEB is a series of thermal units at a power station in Koradi in the east of Maharashtra state. This was conceived as a minemouth station, standing in the Silewara coal fields, 1/ and according to plans there are to be six generating units making about 1,000 MW total capacity. The first two units of 120 MW each are now expected to be commissioned in 1973/74 and then another two of the same size in 1974/75. After that, the plan is to increase the size of the units by putting in two of 250-300 MW each, and it is the commissioning of these that the MSEB would now like to speed up, as it is being realized that the power shortage is likely to grow even larger after 1975. There are, however, several points to consider before one can be assured that this will mean a solution to the power shortage problems in Bombay, even leaving aside the question of whether the funds will in fact become available.

38. First, there are some technical doubts as to whether one can reasonably expect that the construction of these larger generating units can be speeded up very much compared with the original timetable. According to government policy, equipment for power stations must be locally produced. Up to the present, Indian industry has never produced units as large as the 300 MW range and neither does there exist experience in India in the installation and operation of them. One could therefore argue that it would be unwise to make use of these untried items in a crash program. Second, there is the question of coal availability. The Silewara coal field is not producing yet but requires to be opened up, and this takes a long time. Already according to the original schedule of construction this would present a problem and necessitate coal being transported by train from other coal fields in the area at least for the first few years, thus reducing the economic advantage of a minemouth location for the generating station. If the large units are now to be put into operation earlier than planned, the supply problem will be aggravated and it is not even clear that the railway capacity to transport the coal exists at all. Needless to say, the economies of the whole generation program will also be affected if even more coal than originally planned has to be

1/ A previous study had shown it to be more economic to transmit electricity from the coal fields to the load center at Bombay rather than to transport the coal and have the generation in Bombay.
brought by rail from other coal fields. Third, the transmission capacity might conceivably become a bottleneck, as the power to supply Western Maharashtra has to be transmitted some 500 miles from Koradi and at present the transmission capacity for this does not exist. An EHV transmission line is to be built but construction is delayed and indeed has not yet been started, one of the reasons reportedly being a lack of decision as to whether it should be built for 400 kV or 500 kV.

39. The power shortage foreseen is foremost a question of not being able to meet the demand at time of system peak and not so much one of annual energy requirements. There would thus seem to be a case for the introduction into the generation system of some typical peaking equipment, such as gas turbines. No such units are used at present and no plans exist for setting any. One explanation given for this is that the country cannot afford to use imported fuel to produce electric power, which would be necessary in the case of gas turbines. It is doubtful, however, if this argument stands up to rigorous economic analysis, just as long as the policy is to plan to supply the power demanded at the peaks rather than to accept load shedding as a matter of principle. (This latter line was advocated by some officials, but that too would have to be examined carefully before one could decide on its economic merits.) Another way of assuring adequate power supply capacity in Bombay in the somewhat longer run, which has been suggested by Tata, is to put in an oil-fired 300 MW unit at their existing power plant in Trombay. This would not depend upon transmission capacity and it is argued there will be fuel available at a competitive price from the refineries in Trombay. Obviously this suggestion runs counter to the government's general policy concerning imported fuel that was mentioned earlier, and further Tata's suggestions concerning the availability of residual oil fractions for fuel is not generally accepted by officials. Discussions are going on between Tata and the state government and these also concern the future division of responsibility for the power supply in the Bombay region in general. 1/ Tata has suggested that a joint company could be set up, to take over all generation and transmission facilities in the area from both Tata and MSEB but so far the discussions do not seem to have entered a decisive stage.

40. Historically the Bombay region has had the advantage over most other regions in India of a plentiful supply of cheap power. Tata were very early in their exploitation of the hydro-power resources and they have been able to keep a comparatively low price for delivered power. Now the picture is changing and a growing share of the power in Maharashtra is coming from thermal stations with higher generation costs. 2/ The program for the future also foresees a growing share of the generation in the eastern part of the state, where the coal fields are, while most of the

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1/ As mentioned before, Tata's present license expires in 1980.

2/ In 1970/71 over half the generation is in thermal stations, while in 1962/63 about two-thirds was hydro.
load is in the west, thus increasing the transmission distance for the power to Bombay. Finally it may be noted that the coal in Maharashtra, which is planned to be used, is of a low quality, with very high ash and moisture content and low calorific value. All this makes for rising power costs in Bombay, while at the same time several other states in India are beginning to develop large hydro-power resources. These facts taken together mean that the advantageous electric power position of Bombay may gradually disappear.

**Telecommunications**

41. Investment in the telecommunications sector is given a low priority in the central government's plans. One of the consequences of this is that the expenditure approved for the Bombay Telephones district will not be sufficient to reduce the backlog in the giving of new connections, or even to keep pace with the growth in demand. It is thus estimated that the actual waiting list will grow from about 61,000 at the beginning of the Fourth Plan period to about 120,000 at the end, despite capital investment of approximately Rs 300 million. Even if investment were to increase, the number of waiting applicants would probably still rise, due to suppressed demand which will only be revealed as further connections are made. In any case, it is unlikely for practical reasons that a much larger physical program could be mounted over the next few years. Also, it is not permitted to import telecommunications equipment, and production capacity in India is limited (a shortage of cable was referred to in paragraph 21).

42. For the metropolitan region outside the area of Bombay Telephones a demand projection has been prepared, which indicates a total demand of 28,000 in the year 1975 and 53,000 by 1980. An investment program to provide the exchange capacity for this (50,000 lines main exchange and 2,600 lines small exchange capacity) and also direct-dialing facilities to Bombay has been estimated at about Rs 170 million. Comparing this with the present situation, where there are 2,700 connections and a waiting list of 3,600 (see para. 21) the increases on the face of it seem rather startling. If one were to regard this as an investment proposal for a 10-year period, it would mean an average of 5,000 new connections each year (equal to the present total for the whole of the Maharashtra Circle) and an average investment level of about Rs 17 million per year (presumably more than a tenfold increase compared with what the figure for the area has been so far). Even judged simply as a demand projection the projected increase seems high, especially for the period up to 1975 (the present recorded demand totals 6,300, i.e. the sum of the number of connections and the waiting list). Part of the explanation for the high figures is the proposed Twin City development, for which a demand of 23,000 is foreseen in 1980, but even so the balance of 27,000 new lines seems very high for the rest of the area. Unless the general investment level in the telecommunications sector is stepped up appreciably it also seems unlikely that such a figure could in fact be realized.
43. The Twin City is another matter entirely. For this completely new development no historic demand trends exist, and if it succeeds in one of its expressed aims, namely to attract businesses which are now located in Bombay City (or which would otherwise have located themselves there) one could well expect a demand level more like the one in Greater Bombay than the one in the rest of the metropolitan region. It can even be argued that it is necessary for the success of the venture that the level of telecommunications service be very high, as the main argument advanced for business locations in the crowded centers of big cities usually is the need to be near other businesses. If one now wants units to move to a new location outside the old center, it is reasonable to expect that one necessary thing is to assure them of good telecommunications. In view of the not-too-good service in this respect in Greater Bombay at present, it might even be prudent to promise a better service and thus to offer a distinct advantage. But this means that investment for the Twin City must not be curtailed; proposals have been put forward to expand exchange capacity to 9,400 lines up to 1975 (as opposed to the existing 700 in the area). Also direct-dialing to Bombay is an important and necessary convenience.

Water Supply and Sewerage

44. For many years one of the overwhelming problems in the region has been that of water supply to Greater Bombay, where the situation has grown steadily worse (see para. 7). As early as 1964 the International Development Association (IDA) was approached with a request to help finance the so-called Upper Vaitarna project, a dam and a pipeline to increase the water available to Bombay by 120 Mgd, but this request was subsequently withdrawn. For a variety of reasons, progress on this project has been very slow and it is still not completed. Currently most of the investment resources BMC can find for the sector go to this purpose, and the pipeline is expected to be commissioned in stages during 1971 and 1972. The dam, for which the state Irrigation and Power Department is responsible, but to the cost of which BMC has to contribute, is now expected at best to be completed in 1972.

45. Meanwhile, after the experience of a severe drought in 1966, IDA was again approached but now with a new project, the Bhatsai. This consists of a dam on the river Bhatsai and a pipeline to carry the water to Bombay (see Map 3). The discussions about this project have been protracted and there is still no agreement on a definite project. As now envisaged, IDA might help finance a project package consisting of the river pick-up, pumps and pipeline from the Bhatsai, treatment works in Bombay (not only for the Bhatsai water), strengthening of the distribution system and extension of the sewerage system. If no further delays are experienced, it is hoped that the project can be appraised by IDA sometime in the second half of calendar year 1971.

46. There will have to be further heavy investment for water and sewerage in Greater Bombay even after the present projects have been implemented. The total availability of water, including the Upper Vaitarna
and Bharsai projects as now considered, will be about 430 Dmgd and rather conservative projections indicate that this amount will be fully used up in the area served by the BMC system by the second half of the 1970’s. Further investment in supply would thus be needed as soon as the present five-year program is finished. Then there is a very large investment backlog in sewerage: neither the collection system nor the treatment plants are designed to handle the large amounts of sewage that will accompany the increased water supply.

47. Outside the present BMC-system it is mainly the supply to the Satapushed urban and industrial complex and to the Twin City area which is of interest. Here the MIDC has put forward proposals as to how their various supply systems in the vicinity might be utilized and ultimately form a water supply grid for the entire sub-region. These proposals are centered around the Barvi project, on which construction has already begun. This consists of a dam on the river Barvi (a tributary to the Ulhas, see Map 3) and a pipeline to carry water to the industrial areas along the lower Ulhas and in Trans-Thana. As first designed the system would have a first stage capacity of 50 Dmgd, which could later be increased to 100 Dmgd by adding crest-gates on the dam and duplicating other items.

48. Now that plans for the Twin City are being developed, MIDC has suggested that Barvi can also be used to supply the water needed for this project, and a modified design has been adopted which will permit an ultimate yield of at least 130 Dmgd. In the first stage a pipeline will be constructed to Trans-Thana as planned, but this can carry substantially more water than will be needed by the industries there. A part of the existing pipeline from the BMC/Trans-Thana supply system can then be used to carry this surplus water down to the proposed metro-center in the "anvel area. When more water is needed, a second stage would be constructed which would consist of a branch pipeline from the first one down towards Panvel (see Map 3 for the different pipelines). In this way MIDC feels it is possible to give a supply of about 90 Dmgd to the Twin City, to which could be added some from the Kansai system also. As to the cost of all this, estimates exist for the Barvi project which show a cost for the first stage of Rs 132 million and a further 71 million for the second stage. It should be emphasized, however, that while MIDC has decided to go ahead with the first stage of the Barvi project, G.I.C. at the time of the mission’s visit had not taken any decision on how the water supply to the Twin City should be arranged.

49. One of the most important issues for water supply in the metropolitan area concerns the need for integrated planning and a coordinated investment program. There was a proposal made in 1968 by the consultants who were studying possible ways of increasing the water supply to Greater

\[1/\] This new design is very similar to the one suggested by consultants to the BMC in 1972, when it was proposed to use Barvi as a source also for BMC.
Bombay, that the supply to both Bombay and the Kalyan/Trans-Thanha areas should be achieved by one integrated system. The least cost solution was found to be first to construct the Varvi project and to carry water from there not only to Trans-Thanha but also across the creek into Bombay. After that the Bhatsai project could be added, now with the water transmitted along a southerly alignment through the same area and then into Bombay. The order in which the two projects were carried out was not of prime importance, however; the main thing was that they should not be carried out in parallel to serve different purposes. The state government chose to disregard this proposal, however, and to let MIDC go ahead on its own with a separate Varvi project, creating the present situation where there are two entirely unrelated large water supply projects some few miles apart. But even if an opportunity has thereby been missed, there will obviously be further extensions of the water supply in the metropolitan area in the future, and so the arguments for taking an integrated view are very much still there.

50. An important observation concerns the fact that several of the large water supply projects in the region have been unduly delayed in implementation. The list of reasons can be made very long. In the case of the Upper Vaitarna project the original contractor for the dam went bankrupt, and also BMC has experienced great difficulties in getting the steel that is needed for the pipeline and in acquiring the land for the right-of-way (part of the difficulty here stems from the fact that it is the state that has to acquire the land for BMC). In the case of the Varvi project the development is similar, the first contractor for the dam has gone bankrupt and MIDC is having some trouble in getting the steel. Unresolved problems concerning financial and organizational matters have also greatly added to the difficulty of reaching an agreement between IDA and Indian authorities about the Bhatsai project. The conclusion must be that there is an urgent need to streamline the overall implementation process and to strengthen the organizational framework in the sector.

Gas Supply

51. The BMC in the middle of the 1960's carried out a gas market survey, the result of which was to show a potential demand from 600,000 customers for about 60 million cu. ft. of town gas per day by 1981. Based on this a project was prepared for a comprehensive network of gas distribution in the whole of Greater Bombay. As originally envisaged the gas would be produced by the Indian Fertilizer Corporation at their plant in Trombay, the production being based on petroleum cracking. BMC was to take over the existing Bombay Gas Company and to be responsible for the investment in transmission and distribution facilities. The estimated cost was about Rs 570 million for the production (at ultimate capacity) and 305 million for the full distribution system, to be spread over a 12-year period. No way has been found to finance this project, however, and also BMC and the Fertilizer Corporation failed to reach an agreement on the terms for the production. At present the project seems to be quite dormant, and presumably the economics of it would have to be checked very carefully, today with the spread of bottled gas as a competitor.
IV. PRICING POLICIES AND FINANCE

52. The various utilities in the metropolitan region follow different pricing policies, as is to be expected in a situation where the ownership structure is so varied. There are, however, some general observations that can be made. First, it is evident that social (political) considerations play an important role in the determination of rates, in that the relations between the rates for domestic consumers ('the ordinary man') and those for other classes of consumers are not determined basically by cost-of-supply considerations. Thus it is significant, for example, that when BEST and Bombay Suburban recently had rate increases (partly to pass on increases in the cost of bulk supply) all rates except those for residential consumption were increased. The same thing happened when BMC raised the water rates: only the rates for non-domestic consumers were affected. A second general feature is that the rates do not usually seem to be determined with a view to fulfilling any "customer's information" purposes. No special peak-load prices exist, \(^1\) and investment decisions generally seem to be taken on a basis of forecast physical 'needs' or social considerations rather than follow from the results of planning and operating the utility economically. An obvious example of the latter phenomenon is the case of the telephones in Bombay, where a huge profit is made but where investment is held back by a deliberate policy decision from the central government level. MIDC's large-scale commitment to the Barvi project could well be an example of the opposite, where investment is allowed to proceed without sufficient guarantees of an adequate return, and where cheaper alternatives of supply appear to have been disregarded.

Electric Power

53. BEST and Bombay Suburban have rather similar rate structures, although the rates are not identical (see Appendix 3 for low tension rates). The difference between the rates for residential and commercial use is apparent, and it is hard to see that this has anything to do with differences in cost of supply. The very low rate which Bombay Suburban offers for appliances and heating seems to be promotional, the company also deriving some income from the renting of appliances. Generally speaking one would expect Bombay Suburban to have somewhat higher costs for their service than BEST, as the latter has a more compact and densely developed area to serve. Adequate data to support an analysis along these lines were not obtainable from BEST, but it is clear that the difference between the rate levels for residential lighting is not accidental: Bombay Suburban is under some pressure from the public to lower its rate (and has in fact just recently lowered it to the present value, when otherwise rates in general have been increased), and a cost analysis of its data indicates

\(^1\) There exists for the telephones a lower night rate for trunk calls, which can be termed as introducing an element of peak pricing in reverse.
that the rate is only marginally above cost. BEST on the other hand claims not to be losing money on its residential tariff and, judging from the fact that this applies to about one-third of its total sales and that BEST makes a reasonable profit from its electricity department, this may well be correct. When it comes to the high-tension supply both BEST and Bombay Suburban again have similar rates, which work out to be only marginally higher than what an application of Tata's bulk rate would give. This presumably to a certain degree is the effect of competition, for Tata supplies industry in Greater Bombay, also, although normally only in cases where there is a rather large load (Appendix 4 gives a comparison between the different high-tension suppliers' prices).

54. Turning to MSEB (tariff in Appendix 3), one notes differences when comparing its rates with those of the other two distributors. Most conspicuous is the much higher rate for residential purposes. MSEB has a uniform low-tension rate in the whole state, and probably has higher average distribution costs than both BEST and Bombay Suburban have, operating as they do in urban areas, which means that a higher rate for MSEB would be warranted. The difference seems very large, however, and it should be remembered that, while BEST and Bombay Suburban use underground cables for all distribution, MSEB is allowed to construct overhead lines, which means a large cost advantage. Noting that the MSEB rates for other types of customers are not proportionally as high in comparison with the Bombay utilities' rates, it is tempting to draw the conclusion that MSEB feels less of a restriction to charging full-cost (that is, including an adequate return) prices to residential consumers. At the very least, the fact that residential customers can be made to pay much higher rates elsewhere in the state than in Bombay, throws an interesting side light on the prevailing view in Bombay, that residential tariffs for political reasons have to be kept as low as possible. On the other hand, when it comes to high-tension supplies, MSEB's rates work out to average prices that are only very little above the ones charged in Bombay (see Appendix 4). It was not possible to obtain sufficient data to make an analysis of this matter, but bearing in mind that the average generating cost of MSEB is higher than Tata's, it seems quite likely that industry is given some preferential treatment by MSEB. This would fall well in line with the policy of the state government to induce industrial locations outside the Bombay region. In fact, there is even a program under which the state government gives MSEB a subsidy for it to offer, for an initial five-year period, the same low power rates to industries locating outside the developed parts of the state as they would get from Tata. 1/

55. When judging the financial performance of the electricity undertakings in Bombay, it is important to remember that the licensed utilities

1/ This applies only to loads over 200 kW.
are under rather strict regulation. The Mission was not in a position to make anything but a superficial analysis of these questions, but it would appear that within these restrictions Bombay Suburban achieves a high financial return, straining at the upper limit which the regulation will allow. BEST also seems to be doing fairly well in its electricity department although perhaps with a downward tendency, as witnessed by some deterioration in the operating ratio over the last few years. The overall financial performance of BEST (i.e. including both electricity supply and buses) has deteriorated markedly, however, over the last few years, and the undertaking reported an actual loss for 1969/70. This is due to the poor performance of the operation of the buses, in which the deficit has been mounting. This in turn can be explained by a reluctance to increase the fares to a realistic level, but this matter is pursued in the transport annex to the main report.

56. While the rate of return allowed for the regulated undertakings is not very high, it must be taken into account that the benefits to the economy from power sales are quite a bit higher than is recorded by the revenues from the sales. This is because the state government levies a duty on electricity consumption, to be paid by the consumers above the bill for the sale of electricity. This duty is high on commercial and residential uses, whereas industrial uses are favored by a much lower duty. (Appendix J) gives the duty for various classes of consumers; in addition to this, there is a duty levied on bulk sales of more than 5 MW/year to any one single customer, which is 0.5 paisa/kWh). The effective price which the consumer faces, which reveals his willingness-to-pay, is thus significantly higher than the tariffs suggest for a large segment of the energy consumption. Another effect of the duty is to distort the cost comparisons between electricity and other forms of energy, where no similar duty applies, e.g. gas. With the relatively low duties on industrial consumption, however, one can reasonably expect that the distorting effect will be limited in this sector: for commercial and residential purposes, where the effect on the price is much larger the likely assumption is that for most uses there is no real possibility of substitutes. One obvious and large exception to this last statement is for cooking, where gas and kerosene dominate entirely, and where one of the reasons given for this is that electricity is not competitive from a cost point of view. On the whole, the practical effects of the duty in distorting resource allocation in the energy sector are probably limited.

1/ Although not affected by the same regulation, state electricity boards are supposed to run their operations on a 'no-profit-no-loss' basis, and because of the way this is interpreted it is hard for the MSEB to achieve a reasonable rate of return on its assets.

2/ Also the definition of the rate base in the regulating Act is such as to underestimate the rate of return as it would appear with a more conventional definition of capital invested.
None of the existing tariffs contain any price differential between peak and off-peak power demand. The two-part tariff for industrial uses makes it generally advantageous for the consumer to try to decrease his peak power demand and spread the energy consumption over more hours; but it does not give any specific incentive to avoid the system peak hours. Now the load factors for the various electricity undertakings are high (for the entire Western Maharashtra and it is over 70%, Bombay Suburban reports 67% and BEST 62%), and so there is no very strong case for a promotional low rate during periods of low demand. Rather, consideration should be given as to whether a peak surcharge might not be useful if practical.

As has been discussed in Chapter III, the Bombay area appears to be on the verge of a power shortage, which is likely to become progressively more severe over the next years. If a study of resource allocation and economic analyses shows that there is no relatively speedy way of increasing the peak-power availability which is economically justified, there is a good argument for considering the introduction of a special rate for peak kWh. The opposite approach of planned load shedding is difficult to quantify with respect to effects to the economy but should be considered nonetheless.

Telecommunications

Financially the telecommunications sector in Bombay is doing very well indeed. With gross assets about Rs 400 million, the Bombay Telephones district for the last financial year reported current expenditure of 55 million rupees and revenues of 154 million rupees i.e. a surplus of about 100 million. 1/ Its price level in spite of this was obviously not high enough to equate supply and demand either for new telephones or for the placing of calls during peak periods (see discussion paras. 6 and 41), and so physical rationing took place. However, if it is decided largely to disregard 'economic' investment criteria for the sector in favor of other welfare considerations, it may very well be justified not to use price as the rationing device. The making of a decision on the price-level in such a case involving a monopoly is very akin to making decisions about taxation and can only be judged in a general context.

Water Supply and Sewerage

The general picture given by the water rate schedules of the different suppliers is one where residential use is given a preferential treatment (see Appendix 5 for rates). This is contrary to what cost-of-supply considerations would indicate: there is a definite cost advantage in selling a certain quantity of water to just one large consumer instead of having

1/ These figures are on a cash basis, no others were available. It is hard to believe that such figures do not also indicate a good financial performance on a formal accounting basis.
to bear the cost of a distribution system to reach a large number of small consumers. Although the mission was not able to get data for a real cost analysis, the assumption in the light of the large differentials between the two rates must reasonably be that several, if not all, water authorities are in fact subsidizing the residential consumers, whereas non-domestic consumers (industry takes the bulk of the water in this category) are paying a price that may be appreciably above cost of supply. 1/ For those properties (largely in Bombay City) where the supply is not metered, there is of course no particular relation at all between cost of supply and price to be paid.

As to the adequacy of the rates charged from a financial point of view (that is, judged against the criterion that the water authority should earn a reasonable return on the total assets), indications are that in general they do not. This seems to be the case for BMC, and the mission also obtained qualitative information from the Public Health Engineering Department to the effect that most other municipalities charge rates which, while covering current costs, do not provide for the capital costs. (While the Public Health engineering Department suggests an initial rate level to the municipalities when handing over for operation a new distribution system, the municipalities are in fact free to determine the rates both initially and later on.) For itself, the Department claims to charge adequate rates for those operations it runs (such as Radlapur waterworks); but the mission was not in a position to check on this claim. MIDC makes a similar claim, and the fact that they show an operating ratio of about 70% for their water department indicates that this may well be true. So far, however, the operations only include comparatively small supply systems like Shahad and HCC/Trans-Thana (there are also some outside the metropolitan region) and the position may deteriorate when the Barvi system comes into operation. Here MIDC undertakes a very large investment program, which will probably lead to the existence of substantial surplus capacity for a number of years, and so it will become harder to cover the full capital costs.

The services of sewage collection and disposal (if they exist) are not priced. Rather, there is a tax levied by the municipalities, the Jalalkhor tax, the proceeds of which are supposed to cover the cost of sewage collection and disposal, refuse collection and disposal and the maintenance of storm drains. The tax is a flat percentage (in Greater Bombay 3.5%) of the rateable value of the properties, and it is claimed that it does not bring in sufficient revenue to cover the costs for the services. The absence of a system of sewage rates, directly related to

1/ It should be noted, however, that this is a very tentative hypothesis; there are many distorting elements in the accounting practices of entities like BMC, which may render such information as is now obtainable very misleading.
the load the various dischargers impose on the disposal system, may not be
too serious as long as no (or very little) treatment is given to the sewage.
As soon as more ambitious methods are adopted, however, efficiency consider-
ations strongly suggest that at least industries be charged according to
what they dispose of in the sewers, as this can vary considerably with the
kind of processes used by the industry concerned.

62. There is one other source of revenue for the sewage system, and
that is capital contributions from property owners towards the first con-
struction of sewers. In the most common form of development in Bombay,
the Town Planning Schemes, the land remains in private hands, and the
municipality just buys what is necessary for roads and public purposes and
construct roads, sewers and storm water drains. To capture part of the
increased value of the land due to this development, the municipality is
then entitled to levy betterment charges on the properties covered by the
Scheme. These charges normally cover the cost of the land acquisitions
and 50% of the cost of the development investments. These types of capital
contributions are only possible when there actually is a new development
in an area. Thus, when the BMC sooner or later has to replace a lot of
the existing old sewer lines in Bombay City, it will not be possible to
get any contributions for this.
To conclude this review of the public utilities in the Bombay Metropolitan Region, it is appropriate to discuss some more general issues in connection with the formulation of a metropolitan development policy. Two complexes of issues will be singled out here, the first concerning the appropriate institutional framework and the forms for coordination between various sectors, and the second concerning the existence of economies and diseconomies associated with various forms of urban development.

Coordinated Development and the Institutional Framework

In this context one can talk about coordination on at least three different levels. At the lowest level, one can refer to coordination within one specific sector, such as power, and discuss questions concerning the coordination of the development in that particular sector within the metropolitan region as a whole. On a second level one can study the public utilities as a group and the need for coordination between them, and finally, on the highest level, there are the questions concerning the coordination between the development of the public utilities (jointly or separately) and the development of other sectors, such as housing, industry or transportation.

The Power Sector

It seems clear that the balance of economies prevalent in the power sector are such that the metropolitan region as a whole should be served by one interconnected supply system. At present there is indeed such a system, based around the high voltage transmission network owned jointly by MSEB and Tata, which links production facilities belonging to Tata, MSEB, the Railways and the Atomic Energy Department. Deliveries to consumers from the system are effected within the metropolitan region by Tata, MSEB, BEST, Bombay Suburban and Thana Electric; however the system not only serves the metropolitan area. The question then must be, whether changes in the institutional division of responsibilities within the overall system would make it possible to reap any significant gains. For example, (a) would it be better if all the production facilities were in the hands of just one owner or (b) if the distribution function for the entire area were taken over by only one undertaking?

In theory at least, there is no compelling reason for having all production facilities in one ag. It is sufficient to have a common load dispatching center in the system and to give this complete freedom to operate the system in an optimal way irrespective of who owns the various generating units. One way to achieve this is to have the various contributors to the system agree on a formula for revenue-sharing and to turn the actual operation of all the units over to one entity, be this specially set up for this purpose or one of the partners. If the integration is less
far-reaching, so that extraneous restrictions are laid upon system operation, e.g. the requirement that the units belonging to a certain owner must be operated for a specific minimum time, there will be some deviation from optimum results. 1/ In fact, what Tata have suggested to the state government (see para. 39) about setting up a joint company, which would operate the transmission system and all the production facilities in the Bombay area should be seen against this picture. Another way to minimize possible detrimental effects of differing ownership of production facilities would be for the MSEB to use its option to take over the Tata facilities when Tata's license expires (although with the Board's present difficulties to mobilize financial resources, this would not seem to be operationally likely). The mission, however, is not in a position to pass judgement on the relative merits of these proposals or others that may be possible. Seen purely from the point of view of the Bombay region, there probably is some advantage in having a unit created specially to serve the interests of the region, but there is also the wider context of the power supply to the whole of Maharashtra state (and wider still: the Western Power Region) to consider. It could well be that what would be best for Bombay is not the same as what is best for the larger unit.

67. On the distribution side, there are two slightly different questions that could be raised about the efficiency of the present institutional arrangement in the Bombay region. The first concerns the fact that the division of service is not done strictly on a geographical basis, i.e. it is not merely such that one distributor has an exclusive right to supply in his area. What blurs the picture is the fact that Tata gives a direct high-tension supply to some (large) industrial consumers in areas where otherwise one of the sub-licensees is responsible for the distribution. To a certain extent this can lead to an unnecessary duplication of facilities, and thus there is ground for an argument that some change in the present institutional arrangement is warranted. If there should be a change in the institutional framework on the production and transmission side, as discussed above, that might be a good opportunity to draw a clearer line between the bulk supply and the distribution functions.

68. The second question concerns the number of separate distribution authorities serving the metropolitan area, and whether there are any significant economies likely to be reaped by changes in that respect. The arguments here are not very compelling: the large economies are on the generation/transmission side, and when all the distribution authorities buy their bulk power from the same supplier, as is the case in Bombay, these are taken care of. There still is something to be said about "border-line" effects (i.e. two authorities both having to extend supply to areas close to their common border), administrative overheads, stores, maintenance staff etc., but if the separate authorities are reasonably large to begin with,....

1/ This applies to the short-run situation with given production facilities. It is obvious that similar problems occur in planning of system expansion. In the Bombay case these have been partially avoided by barring Tata from adding to their generating capacity.
these effects may not be large. Some more weight could be given to the argument that an integration between smaller distribution systems makes it possible to get along with somewhat smaller reserve capacities on various components of the system, as power can be transmitted more flexibly throughout the system when the demand pattern changes. If one were to start all over from scratch, no doubt these arguments would lead to the establishment of fewer authorities in the area than there are now; but now that there is a historically given pattern of institutions, there are a lot of complications to take into account, and the fundamental question must be whether the reasons for a change are so strong as to make it worthwhile. It may be noted, however, that the arrangement of joint management that existed up till recently between Bombay Suburban and Thana Electric (para. 18) could be taken as one indication that the latter is considered to be too small a unit for optimal performance. 1/

The Telecommunications Sector

69. In the telecommunications sector there is already unified treatment of the metropolitan region, in the sense that the important decisions are taken at the national level. There might be a slight advantage for metropolitan planning if there were just one regional entity for construction and operations to deal with, instead of two as there are now, but this hardly constitutes a decisive argument against the present division between Bombay Telephone and the Maharashtra Circle.

The Water and Sewerage Sector

70. In water supply the conceptual structure is similar to that of electricity supply, with a difference between production and bulk transmission on the one hand, and distribution on the other. The development of the sector in the Bombay region has, however, not yet reached the stage where there is one integrated transmission and bulk supply system for the whole area; rather there are several. And besides these there are small distribution systems that have local sources and are not connected at all to any larger transmission system. As had been described in Chapter III the recent development and present plans point towards the establishment of two independent large bulk supply systems in the region, BMC's and MDC's. It is clear, however, that this cannot be the optimal pattern (see para. 49) and that the region is best served by a close cooperation between these authorities in planning for future source development and system extensions, and also by an integration of the transmission systems. The desirable complement to this development is the introduction of one single bulk water supply authority with responsibility for the whole region.

71. The parallel construction of the Barvi and Bhatasai projects has already been cited as an illustration of the drawbacks which are inherent in a situation where several different authorities are able to, and indeed

1/ Outside the metropolitan area the MSEB has taken over a number of small distributing licensees over the past years.
do, follow separate courses of action and commit separate funds. The Bhatsai project itself also illustrates the problems when two authorities share the responsibility for projects. The state government is responsible for the construction of the dam, whereas the BMC has to build the rest of the supply and transmission works. The result has been that while the dam is already underway, BMC so far has not been able to secure the financial resources needed for the rest of the scheme, so that in principle there is no knowing when the capacity to use the water from the dam will be there. \[1\]

There are at least two important questions which a single responsible authority would have had to ask itself before deciding to go ahead with the dam: (a) is it right to start work on a new project now, or would it be better to use the resources for the ongoing Upper Vaitarna project, which is proceeding very slowly, and which is the first that can bring relief to Bombay? (b) is there a risk that a decision to commit funds for the dam now, without knowing for certain what resources will be available for the rest of the water supply program, could lead to a situation where one later finds that, in view of the total resources which will actually become available, those funds should optimally have been used in another way? It is of course possible that the answer to both these questions would be that the optimum course of events should have been the same as now; but it is quite clear that the present institutional framework made it possible to go ahead without even asking the questions at all clearly.

72. Water distribution is now in principle a municipal responsibility, with entities like MIDC giving some supply to industrial areas where there is no municipal system. There is little to say about this. There does not seem to exist any strong argument against a system of municipal distribution; it is in fact common all over the world. At present some municipalities (besides BMC) operate sources too; one would expect that in the longer run they would all be connected to the regional bulk supply system.

73. In respect to sewerage the Bombay region is far from a stage of development where a metropolitan-wide authority would be useful. But it should be stressed, that even if there is no case for a body with operational responsibility, there should be a coordinated planning for the various sewerage schemes that are beginning to evolve, so that one can be sure that they are not working at cross purposes from an economic or environmental point of view.

Coordination between the Public Utilities

74. Turning to the second level of coordination, that between the different public utilities, this turns out to be important only in rather a specific context. There appear to be no particular trade-offs in their use to take into consideration (excepting maybe some between electricity and gas, but this is of very little importance in the Bombay context), and

\[1\] As described earlier (para. 45), discussions about possible IDA support for an investment program including Bhatsai have been going on for several years.
when it comes to establishing priorities for the allocation of investment resources, there is no special reason for singling out the public utilities as a group from all other investment sectors. On these two counts, therefore, there is no need for a strong formal cooperation between the public utilities sectors. There remains, however, the fact that there are some instances where the planning and operations of one of the sectors has an influence on the conditions of another, and in such cases there is obviously an argument for cooperation.

75. In urban areas the case of interaction between the planning operations of the different utilities stems mainly from the fact that they all make use of overhead or underground pipes or cables. This gives rise to external diseconomies when one utility has its pipes/cables so that they obstruct those of the others (e.g., makes it harder to get at them for maintenance or renewal), or even damages them when excavating for its own. On the other hand there are also some possibilities for reaping economies, as when several utilities are able to use the same ducts or cable-tunnels for their lines in crowded sections of a city. Close coordination at parts of the planning and at the operational level is necessary to minimize the negative interactions of this type and to explore the possibilities for external economies. 1/ There is already such cooperation instituted in Greater Bombay, where there is an established routine for consultations between the utilities in matters concerning underground works and an executive engineer in the BMC administration in charge of coordination of works in the streets. As these things are usually local in character, there is no strong argument for setting up metropolitan-wide institutions; the cooperation must be in each case between those agencies that actually do the detailed planning, construction or operational work.

Coordination with Other Sectors

76. On the highest level of coordination considered here, that of coordination between the public utilities and other sectors in the area, the general case for overall investment coordination and pooling of resources on the one hand as opposed to narrow sectoral planning and earmarking of investment funds on the other will not be argued here. There is nothing separate and specific to be said about this from the pure public utilities' points of view. 2/ More relevant here is the simple observation that the demand planned to be met for the services of the utilities is largely determined by programs made up in the other sectors. Normally there is a certain steady increase in demand for utilities' services from the existing consumption areas, which to some extent determines the investment programs for the public utilities undertakings. The more important increase, however, is that growth in demand which stems from new housing development, new industrial areas or redevelopment areas. In short, where there is a large change in the volume of activities over a short period. Clearly it is of the utmost importance for the proper planning in the utilities sectors that they know

1/ E.g. in the detailed planning for a new development such as the Twin City.
2/ The general case is made in the main report.
about such future changes as early as possible. It is not sufficient to know the overall growth in demand in the metropolitan area; the specific locations where development is expected or planned for specific years is equally important, to make it possible to plan an optimal layout of the supply systems. The lead-time necessary to give an adequate supply from the start in a new development without having to resort to expensive temporary arrangements can be quite long, especially if land acquisition is necessary for pipes, sub-stations etc. Conversely, however, there can be cases when the order of new developments is influenced by considerations concerning the supply of one or several of the public utilities services, be it the possibility to make use of spare capacity of existing facilities or the time needed to construct new facilities in various cases.

77. To achieve the coordination needed for these purposes, several planning stages have to be considered. The metropolitan level of planning is important, as it is there that the overall development strategy for the longer run is (or should be) determined. This influences the level of development of production (source) capacities and the regional transmission networks of the utilities. Equally important, however, is a later planning stage, which may be referred to as that of municipal development planning, where the specific development over the next 5-10 years is determined in more detail. These are what are used for the planning of sub-transmission and distribution investments and, conversely where considerations pertaining to the utilities should be taken into account in other sectors where relevant. A difficulty obviously exists in securing this kind of cooperation, when, as is the case in the Bombay region, the responsibility for the utilities services is so fragmented. The difficulty has to be overcome, however, and the different institutions must be brought into the planning process, be it by some kind of coordinating committees, by an instituted way of sending all plan proposals to the interested parties at an early stage while their views can still be taken into account, or in some other way.

Urban Economies or Diseconomies

78. Common to the public utilities is the fact that they make use of distribution lines going from certain nodes (substations, exchanges, reservoirs) to reach the individual consumers. This means that in general there is an "economy of density" at work, where a higher population density (or more generally: a higher density of activities consuming the service) leads to lower distribution costs for the utility. First, there is the fact that the average distribution line gets shorter, which tends to reduce the initial capital cost of establishing the distribution network. Then, at the operational stage, the shorter connections mean lower maintenance costs, and quite frequently also lower losses in the distribution systems. These effects thus tend to support an argument that a dense urban development is advantageous from the point of view of achieving low-cost public utilities services. Theoretically there is nothing to say that the downward sloping specific cost against density curve ever turns upwards again, but at least one can argue that the gains in this respect of further increasing density must get progressively smaller as the density gets higher.
it is even possible to point to specific adverse effects, as when higher buildings begin to require extra pumping for water pressure (this is of course a relevant cost, even if it is not paid by the utility undertaking).

79. The effects discussed so far do not cover all the picture when it comes to judging the influence of urban density on the cost for public utilities services: there are some diseconomies of density, which have to be taken into account. One rather obvious one is that for some utilities (electricity and telephones) there exists a choice in principle between overhead or underground lines, with overhead being by far the cheaper but often not permitted on grounds of amenity (as is the case in Bombay) to be used in densely developed areas. This can introduce a sudden jump in the specific cost curve, but the effect is not one that gets larger continuously; once the decision to go underground has been taken, further increases in density do not alter cost relations on this account. Another effect, which is of a more continuous nature, stems from the fact that the utilities need some land for their facilities (transformers, exchanges, pumping stations, rights-of-way for large pipes), the cost of which increases with the density of the urban development. This increasing cost is not just a consequence of rising direct land prices but also of the fact that the process of acquiring land for new facilities in already developed areas (which there is always need for) gets longer and more complicated, often causing losses in interest on idle capital etc. In fact, this is one of the chief complaints voiced by both BEST and Bombay Telephones about their operations in Bombay City.

80. Furthermore, in para. 78, it was argued that there exists an economy of density for the establishment of a distribution network, due to the effect of shorter average supply lines. This is clearly true for the case of new development, but when one considers laying pipes or cables in an already developed area either to replace old ones or to increase capacity, there are also offsetting effects which get more important as density increases. The necessary excavating and construction work gets more complicated when the various lines are more crowded together, and the risk of causing damage to other services increases. Larger works cause disruptions to normal activity in the streets and adjoining properties, the effect of which is also likely to be stronger in high-density areas.

81. The preceding discussion on the effect of density has been rather abstract and general. For practical considerations about the future development in Bombay it is necessary that the various effects are balanced against each other in the actual cases in question. Only then will it be possible to judge whether, from the point of view of achieving low costs for the public utilities services, further development should be encouraged in Bombay City or in the outer parts of Greater Bombay, or if as much as possible should be directed to new areas like the Twin City. To arrive at a concrete result, however, one would need a lot of detailed information which is at present not readily available and to take several complicating factors into account. For example, large-scale increases in the density of development in the City would surely mean that new sewage mains would have to be
laid in order to increase capacity, and that is expensive. But then a lot of replacement and new construction is probably necessary anyway, as the existing sewerage network is old and insufficient already, and thus the disruption costs to a large extent have to be incurred in any case. Again, when it comes to electricity cables, BEST is just converting its sub-transmission from 6 kV operation to 11 kV operation, which the existing cables permit due to the fact that they were once designed with very large safety margins. In this way a tripling of capacity is achieved without any new cables, which in turn means that there will be reserves for quite a sizeable increase in demand.

82. Facts such as these make the evaluation of the various effects difficult, and the question that must be asked is, whether the answer (whichever way it goes) is important enough from a decision-making point of view to warrant the effort needed to get it. Are not the effects in other sectors, such as land usage, transportation and housing, so much larger that one can safely say that the cost variations for the public utilities between different development alternatives will not influence the decision? It is tempting to answer "yes" to this question, believed to be the most important question; but the final answer can only be given when many more case studies have been done and the calculations necessary performed with accurate data compiled in a form which can be used with confidence in the calculations.
### Electricity undertakings, comparative data

**(Financial year 1969/70)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Utility undertaking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy sales, GWh</td>
<td>MSEB</td>
</tr>
<tr>
<td>Growth trend, %</td>
<td>14</td>
</tr>
<tr>
<td>Consumption categories</td>
<td></td>
</tr>
<tr>
<td>licensees, %</td>
<td>49</td>
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<tr>
<td>industry, %</td>
<td>34</td>
</tr>
<tr>
<td>commercial, %</td>
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<tr>
<td>residential, %</td>
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<tr>
<td>other, %</td>
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</tr>
<tr>
<td>Peak load, MW</td>
<td>900 1/</td>
</tr>
<tr>
<td>Growth trend, %</td>
<td>17</td>
</tr>
<tr>
<td>Customers</td>
<td>9,66,000</td>
</tr>
</tbody>
</table>

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1/ Estimated figures.

2/ Due to rationing actual growth rates 1969/70 were substantially lower.

3/ Trend values estimated, actuals for 1969/70 were 16%.

4/ Only a limited number of large industries get sales for final consumption, all the rest is for resale.

It should be noted that the figures for MSEB refer to the board's operation in the whole state, not only in the Bombay region.
Financial assistance for water supply and sewerage projects from state government to municipalities in Maharashtra state

A. For urban municipalities

- with a population less than 20,000: a grant of up to 50% of the project cost and a government guarantee for a 40-year loan covering 50%.

- with a population of more than 20,000 but less than 50,000: a grant of up to 40% of the project cost and a government guarantee for a 40-year loan covering 50%.

- with a population over 50,000 (and less than 500,000): a grant of up to 3 1/3% of the project cost and a government guarantee for a 20-year loan covering 66 2/3%.

B. For municipal corporations (only four in the state): no assistance.

C. For rural municipalities: a grant covering 90% of the project cost.

The part of the project cost not covered by grants or government-guaranteed loans is to be given as a cash contribution from the municipality (it is the government that is responsible for the actual construction, except for the municipal corporations). All types of works are covered by this assistance scheme: water catchment, transmission, treatment and distribution, sewage collection and disposal.
### Low-tension electricity tariffs and duties
(expressed in paisa/kWh)

<table>
<thead>
<tr>
<th>User category</th>
<th>Utility undertaking</th>
<th>Duty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BEJTL1</td>
<td>Bombay Suburban 1/</td>
</tr>
<tr>
<td>Residential</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lights and fans</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>heating and appliances</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lights and fans</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>heating and appliances</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>cinema, theaters</td>
<td>no special rate</td>
<td>first 150 kWh/month: 31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>following: 20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>motive power</td>
<td>up to 100 kW: 14</td>
<td>up to 15 BHP: 13</td>
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<tr>
<td></td>
<td>over 100 kW: 12.5</td>
<td>15-50 BHP: 12.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>two-part tariff</td>
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<tr>
<td>lights and fans</td>
<td>25</td>
<td>reasonable amount</td>
</tr>
<tr>
<td>service industries</td>
<td>14</td>
<td>included in motive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>no special rate</td>
</tr>
</tbody>
</table>

1/ Average cost for the bulk supply from Tata is about 7.3 paisa/kWh.
2/ A 10% surcharge is levied on all tariffs except for residential and commercial lighting and for industrial motive power.
Comparison of high-tension tariffs

The high-tension tariffs of the different suppliers are all in two parts, with one demand charge and one energy charge. The intervals for the different steps in these tariffs vary, however, and so it is more illuminating to see what average prices result in a few cases than just to reproduce the different tariffs as they are given.

The illustrating cases are chosen as follows:

I a load of 100 kW, running for 180 hours/month (equal to one-shift operation)

II a load of 500 kW, running for 360 hours/month (equal to two-shift operation).

III a load of 1,000 kW, running for 540 hours/month (equal to three-shift operation).

In all cases a power factor of 85% has been assumed.

\[
\begin{array}{|c|c|c|}
\hline
\text{Average price, paisa/kWh} & \text{Case I} & \text{Case II} & \text{Case III} \\
\hline
\text{Tata's tariff} & 12.0 & 8.7 & 7.6 \\
\text{Bombay Suburban's tariff} & 12.3 & 9.2 & 7.6 \\
\text{MSEB's tariff} & & & \\
\text{a) hydro stations} & 13.5 & 9.7 & 8.4 \\
\text{b) thermal stations} & 12.9 & 9.3 & 7.8 \\
\hline
\end{array}
\]

(BEST's high-tension tariff is not known in detail, but is very close to Tata's).
### Water rates, rupees/1,000 Ig.

<table>
<thead>
<tr>
<th>Supply system</th>
<th>User Category</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Domestic</td>
<td>Average of all users</td>
<td>Non-domestic</td>
<td></td>
</tr>
<tr>
<td>BMC, metered supply(^1)</td>
<td>0.77</td>
<td></td>
<td>2.50(^2)</td>
<td></td>
</tr>
<tr>
<td>MIDC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sahad</td>
<td>1.10</td>
<td></td>
<td>1.60</td>
<td></td>
</tr>
<tr>
<td>HOC/Trans-Thaná</td>
<td>1.00</td>
<td></td>
<td>2.90</td>
<td></td>
</tr>
<tr>
<td>Ransai</td>
<td>n.a.</td>
<td>1.50(^3)</td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>State(^4)</td>
<td>1.00</td>
<td></td>
<td>n.a.</td>
<td></td>
</tr>
</tbody>
</table>

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\(^1\) Olcer properties in Bombay City are not metered. An annual charge of 4.5% of the rateable value of the property is levied.

\(^2\) Average of several consumer categories.

\(^3\) Actually capital contributions + lower rates will be charged, but the figure given is the average computed equivalent.

\(^4\) The rate applying in Kalyan, which gets its water from the government waterworks in the Badlapur.