12th February, 2015
CREG/MUM/MERC/15/35

To,
The Principal Secretary,
Maharashtra Electricity Regulatory Commission,
13th Floor, Centre No. 1,
World Trade Centre, Cuffe Parade,
Colaba, Mumbai – 400 005

Dear Sir,

Sub: Submission of Revised Network Rollout Plan

The Hon'ble Commission in its Order dated 14th August, 2014 in Case No. 90 of 2014 had directed Tata Power – D to approach the Hon'ble Commission with a Network Rollout Plan. In compliance with the above order, Tata Power-D submitted its fresh Network Rollout Plan under Affidavit on 9th October, 2014.

However, subsequently, the Hon'ble Appellate Tribunal for Electricity vide its judgment dated 28th November, 2014 in Appeal Nos. 246 & 229 of 2012 directed Tata Power to submit a revised Network Rollout Plan with the following directives:

"61. In view of above, Tata Power is directed to submit its Roll Out Plan as indicated above for approval of the State Commission."

In view of the above directions of the Hon'ble Appellate Tribunal, we are attaching a revised Network Rollout Plan on affidavit. We request the Hon'ble Commission to kindly take the same on record for the purpose the approval of Network Rollout Plan.

Thanking you,

Yours faithfully,

Rec'd 12-2-15
OFFICE OF THE
MAHARASHTRA ELECTRITY
REGULATORY COMMISSION
COLABA, MUMBAI - 400 005

Bhaskar Sarkar
Head -Business Strategy & Regulations, Mumbai Operations

BEFORE THE MAHARASHTRA ELECTRICITY REGULATORY COMMISSION,

MUMBAI

In the matter of:

The Tata Power Company Limited ...Petitioner

AFFIDAVIT ON BEHALF OF THE PETITIONER/ THE TATA POWER COMPANY LIMITED

I, Bhaskar Sarkar, aged 49 years, son of Mr. Arup Kumar Sarkar, residing at Flat No. 1202, Intop Tower, Plot No. 12 & 13, Sector – 19, Kharghar, Navi Mumbai – 410 210 do hereby swear and say as follows:

1. I am the Head -Business Strategy & Regulations (Mumbai Operations), of The Tata Power Company Limited (hereinafter referred to as "Tata Power"), the Petitioner in the instant matter and I am duly authorized by the Petitioner Company to make this Affidavit.
2. I am filing this Affidavit on behalf of The Tata Power Company Limited.
3. I say that the information enclosed as **Appendix**, now shown to me is based on the records of the Petitioner Company and information received from the concerned officers of the Petitioner and I believe the same to be true and correct.

Ms. ROSHAN M. MASTER
NOTARY, GREATER BOMBAY
2403, ORCHID TOWER A
BELLASIS ROAD,
MUMBAI - 400 008.

BEFORE THE MAHARASHTRA ELECTRICITY REGULATORY COMMISSION,

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2. I am filing this Affidavit on behalf of The Tata Power Company Limited.
3. I say that the information enclosed as **Appendix**, now shown to me is based on the records of the Petitioner Company and information received from the concerned officers of the Petitioner and I believe the same to be true and correct.

Ms. ROSHAN M. MASTER
NOTARY, GREATER BOMBAY
2403, ORCHID TOWER A
BELLASIS ROAD,
MUMBAI - 400 008.

Sworn at Mumbai on this 12th day of February, 2015 that the contents of the above Affidavit are true to my knowledge, no part of it is false and nothing material has been concealed there from.

Deponent

VERIFICATION

Sworn at Mumbai on this 12th day of February, 2015 that the contents of the above Affidavit are true to my knowledge, no part of it is false and nothing material has been concealed therefrom.

Deponent

Place: Mumbai

Date: 12.02.15

Before me

Mr. ROSHAN M. MASTER
NOTARY, GREATER BOMBAY
2408, ORCHID TOWER A
BELLASIS ROAD,
MUMBAI - 400 008.
Reg. No. 404

12-2-15

BEFORE THE MAHARASHTRA ELECTRICITY REGULATORY COMMISSION,

MUMBAI

Filing No:

Case No:

IN THE MATTER OF:

Petition for submission of Revised Network Rollout Plan in compliance to the direction of the Hon'ble Commission in Case No. 90 of 2014 and the direction of the Hon'ble ATE in Appeal 229 and 246 of 2012

AND IN THE MATTER OF:

The Tata Power Company Limited
Bombay House, 24 Homi Mody Street,
Mumbai - 400 001. ...Petitioner

MOST RESPECTFULLY SHOWETH:

1. Background

1.1. The Tata Power Co. Ltd. (Tata Power), under the provisions of Section 14 and 15 of the Electricity Act, 2003 had made an application for grant of distribution licence to the Hon'ble Commission (Case 90 of 2014). As part of this Licence Application, Tata Power had submitted a Network Rollout Plan.

1.2. On 14th August, 2014, the Hon'ble Commission granted the Distribution Licence to Tata Power. In the said Order for grant of Distribution Licence, the Hon'ble Commission made certain observations on the Network Rollout Plan submitted by Tata Power and directed Tata Power to submit a revised Network Rollout Plan within 6 weeks of the said Order.

1.3. Accordingly, a Revised Network Rollout Plan was submitted by Tata Power on 9th October, 2014.

1.4. Subsequently, the Hon'ble ATE issued a judgment in Appeal No. 229 and 246 of 2012, wherein it has directed Tata Power to submit a revise Network Rollout Plan based on the directions given by the Hon'ble ATE.

1.5. In compliance to the above directions, a revised Network Rollout Plan has been enclosed herewith.

2. Prayers

In view of the above facts and circumstances, Tata Power hereby prays for the following:

2.1. To approve the revised Network Rollout Plan;

2.2. Condone any inadvertent omissions/errors/shortcomings and permit Tata Power to add/change/modify/alter this filling and make further submissions as may be required at a future date.

2.3. Pass any other such directive as that the Hon'ble Commission may deem appropriate in the facts and circumstances of the case.

Date: 12th February, 2015

Place: Mumbai

For and on behalf of the Petitioner

February 2015

Network Rollout Plan for Tata Power-D

Maharashtra Electricity Regulatory Commission

MERC

Tata Power Company Limited (Tata Power-D)

TATA

TATA POWER

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1 INTRODUCTION

1.1 BACKGROUND OF TATA POWER AND ITS DISTRIBUTION BUSINESS

1.1.1 The Tata Power Company Ltd. is a company incorporated under the provisions of the Indian Companies Act, VII of 1913, with its registered office at Bombay House, 24, Homi Mody Street, Fort, Mumbai 400 001. The Tata Power Company Limited (hereinafter shall be referred to as "Tata Power"), being among the oldest players in the power sector in the country, is also India's largest integrated private power company. In its journey of close to a century, Tata Power has emerged as a prominent player in the Indian Power Sector with a strong presence across the entire value chain of the Power Sector i.e. Fuel Mining, Fuel Logistics, Power Generation (Thermal, Hydro, Solar and Wind), Power Transmission, Power Distribution and Trading.

1.1.2 As a distribution licensee, Tata Power is present in two major cities of the country: Mumbai and Delhi. While Tata Power is present in Mumbai for close to a century, Tata Power established its distribution business in Delhi in 2002 with a 51:49 partnership between Tata Power and Government of Delhi.

1.1.3 In Mumbai, Tata Power has been operating as a distribution licensee for about 100 years. Four licences had been issued to predecessors of Tata Power under the erstwhile Indian Electricity Act, 1910 to supply electricity in and around Mumbai, being:-

(a) **The 1907 Licence** - The Bombay (Hydro-Electric) Licence dated 5th March, 1907 originally granted to Dorabji J. Tata and Ruttonji J. Tata. This licence was assigned on 7th November, 1910 in favour of The Tata Hydro Electric Power Supply Company Ltd;

(b) **The 1919 Licence** - The Andhra Valley (Hydro-Electric) Licence dated 3rd April, 1919 issued in favour of The Tata Hydro-Electric Power Supply Company Ltd.;

(c) **The 1921 Licence** - The Nila Mula Valley (Hydro-Electric) Licence, 1921 dated 15th November, 1921 issued in favour of Tata Power; and

(d) **The 1953 Licence** - The Trombay Thermal Power Electric Licence, 1953 dated 19th November, 1953 in favour of The Tata Hydro Electric Power Supply Co. Ltd., The Andhra Valley Power Supply Co. Ltd. and Tata Power.

1.1.4 The 1907 licence, 1919 licence, 1921 licence and 1953 licence are hereinafter collectively referred to as "Tata Power Licences". As per the respective clauses of these licences, the applicability of Clause IV, V, VI of Schedule of the Indian Electricity Act 1910, (which deals with Universal Supply Obligation) was excluded.

1.1.5 The Tata Hydro-Electric Power Supply Company Limited and The Andhra Valley Power Supply Company Limited were merged into Tata Power Company Limited, to form one unified entity. Consequent to the merger, the four licences assigned to the above mentioned companies were also merged and Tata Power Company Limited was granted a licence by the Government of Maharashtra (GoM) for the supply of energy to the public in its Mumbai Licence Area and to supply energy in bulk to Distribution Licensees, vide resolution No: IEA –2001/ CR-10509/NRG-1, dated July 12, 2001.

1.1.6 Post enactment of the Electricity Act 2003, the Hon'ble Commission, Maharashtra Electricity Regulatory Commission (MERC) on 20th August 2008, issued specific conditions for the licence to the distribution business of Tata Power (hereinafter shall be referred to as Tata Power–D), which inter-alia specified that Tata Power is entitled to sell, supply and distribute electricity to the public for all purposes in accordance with the provisions of the Act and the term of the licence would be till 15th August, 2014.

1.1.7 As the validity of the licence was till 15th August, 2014, Tata Power-D, under the provisions of Section 14 and 15 of the Electricity Act, 2003 made an application for grant of distribution licence to the Hon'ble Commission (Case 90 of 2014). After following the due procedure laid down under the various Sections of the Act, the Hon'ble Commission granted a Distribution Licence to Tata Power-D for a period of twenty five years effective 16th August, 2014.

1.2 DISTRIBUTION BUSINESS (MUMBAI)

1.2.1 Tata Power has served the city of Mumbai for nearly a century as a generator, transmission and distribution licensee and has to its credit the distinction of providing uninterrupted and reliable power supply across consumer segments. It has acted as a major catalyst to the development of Mumbai, in its journey from the British ruled cluster of islands to a textile hub, and then to being the Financial Capital of independent India. Tata Power-D, inter alia, supplies power to the Residential Consumers (slums & societies), Commercial, Industrial, Railways, Refineries, Textile

Mills, Mumbai Port Trust, BARC, Airport, Hospitals and other vital installations located in the area from the southern tip of Mumbai upto Vasai Creek including Mira Bhayander Municipal Corporation (MBMC).

1.2.2 The area of supply of Tata Power-D in Mumbai extends from Colaba to Mahim falling under the Mumbai City Revenue District, Bandra to Dahisar falling under western suburban parts of Mumbai Suburban Revenue District, Chunabhatti to Vikhroli and Mankhurd in Eastern Suburban parts of Mumbai Suburban Revenue District and area of Mira Bhyander Municipal Corporation. The geographical map of the present Licence Area is depicted in the figure below:

Figure 1: Distribution Licence Area of Tata Power-D

1.2.3 Historically Tata Power-D has been sharing its distribution licence area with two other distribution utilities: The Brihanmumbai Electricity Supply and Transportation Undertaking (hereinafter shall be referred to as "BEST") and Reliance Infrastructure Ltd (Distribution) (hereinafter shall be referred to as "R Infra-D"). This situation continues in the new licence regime of Tata Power-D as well. Thus, Tata Power-D as a distribution licensee operates in an unique environment in Mumbai; wherein parallel distribution licensees exists with overlapping Distribution Licence Areas as follows

- Tata Power–D & BEST in South Mumbai and
- Tata Power–D & R Infra-D in the Mumbai Suburbs (excluding T Ward and partial S Ward i.e. Bhandup, Nahur and Mulund) and MBMC.

1.3 HISTORY OF DISTRIBUTION NETWORK DEVELOPMENT

1.3.1 As explained earlier, the applicability of Clause IV, V, VI of Schedule (which deals with laying of network and Universal Supply Obligation) of the Indian Electricity Act 1910, was excluded for Tata Power. In 2002, when Tata Power had increased its spread in the retail distribution business, its licence was challenged by R Infra-D. The matter was finally settled in July, 2008 when the Supreme Court ruled that Tata Power-D did have a distribution licence in Mumbai and can supply power to any consumer who applied for it.

1.3.2 Post the above mentioned Supreme Court Judgment, Tata Power-D has increased its penetration in distributing power supply to consumers in various categories of industrial, commercial and residential across Mumbai. Subsequently, Tata Power-D also submitted a network rollout plan to the Hon'ble Commission for approval. However, the Hon'ble Commission in their Tariff Order for Tata Power-D in Case 113 of 2008 ruled the following:

> *.....incurring heavy capital expenditure for the network roll-out is not the only option available to TPC-D in its efforts to supply electricity to different consumers in its licence area, and the provisions of the EA 2003 relating to Open Access and the provisions of the MERC (General Conditions of Distribution Licence) Regulations, 2006 relating to use of the distribution network of another distribution licensee, need to be explored by TPC-D, so that the cost is optimised. The Honourable Supreme Court also, in its Judgment on the matter of TPC's distribution licence, observed that TPC could supply to consumers in its licence area, by utilising the distribution*

network of the other distribution licensee already present in the area. Hence, incurrence of capex cannot be a condition for meeting the Licensee's obligations to all the consumers. In fact, the capital costs should be incurred only when there is no better optimal solution.

Thereafter, the development in South Mumbai and Mumbai Suburbs were different as follows:

Developments in Licence Area common to Tata Power-D and R Infra-D

1.3.3 Post the above mentioned directive of the Hon'ble Commission in Case 113 of 2008, wheeling charges and the changeover protocol were approved by the Hon'ble Commission in 2009 (Case 121 of 2008 and Case 50 of 2009) to enable supply of power by Tata Power-D to consumers using the distribution network of R Infra-D. This changeover protocol was applicable to the distribution licence area common to Tata Power-D and R Infra-D.

1.3.4 **Network laying restrictions (Case 151 of 2011)**

- After about two years of operation of the changeover protocol laid down by the Hon'ble Commission, R Infra-D filed a petition in Case No. 151 of 2011, seeking a relief on account of certain issues affecting its financial viability as a Distribution Licensee due to the order dated 15th October 2009.
- R Infra-D requested the Hon'ble Commission to restrain Tata Power-D from utilizing its network for supply of power to changeover consumers, if Tata Power-D is allowed to or to connect new consumers to its network in R Infra-D's area of supply before meeting its Universal Service Obligation (USO). R Infra-D further prayed that Tata Power-D be restrained from connecting on its network any existing R Infra-D consumer or new consumer in R Infra-D's area of supply, till it complies with its USO by laying its own network.
- After conducting several hearings in the matter on 22nd August 2012, the Hon'ble Commission restricted changeover and of consumers to Tata Power-D to certain categories and the area for network development to 11 Clusters.
- Tata Power-D was directed to focus all its energies and capital expenditure and ensure that by the end of one year from the date of this Order, Tata Power-D has rolled out its entire distribution network in the 11 Clusters.
- This restriction was imposed for a period of one year and the Commission

directed that they would review the status and forward path after this period was over.

- Further, all capital expenditure schemes approved till then were to be aligned to implement the above directives.

This Order of the Hon'ble Commission was challenged by both Tata Power-D and R Infra-D in the Appellate Tribunal of Electricity (ATE) in Appeal No. 246 of 2012 and Appeal No. 229 of 2012, respectively.

1.3.5 Review of Case 151 of 2011 (Case 85 of 2013)

- The Hon'ble Commission reviewed the network development plan submitted in Case 85 of 2013 and in the interest of consumers directed enmass transfer of about 7.92 lakh consumers consuming 0-300 units to Tata Power-D using R Infra-D network to provide the benefit of cheap power to consumers consuming 0-300 units.
- Further, the restrictions on network development as imposed under Case 151 of 2011 were to continue till the Hon'ble Commission reviewed the matter.
- R Infra-D had secured a stay on this Order from ATE for transfer of consumers in Appeal No. 278 of 2013
- Tata Power-D had also challenged certain strictures of the Hon'ble Commission as pace of network development was impeded due to various externalities in Appeal No. 36 of 2014.

Developments in Licence Area common to Tata Power-D and BEST

1.3.6 When BEST refused to give a No Objection Certificate (NOC) to one of his consumers to avail power supply from Tata Power-D in the licence area common to Tata Power-D and BEST, the consumer approached the Hon'ble Commission to direct Tata Power-D to supply to him. The Hon'ble Commission issued an Order in February, 2010 holding that Tata Power-D was bound to supply electricity in terms of applicable Regulations and therefore directed Tata Power-D to supply electricity to the consumers either through BEST wires or its own wires.

1.3.7 However, BEST challenged the matter in Appellate Tribunal of Electricity (ATE) and further in Supreme Court where finally the Supreme Court, in their Judgment dated May 8, 2014 ruled that Tata Power-D can supply power to consumers in the licence

area common to Tata Power and BEST on their own network. Till the Supreme Court judgment was passed, there was a directive by Supreme Court to Tata Power-D to maintain status quo in the said licence area common to BEST and Tata Power.

1.3.8 In summary, although Tata Power-D had a distribution licence in Mumbai, for one reason or the other which were beyond its control, Tata Power was constrained in developing a distribution network in a conventional manner as envisaged of a distribution licensee in the Electricity Act, 2003, Regulations issued by the Hon'ble Commission and Specific Conditions of Distribution Licence 2008 issued on 20th August 2008.

Developments post the Distribution Licence Order

1.3.9 **Grant of Distribution Licence to Tata Power-D as per Electricity Act, 2003 (Case 90 of 2014)**

- As described earlier, the distribution licence of Tata Power-D was valid till 15th August, 2014 and in view of this, Tata Power-D in April, 2014 made an application to the Hon'ble Commission for grant of distribution licence as per the requirements of Section 14 and 15 of the Electricity Act, 2003.
- The Hon'ble Commission granted Distribution Licence to Tata Power-D in the city of Mumbai and parts of Mumbai Suburban Area, (areas of Mira Bhayandar Municipal Corporation including areas covered under Chene and Varsave which are contiguous with Tata Power-D's existing area of Licence) vide order dated 14th August 2014. In the said order, the Hon'ble Commission has made certain observations regarding network rollout plan submitted by Tata Power-D as part of the Licence Application and directives of the Hon'ble Commission regarding network development plan submitted are as follows:
  - Tata Power-D is directed to approach the Commission within 6 weeks with a fresh rollout plan in accordance with the concerns expressed in the Order.

1.3.10 In the backdrop of the above mentioned historical developments and the directions issued by the Hon'ble Commission regarding the Network Rollout Plan submitted during the distribution licence application by Tata Power-D, Tata Power-D had submitted the updated Network Rollout Plan. In that submission apart from the network rollout plan, Tata Power-D has attempted to address the specific issues raised by the Hon'ble Commission in the above mentioned Licence Order.

1.3.11 ATE Judgments relating to appeals filed against Case No. 151 of 2011 (Appeal No. 229 and 246 of 2012)

The Hon'ble ATE delivered a judgment in Appeal No. 229 & 246 of 2012 on 28th November, 2014. The operative paragraphs of this judgment relating to network development have been reproduced below for the ease of reference:

"58. Laying down of parallel network in a congested metropolitan city like Mumbai where a reliable distribution network is already existing is to be viewed differently from situation in other areas in the country where there are deficiencies in the existing distribution network resulting in constraints in maintaining a reliable supply to the existing consumers and extending supply to new consumers. Practical difficulties in laying down the network and extending the 11/0.4 kV network all around the congested areas in multi-storeyed buildings and narrow lanes of slums and the extremely high cost involved in making an unnecessary expenditure has to be considered. In some areas it may be practically impossible to lay down the parallel network by Tata Power due to space constraints. Tata Power itself has stated that it is facing practical difficulties to lay down the distribution network. Tata Power at the same time cannot maintain its right to lay down distribution network selectively even in areas where a reliable network of RInfra is existing. Tata Power should therefore, be restricted to lay down its network only in areas where laying down of parallel network would improve the reliability of supply and benefit the consumer and also for extending supply to new consumers who seek connection from Tata Power. Tata Power's Rollout Plan should therefore, be restricted to only such areas. This may also require amendment in the licence condition of Tata Power, after following due process as per law. The Rollout Plan shall be approved by the State Commission only after hearing RInfra and the consumers. In the meantime, Tata Power should be restrained to lay down distribution network in the distribution area common to RInfra.

59. However, where Tata Power has already made considerable investment in constructing the distribution system in pursuance of the directions of the State Commission, it should be allowed to be commissioned and capitalized, to feed the consumers as decided by the State Commission.

Tata Power may submit a proposal to State Commission in this regard which the State Commission shall consider and decide after hearing the concerned parties including RInfra.

60. *Where Tata Power has already laid down its network and some consumers have switched over from RInfra to Tata Power, these consumers can remain with Tata Power. However, they can choose to switch over to RInfra in future on RInfra's existing network as per the switch over protocol to be decided by the State Commission.*

61. *In view of above, Tata Power is directed to submit its Roll Out Plan as indicated above for approval of the State Commission. In the meantime, Tata Power is restrained to lay down its distribution network in the area common to RInfra till further orders of the State Commission on its Rollout Plan as per the directions given in this judgment. However, Tata Power can supply power to the existing consumers of RInfra irrespective of category of consumer on the request of the consumers only through RInfra's network by paying the necessary wheeling charges as well as the other compensatory charges including the cross subsidy charges to RInfra. However, there shall be no restriction on Tata Power or RInfra to lay network for supply to new connections. The State Commission shall consider to give approval for laying down of network by Tata Power only in areas where there are distribution constraints and laying down of a parallel network by Tata Power will improve reliability of supply and benefit the consumers, only after hearing RInfra and the consumers. Similarly, RInfra shall not lay network in any area where only Tata Power's network is existing and use Tata Power network for changeover of consumers, if any, till further orders by the State Commission, except for extending supply to new connections. The State Commission is directed to devise a suitable protocol in this regard after following due procedure. This may require change in licence condition of the licensees which the State Commission shall decide after following due procedure as per law."*

Therefore, in line with the direction given by the Hon'ble ATE, Tata Power-D has considered following while revising the network rollout plan for Mumbai Suburban area:

- Tata Power-D can lay network and connect to any new consumer in the

entire Mumbai Suburban Area.

- Tata Power-D is allowed to capitalize, commission and feed the consumers on the network, wherein substantial investment has been made by Tata Power-D in compliance to the direction of the Hon'ble Commission in its Order in Case No. 151 of 2011.

1.3.12 ATE Judgments relating to appeals filed against Case No. 85 of 2013 (Appeal No. 278 of 2013 & Appeal No. 36 of 2014)

The Hon'ble ATE delivered a judgment in Appeal No. 278 of 2013 & Appeal No. 36 of 2014 on 29th November, 2014. In this Judgment the Hon'ble ATE has held as follows:

"29. Summary of Findings:

(i) The State Commission has exceeded its jurisdiction in giving the directions for transfer of about 7.92 lakhs consumers in 0-300 Units slab enmass to Tata Power while being connected to RInfra's distribution system. These directions have been passed in violation of the principles of natural justice.

(ii) Appeal No. 36 of 2014 does not survive in view of our judgment dated 28.11.2014 in Appeal No. 246 of 2012."

In our humble submission, this judgment does not have direct impact on the Network Rollout Plan.

1.3.13 Thereafter, based on the directions of the Hon'ble ATE in Appeal No. 229 and 246 of 2012, Tata Power-D is submitting this Revised Network Rollout Plan for the approval of the Hon'ble Commission.

2 PROFILE OF MUMBAI WITH POWER DISTRIBUTION PERSPECTIVE

Mumbai, amongst the largest urban agglomerations in the world, is the financial and commercial capital of the country. Attracted by the opportunities offered by this dynamic and congenial city, millions of people from across the country have flocked to it for generations, giving it its cosmopolitan outlook. Situated on the Arabian Sea coast in western India, the city is an important trading centre and port city. It is the 2nd most populated city in the Country and 5th most populated city in the World which is spread over 603.4 square kilometers along with its metropolitan region (Municipal Corporation of Greater Mumbai). The spread of Mumbai City and the population base has resulted in a density of around ~20,500 people per sq.km. which is one of the highest density in the world.

Over a period of time, Mumbai has transformed from an Industrial / Mill centre to a Commercial / Financial hub. Most of the large industries have moved out of Mumbai and the premises have been redeveloped into commercial, financial and residential centres. Mumbai also has a large population of residential consumers and being a densely populated city continues to grow vertically. The Hon'ble Commission in their Order in Case 90 of 2014 has also captured the key features of Mumbai as follows:

a) *Mumbai city consists of several islands. It faces a peculiar geographical constraint as it is surrounded by sea, river, creeks, reserve forests, mangroves, covered landscapes and other ecologically sensitive pockets. As a result the city grows vertically, making it difficult to create power transmission and distribution infrastructure.*

b) *Mumbai City is the 2nd most populated city in India and 5th most populated city in the World. As per 2011 census data Mumbai city district has a population of 3,085,411 whereas Mumbai suburban district has a population of 9,356,962. The population density in Mumbai city district is estimated at 19,652 persons per sq. km, population density in Mumbai suburban district is estimated at 20,980 persons per sq. km. The literacy rate in Mumbai city district is 89.21% whereas for Mumbai suburban district it is 89.91% which are higher than the national average of 73%.*

c) *Mumbai has a tropical climate, specifically a tropical wet and dry climate, with seven months of dryness and peak of rains in July. The maximum annual rainfall ever recorded was 3,452 mm in 1954. The highest rainfall recorded in*

a single day was 944 mm on 26 July, 2005. The average total annual rainfall is 2,146.6 mm for the Island City, and 2,457 mm for the suburbs. Mumbai city along with its sub-urban area see approximately 5 months of monsoon which essentially means that very limited amount of developmental activity can be undertaken during these months.

Municipal Corporation of Greater Mumbai (MCGM) has specified wards covering the entire island city of Mumbai along with the suburban area (metropolitan area) of Mumbai. Further, the area of Mira Bhayander Municipal Corporation (including Chene and Versave Village) is contagious to Mumbai. The list of ward is specified in the table below:

Table 1: Municipal Wards within Mumbai area

Ward	Name of Area	Ward	Name of Area
ISLAND CITY (BEST LICENSE AREA)		SUBURBAN DISTRICT (R-INFRA LICENSE AREA)	
A	Colaba	H East	Khar/Santacruz
B	Sandhurst Road	H West	Bandra
C	Marine Lines	K East	Andheri (East)
D	Grant Road	K West	Andheri (West)
E	Byculla	L	Kurla
F South	Parel	M East	Chembur East
F North	Matunga	M West	Chembur West
G South	Elphinstone	N	Ghatkopar
G North	Dadar/Plaza	P South	Goregaon
		P North	Malad
		R South	Kandivalli
		R Central	Borivali West
		R North	Dahisar
		S	Bhandup
		T	Mulund
		NA	Mira Bhayander Municipal Corporation (including Chene and Versave Village)

Each ward has its own demographic and economic profile in addition to unique geographical features, which play an important role in network rollout.

2.1 POWER DISTRIBUTION IN MUMBAI

2.1.1 As described above, Mumbai is one of the most developed cities of India and known to be the financial capital of India. One of the key contributors in the development of Mumbai to its present status has been a very reliable power supply arrangement. While most of the country was and is reeling under power deficit scenario, Mumbai, for decades has been getting a very reliable and 24x7 power supply.

2.1.2 While the sourcing of power to Mumbai is a combination of embedded generation and power sourced from outside Mumbai through a transmission network, the Distribution sector in Mumbai is unique with a parallel licensing scenario and supplied power by four different distribution licensees; viz: Tata Power-D, R Infra-D, BEST and MSEDCL.

2.1.3 The distribution network imparts a key role in maintaining the high levels of reliability in the densely populated city and the key features which govern the distribution of power in the city and its suburban area are as follows:

- The distribution network is predominantly underground emanating from the Receiving stations of Transmission utilities.
- Development of distribution network in the city requires extensive digging of the roads and for such excavation, permissions are required to be obtained from the Municipal Authorities.
- Most of the major arterial roads in Mumbai are concretized, making it difficult for excavations for laying underground cables, whereas in small lanes and roads especially in areas dominated by slums, space is not available for excavations and cable laying.
- There are no defined Utility corridors for underground network in Mumbai.
- On account of extreme monsoon for a period of four months in the city, all developmental activities requiring excavation of roads are stopped. Hence, effective period available for any network development is around 7 months.
- As described earlier, Mumbai being a densely populated city, space is at premium and acquiring space for development of substations is in itself a challenge

2.1.4 The Revised Network Rollout is after taking into account all the factors like, meeting new demand growth, actual load booked by consumer with Tata Power-D, laying of

backbone network to improve efficiency and loading of the network wherein substantial investment has been made by Tata Power-D in pursuance of the direction of the Hon'ble Commission in Case No. 151 of 2011.

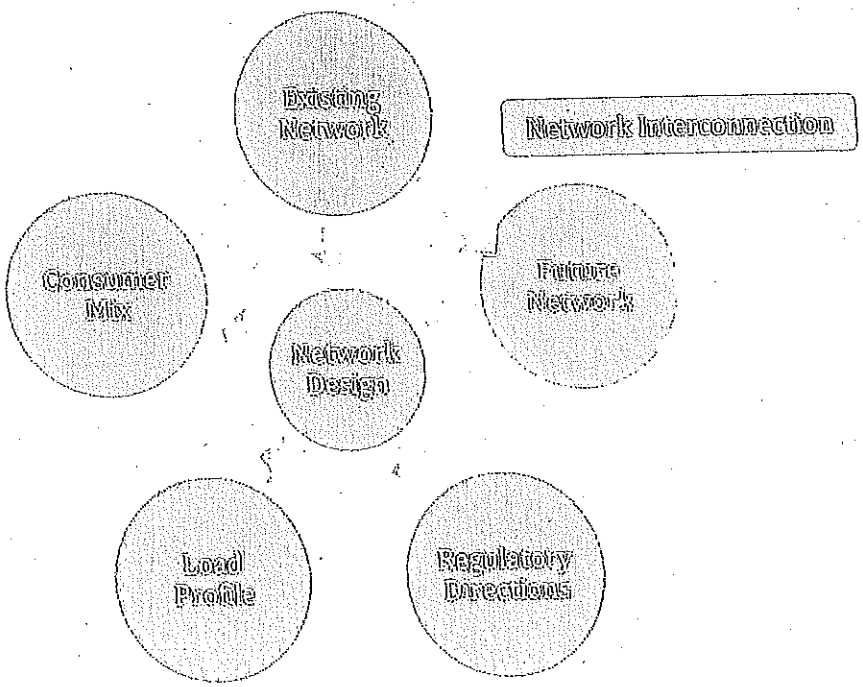
3 NETWORK COMPONENTS & DESIGN

3.1 NETWORK COMPONENTS & DESIGN APPROACH

3.1.1 Long term planning of the distribution system is an essential part of the planning activities of a Distribution utility. The main purpose of the distribution system planning is to determine the optimum network arrangement with appropriate components and network design so as to meet the load requirement, reliability of power supply, capable of reaching out to all categories of consumers including subsidized consumers and regulatory & safety standards. Further identification of appropriate network components and suitable network design is necessary to ensure that the network being developed is efficient and economical.

3.1.2 Load profile, existing network, consumer mix and the landscape of the area where power is to be supplied are the critical parameters which need to be considered for identifying appropriate network components and finalizing suitable network design.

Figure 2: Network Components and Design Approach



3.2 LOAD PROFILE

3.2.1 The demand to be catered to would depend upon the peak demand of Mumbai and

the individual demand being met by individual distribution licensees in Mumbai. The peak demand of Mumbai is in the range of 3200 to 3300 MW. The peak demand of Mumbai for past 4 years (as represented in the Table 2) has been considered.

Table 2: Past Mumbai Peak Demand

Year	Mumbai Peak (MW)	On Dates
FY-2010-11	3130	26.04.10
FY-2011-12	3192	02.06.11
FY-2012-13	3152	05.06.12
FY-2013-14	3216	28.05.13

3.2.2 Over a period of 4 years, peak demand of Mumbai has increased at CAGR of about 1%. However, this growth is not consistent as there was a reduction in peak demand in FY 2012-13 by more than 1% as compared to FY 2011-12. Going forward the growth in Mumbai is expected to be on a CAGR of 2-3% over next 25 years as per the Licence tenure of Tata Power. However, the Network Rollout Planning has been initially considered for a period of 7 years. During this period, appreciable growth of Peak Demand is not expected to happen. Hence, Tata Power has considered a peak demand of about 3220 MW, equivalent to that of FY 2013-14 and has not considered any further increase in the peak demand over a period of Network Rollout plan. Tata Power shall propose further network development, if substantial increase in peak demand is observed in future.

3.2.3 The total ward wise load growth of Mumbai and the wardwise load booked with Tata Power over a period of Network Rollout Plan has been presented in the following graphs to represent the potential load:

Figure 3: Load Projection for the Licence Area

Ward details	Load projection (MW)
A Ward	49
F South Ward	49
G North Ward	35
E Ward	35
D Ward	34
F North Ward	23
G South Ward	20
C Ward	10
B Ward	0
Mira Bhayander Municipal	118
R South Ward	96
S Ward	90
P North Ward	85
K East Ward	84
H East Ward	82
K West Ward	79
N Ward	67
P South Ward	65
T Ward	61
M East Ward	60
L Ward	53
H West Ward	48
R North Ward	47
R Central Ward	47
M West Ward	28
Total	1385

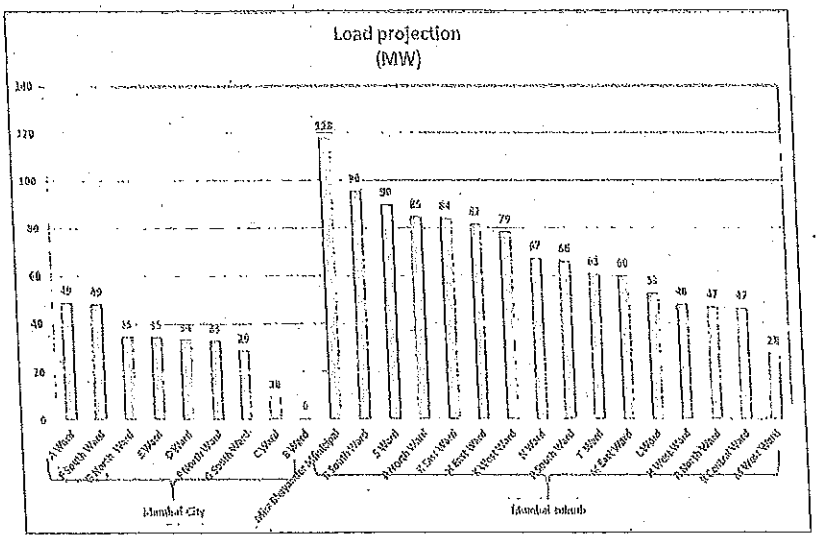
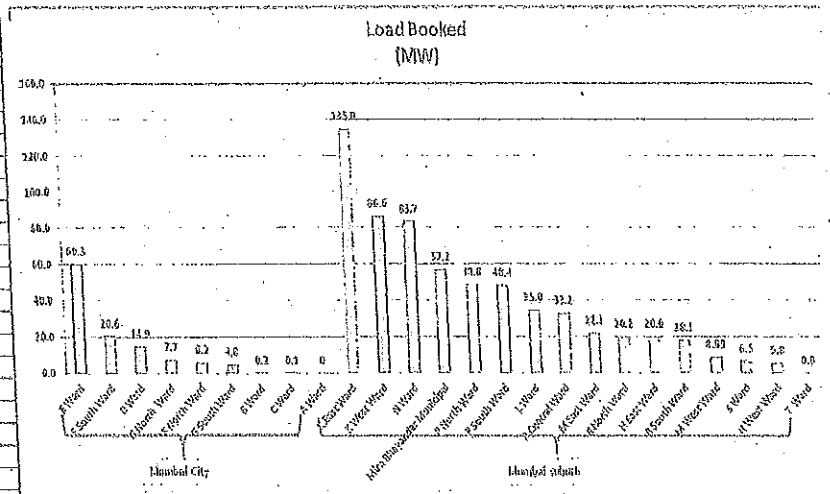


Figure 4: Load Booked in Licence Area

Ward details	Load Booked (MW)
E Ward	60.3
F South Ward	20.6
D Ward	14.9
G North Ward	7.7
F North Ward	6.2
G South Ward	4.8
B Ward	0.2
C Ward	0.1
A Ward	0
K East Ward	135.0
K West Ward	86.6
N Ward	83.7
Mira Bhayander Municipal	57.2
P North Ward	48.8
P South Ward	48.4
L Ward	35.0
R Central Ward	33.2
M East Ward	22.1
R North Ward	20.2
H East Ward	20.0
R South Ward	18.1
M West Ward	6.89
S Ward	6.5
H West Ward	5.8
T Ward	0.0
Total	744.9



3.3 CONSUMER MIX

3.3.1 The demographics of Mumbai is not uniform across the city and is different from the perspective of population growth, infrastructure development, slums in the area, consumer mix etc. The power consumers in Mumbai can be broadly categorised into (i) Residential, (ii) Commercial and (iii) Industrial. The extent of network rollout in a

particular area would depend upon the concentration of the predominant category of consumer in that area. For eg. An area with higher concentration of slums would require LT network whereas an area with Industrial consumers would predominantly have an HT network. i.e. the LT network density would depend on the consumer profile in that particular area.

3.4 EXISTING NETWORK OF TATA POWER-D

3.4.1 Tata Power-D has been a distribution licensee prior to the grant of a fresh distribution licence to it under sections 14 and 15 of the Electricity Act, 2003. The existing distribution network of Tata Power-D comprises of an HT network at 33 kV, 22 kV, 11 KV and to a small extent of 6.6 kV has been developed under the constraints of the above scenarios during its previous Licence tenures and subsequent orders of Hon'ble Commission, Hon'ble ATE & Supreme Court as detailed in Section 1 and emanates from the transmission outlets provided by the Transmission licensees after sanction from the State Transmission Utility. The LT network, on the other hand mainly comprises of LT network, feeder and sub feeder pillars. Although on account of historical reasons and constraints as mentioned above Tata Power-D was not able to develop the distribution network, appreciably during its licence tenures in the last two years, Tata Power-D has developed substantial network after substantial capex was approved to it for the first time in 2012.

3.4.2 The existing network of Tata Power-D as on March 2014 has been presented in the following table:

Table 3: Tata Power-D's Existing Network Details

Network Details	Unit	Total Licence Area
No of DSS (33/11)	Nos	27
Power Transformers Capacity (DSS)	MVA	915
HT Network	ckt.km	1833
No of CSS (11/0.4 or 22/0.4)	Nos	608
Distribution Transformers Capacity (CSS)	MVA	968
LT Mains Cables	ckt.km	1103

3.5 REGULATORY DIRECTIONS

3.5.1 The directions of the Hon'ble ATE which are applicable for Mumbai Suburbs have been detailed out in para 1.3.11. The revised network rollout has been proposed

considering the directions in the said judgment.

3.6 NETWORK COMPONENTS

3.6.1 The primary purpose of a distribution network is to bring power to the load centres and comprises of Distribution Substations (DSS), Consumer Substations (CSS), the HT network and LT network with feeder pillars and sub feeder pillars. Network component selection should be towards addressing the challenges listed above. As at present, the distribution network starts from 33 kV Distribution Sub-station (DSS) and the network has been planned accordingly.

- **Backbone:**
  - **HT cable (33 / 22 kV)** – This shall connect the Transmission Receiving Station to load centers (DSS) within the License Area.
  - **Distribution Sub-stations (DSS)** – DSS shall be constructed near the load centers and shall step down the voltage to 11 kV for further distribution within the load centre.
  - **HT Cable (11 / 6.6 kV)** – These cables shall be used to feed the HT consumers in the area and for connecting DSS to the Consumer Sub-stations.
  - **Consumer Sub-stations (CSS)** – CSS shall step down the voltage from 11 kV to 440 V (LT level). CSS shall also act as an inter-connector between the HT network and the LT network. CSS is installed in the close proximity to the consumer premises i.e. about 300 meters from the consumer premises.
- **LT Network:**
  - **LT Cables and Feeder Pillars** – LT Cables shall be laid in such a way that it is as near to consumer and similarly feeder/ sub-feeder Pillars shall be installed to give the connections to LT consumers to avail the power supply as per MERC (Standards of Performance) Regulations 2014.

3.7 NETWORK DESIGN

Backbone Network:

3.7.1 33 kV Cables

3.7.1.1 33 kV Cables are used to bring power to the DSS from the Transmission Receiving Station (RSS). Considering the spread of RSS and DSS in Mumbai, no specific 33 kV cable network design has been proposed. The network spread totally depends on the nearest RSS to the load center, the requirement of the load center and redundancy requirement.

3.7.2 DSS

3.7.2.1 DSS have been considered to be of 2 x 20 MVA transformers alongwith associated civil construction and protection system. Each DSS has been planned to have provision for 3 numbers of 20 MVA transformers. Initially 2 number of 20 MVA transformers are planned to be installed and as the loading on the transformers increases, the third transformer would be installed to ensure n-1 redundancy. Further, in case of space constraints a mini DSS would also be considered with a capacity 1 x 20 MVA. In order to build redundancy in network design for the DSS, the DSS would be planned to get power supply from 2 nos. of 33 kV cables either from the same RSS or from different RSS.

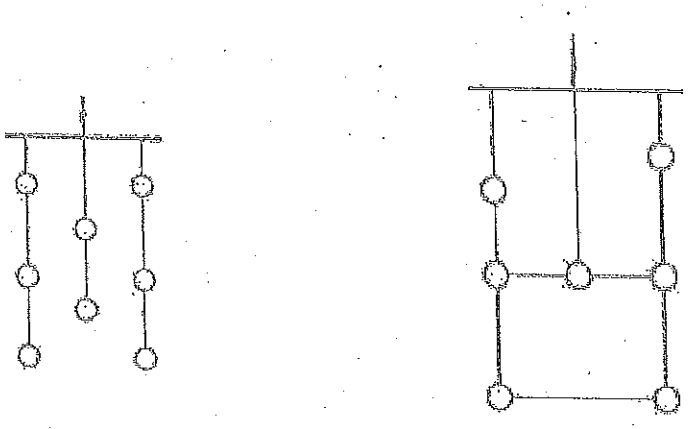
3.7.3 11 kV Cables

3.7.3.1 11 kV cable network is the backbone of the distribution network within the load centre. There can be different designs for 11 kV networks. In case of Tata Power-D the 11 kV network design should be such that it fulfills following criteria:

- Ensure (n-1) redundancy
- Cost Optimization
- Faster Restoration of Supply in case of faults

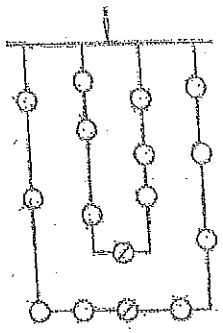
3.7.3.2 The various types of 11 kV network designs considered are pictorially presented and then briefly discussed:

Figure 5: 11 kV Network Designs

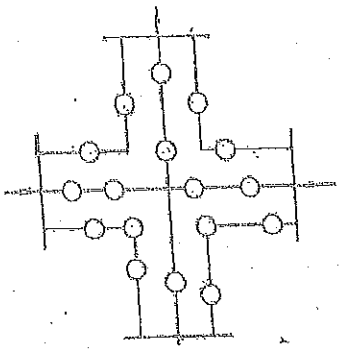


Radial Network

Mesh Network



Ring Network



Interconnected Network

Radial Network: Radial Network Design involves laying the network based on consumer demand and does not have any build in redundancy. The network is laid and extended as per the requirement of the consumer.

Ring Network: Ring Network Design is a common form of network designs used providing (n-1) redundancy, where redundancy is built in the network by creating a ring structure as depicted in the diagram above.

Mesh Network: Mesh Network Design is also one of the conventional forms of network design and has a (n-2) built in redundancy.

Interconnected Network: Interconnected Network Design used to structure a network between 4 different sources. This is useful to create (n-2) redundancy in the system. However, the cost of such inter-connection is substantial and may be used only in case of very critical loads.

3.7.3.3 The table below provides a matrix for selection of Network Design for 11 kV network based on the options discussed above.

Table 4: Matrix for selection of Network Design for 11 kV Network

Network Design	n-1 Redundancy	Cost Optimisation	Faster Restoration of Supply in case of faults
Radial Network	No Redundancy	High	No
Mesh Network	n-2	Medium	Medium
Ring Network	n-1	Medium	Medium
Interconnected Network	n-2	Low	High

3.7.3.4 For developing the 11 kV distribution network of Tata Power-D, Radial Network Design has not been considered as there would be no redundancy in the network and this would affect reliability of power supply to the consumer. Further, although Interconnected Network Design would provide a better reliability, it has not been considered on account of the high cost of network.

3.7.3.5 The Ring Network Design and the Mesh Network Design seem to be the most appropriate designs to meet the network criteria for 11 kV network which provide redundancy as well as cost optimization. Tata Power-D proposes to use the Ring Network Design for 11 kV backbone network. Further, depending of the loading of the network or the criticality of the load connected to the network; a Hybrid Network Design consisting of Ring Network Design and Mesh Network Design may be used in certain areas.

3.7.4 CSS

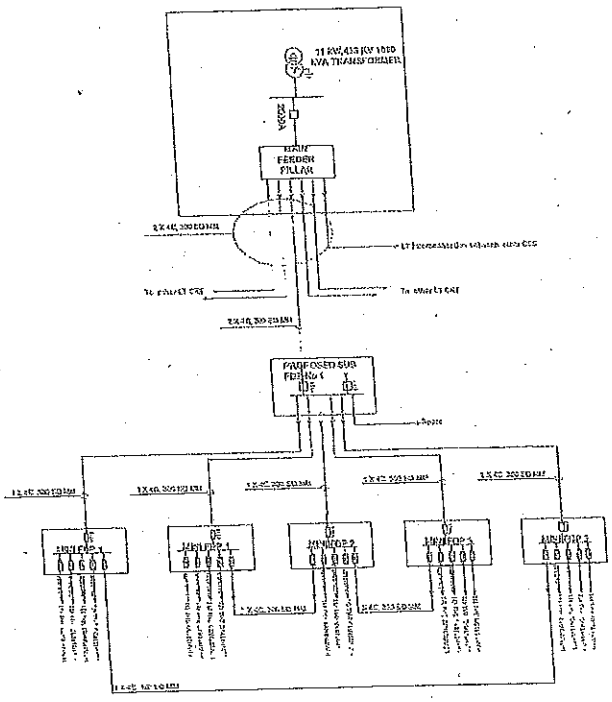
3.7.4.1 CSS have been considered of 1 MVA transformation capacity with associated civil work and protection system. A conventional CSS would occupy about 40 sq. mts. of space.

LT Network:

3.7.5 LT Cables

3.7.5.1 From the CSS, the power is evacuated to the nearest consumer premises through Feeder Pillar, sub-feeder pillars, mini feeder pillars and 440 V LT network. Further, depending on the consumer response, load development and penetration of LT network, Tata Power-D may lay interconnections and convert the LT Cable Network into a Ring Network Design or Mesh Network Design as shown in the figure.

Figure 6: LT Network Design



3.7.5.2 Based on the above design philosophy and the network components proposed to be used, Tata Power-D has carried out the planning of its distribution network in its licence area as described in the subsequent chapter.

4 NETWORK PLANNING PHILOSOPHY

4.1 NETWORK DEVELOPMENT MODELING

4.1.1 The network components of the proposed distribution network have been discussed in detail based on the existing network, load profile and the Regulatory directions described in the earlier chapter. This chapter discusses about "Network Development Model" for determining the quantum of various network components like DSS, CSS, HT and LT cables for developing the distribution network in Mumbai. It is important that factors like anticipated load on the network, capacity of existing network, load profile, regulatory directions, etc. needs to be considered while finalizing the Network Development Model. This Revised Network Rollout Plan has been developed for entire Mumbai after considering the direction given by the Hon'ble ATE.

4.2 NETWORK DEVELOPMENT PHILOSOPHY ADOPTED BY TATA POWER-D

The key considerations for distribution network development philosophy are as follows:

4.2.1 *Key Issue-1 : Governing framework for distribution network philosophy*

The Distribution network planning and development shall be guided by MERC (Electricity Supply Code and other conditions of supply) Regulations, 2005 (hereinafter referred to as MERC Supply Code Regulations), MERC (Standard of performance of distribution licensees, period for giving supply and determination of compensation) Regulations, 2005 (hereinafter referred to as MERC SOP Regulations) and CEA (Technical standards for construction of Electrical Plants and Electrical Lines), Regulations, 2010. Further, direction given by the Hon'ble ATE in its judgment in Appeal No. 229 and 246 of 2012 have also been additionally considered while planning the network in Mumbai Suburban Area. These regulations and directions outline the conditions for performance of distribution licensee and to enable distribution licensee meet its supply and service obligations and the manner in which the same could be accomplished.

Table 5: Conditions for network laying

Conditions	Details
Consumer related	◦ Laying of network to meet the growing demand in various wards across Licence area with major projected load growth and booked loads. ◦ Acquiring consumers on network in Mumbai Suburbs where: ✓ Backbone network has been developed in pursuance of Case 151 Order ✓ Network developed / in progress in pursuance of Case 151 order with an investment of Rs.1220 Crs which is ready to take over consumers ◦ Acquiring consumers in rest of Mumbai including South Mumbai to load the network and improve efficiency of the network.
Timeline related	◦ Category-1: Requires no extension or modification or augmentation of the distribution mains (last mile connectivity would have to be provided only at the time of connection - within time period of one month) ◦ Category-2: Entails extension or augmentation of distribution mains (within time period of three months) ◦ Category-3: Requires commissioning of new substation (within one year)

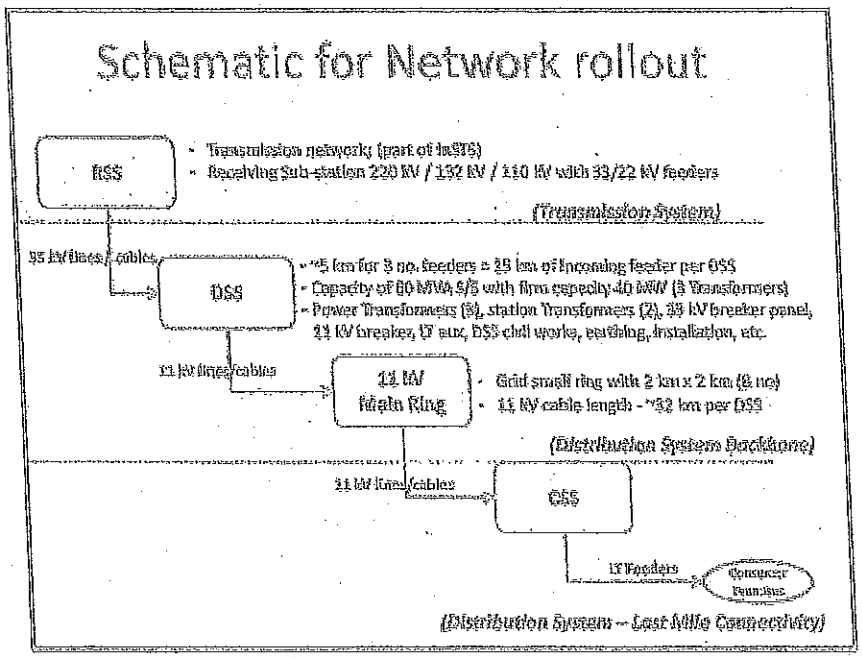
In order to comply with above requirements, distribution licensee needs to (a) create a backbone distribution network infrastructure comprising high voltage (33kV/11kV) Distribution Substation System (DSS), (b) identify source or outlet at RSS to feed supply to DSS, (c) establish connectivity to feed the DSS from identified RSS and (d) create 11 kV ring main network for feeding CSS as and when required. Once the backbone distribution network is ready, distribution licensee can comply with the conditions and timelines laid out under MERC SOP Regulations and arrange to provide supply on request to prospective consumers.

4.2.2 *Key Issue-2 : Scope of Network rollout to cover creation of distribution backbone*

For the purpose of distribution network rollout, it is important that distribution backbone is first put in place. We have developed a standard design configuration centred around the concept of distribution substation system (DSS) of 60 MVA (33kV/11kV) installed capacity for catering to 40 MW load with adequate redundancies to be developed in stages commensurate with load growth in the area.

Following schematic elaborates the scope of DSS based distribution backbone:

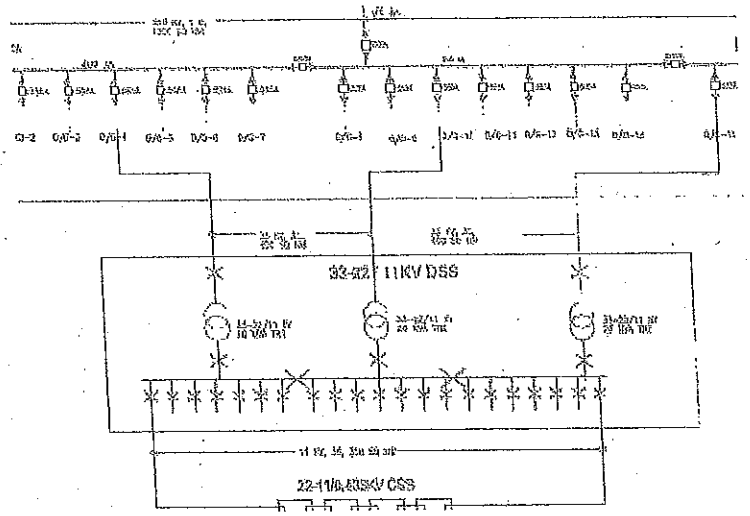
Figure 7: Schematic for Network Rollout Philosophy



The scope of DSS based distribution backbone shall cover following components:

- Component -1: 33 kV line/cable from RSS to DSS (~ 5 km with 3 feeders of 33kV)
- Component-2: DSS and associated equipment (60 MVA)
- Component-3: 11 kV main ring for distribution

Figure 8: HT Backbone Network – SLD



Note: The CSS above have been shown to indicate the purpose of the connectivity of consumer with 11 KV network. However CSS would not form a part of the HT backbone network

Component-1: Under the standard DSS configuration, it is envisaged that around three incoming 33kV feeders shall be feeding power into 3 power transformers at DSS, either from same Receiving Station Source (RSS) or different RSS sources, depending on location. It is envisaged that around 5km 33 kV cable / feeder would be required to be laid out for connecting RSS to DSS. It is expected that DSS would cover a geographic area of around 6 square km catering to about 50000 to 70000 consumers and a demand of 40MVA. For the purpose of this network roll out plan it is presumed that the necessary outlets at respective RSS for feeding power into DSS would be made available by the Transmission Licensee. Our requirement for seeking connection/outlet to respective RSS would form part of STU transmission plan as well.

Component-2: We have designed and developed a standard DSS configuration in line with CEA (Technical Standards for construction of Electrical Plants and Electrical Lines) Regulations, 2010. The selection of site and substation layout shall be in accordance with standard industry practice and applicable guidelines notified by CEA from time to time. A typical DSS shall comprise power transformers, station auxiliaries, bus-bars, (33 kV/11 kV) panels, circuit breakers, foundation, earthing, automation etc. However, installation of power transformers in the DSS can be phased to match the load growth of Tata Power-D, which will ensure optimum

addition of distribution assets.

Component-3: Under the standard DSS configuration, it is envisaged that 11 kV main ring network comprising rings (2 km x 2 km) would be developed. This would significantly improve the reliability of supply for the consumer. Total line length/cable length for 11 kV feeders under the proposed arrangement works out to around 32 km per DSS.

4.2.3 *Key Issue-3: Establishing last mile connectivity from 11 kV Ring Main Grid to CSS*

As per MERC Supply Code Regulations and MERC SOP Regulations, if the supply to an applicant requires installation of new sub-station, the applicant will have to make available space and necessary arrangements within its premises for distribution licensee to install such consumer sub-station system (CSS) within consumer premises.

Further, establishment of CSS and last mile connectivity would be critically dependent on the choice to be exercised by the consumers, hence establishment of CSS and last mile infrastructure has been optimally estimated in this Business Plan. However, it is submitted that with creation of backbone infrastructure for network rollout, subsequent installation of last mile infrastructure can be accomplished within the time period complying with the requirements outlined under Supply Code and SOP Regulations.

Tata Power-D in this submission worked out the capital expenditure required for laying the LT network along with the required Consumer Substations (CSS), Ring Main Units (RMU), 415 V Feeder Pillars and LT Network for providing the power supply to new consumers as well as to load the network optimally.

4.2.4 Further, with respect to the Distribution Network Development Philosophy has to determine the feasible and optimal solutions for the following –

a) **Location, Size and Timing of DSS/ CSS** - The following criteria are considered while deciding installation of a DSS / CSS:

- The location of the DSS / CSS shall be ideally as close to the load centre and CSS location will be prioritized to reach to low-end consumers as far as

possible, so as to reduce the length of HT / LT network and the subsequent voltage drop.

- The location of DSS shall also be on the basis of load forecast, demographic factors, space availability and existing network configuration etc.
- For the purpose of standardization, the DSS capacity shall be 10 / 20 MVA and that for CSS shall be in the range of 1000 kVA to 1500 kVA depending on the load in the vicinity.
- The timing for installation of DSS/ CSS shall depend upon the requirement i.e. areas where HT/ LT network reach is relatively low will get priority as also, the areas where the existing HT/ LT capacity is reaching its optimum loading capacity.

b) Type, Size and Routing of distribution lines and sectionalizing and switching equipment

- Formation of Ring circuit / Mesh circuit or both depending on the technical and economic requirement of the system to enhance reliability of power supply
- Consumers affected due to outage to be minimum in the area
- Standardisation of distribution equipment based on technical standards of construction as specified by CEA.
- Type of cable and equipment will depend on operational requirement, available technologies and cost optimisation

c) The guidelines other than above considered while development of network are as follows:

- Voltage variations shall not exceed the limits specified in MERC (SoP) Regulations, 2014 at the nearest and farthest end under peak load /off peak load conditions and normal operating conditions
  - +6 % to -9 % over the declared system voltage of 33/22/11 kV
  - +6 % to -6 % over the declared system voltage of 0.415 kV
- Power factor shall be more than 0.95 lag at 33-22 kV level
- Following Peak loading criteria shall be adhered to
  - Distribution Transformer: 70 % of rated capacity
  - Underground Cables: 70 % of rated capacity
- The system shall meet (n-1) redundancy criteria

- As a general rule shall be able to address the following contingencies
  - Outage / breakdown of a incoming feeder to DSS
  - Outage / breakdown of a 33-22/11 kV transformer
  - Outage / breakdown of a interconnecting cable section between CSS.
  - Disaster Management Plan in the event of a natural calamity shall be in place.

4.3 COMPUTATION OF NETWORK REQUIREMENT

The component wise Network Requirement has been presented in the following paras:

4.3.1 DSS

The DSS capacity required to be installed in any area shall depend the load booked with Tata Power for new consumers. In order to arrive at the computation of DSS capacity, following tests are applied:

Figure 9: DSS Test

Test	Condition	Result
Test 1	If the Contract Demand is less than 5 MVA	Apply the sub-test, else go to Test 2
Sub-test 1.1	*11 kV or 22 kV network is available*	*Do not add DSS, else add 20 MVA DSS capacity*
Test 2	If the Contract Demand is less than 15 MVA	Add 20 MVA DSS capacity, else go to Test 3
Test 3	If the Contract Demand is more than 15 MVA	Add 40 MVA DSS capacity

Computation of DSS & its Capacity:

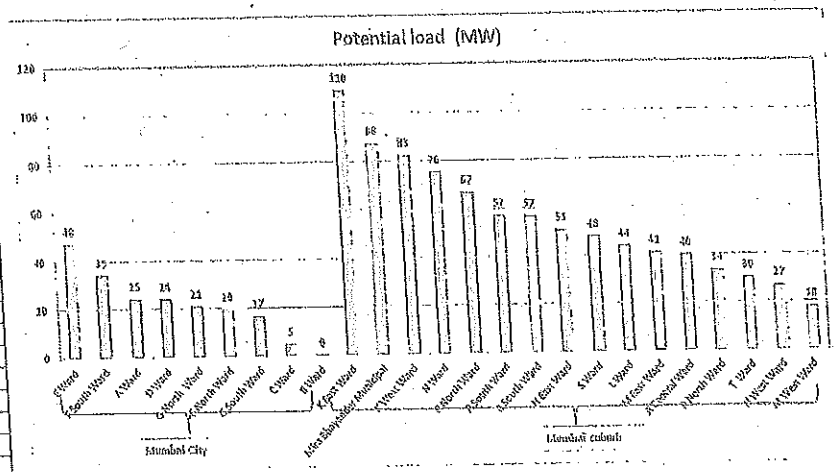
Tata Power-D has arrived at the DSS capacity to be installed in the Licence Area in the following manner:

- Area-wise contract load booked with Tata Power-D, which is projected to be live during Network Rollout Plan period has been presented in section 3.2. However,

considering the only a portion of the load projected and booked will get converted into on ground projects, potential load targeted has been represented in the following graph:

Figure 10: Potential Load targeted for Licence Area

Ward details	Potential Load (MW)
E Ward	48
F South Ward	35
A Ward	25
D Ward	24
G North Ward	21
F North Ward	20
G South Ward	17
C Ward	5
B Ward	0
K East Ward	110
Mira Bhayander Municipal	88
K West Ward	83
N Ward	76
P North Ward	67
P South Ward	57
R South Ward	57
H East Ward	51
S Ward	48
L Ward	44
M East Ward	41
R Central Ward	40
R North Ward	34
T Ward	30
H West Ward	27
M West Ward	18
Total	1065



DSS test shown above has been applied to the contract demand booked with Tata Power-D. Based on the test, in order to cater to the contract demand, approximately 80 MVA capacity of DSS would be required to be installed. The break up DSS capacity proposed in the Licence Area is as follows:

Table 6: Proposed DSS

Proposed DSS		
Particulars	Units	
DSS of 20 MVA Capacity	Nos.	17
DSS of 40 MVA Capacity	Nos.	5
Total Number of DSS Proposed	Nos.	22
20 MVA DSS Capacity	MVA	340
40 MVA DSS Capacity	MVA	200
Total DSS Capacity Proposed	*MVA*	540
Range of DSS Planned	*MVA*	490 to 590

4.3.2 33 kV Network

Based on the proposed DSS and RSS locations, it has been considered that every DSS shall be at an average 5 km distance from the source RSS. In view of this, 10 km of 33 kV cable has been considered for every DSS to be installed considering two incoming cables from same/ different RSS.

Computation of 33 kV Cable

The table below provides the proposed 33 kV HT cable requirement is presented below:

Table 7: Proposed 33 kV HT Cable requirement

Proposed 33KV HT Cable			
Particulars		Units	
Total Number of DSS Proposed	a	Nos.	22
33kV cable per DSS	b	km	10
33kV cable in Length	c=a*b	km	220
Range of 33 kV cables planned		km	198 to 242

4.3.3 11 kV Network

As discussed earlier in this Network Rollout Plan, Tata Power-D has opted for a Ring Network Design for 11 kV network. In order to achieve the spread of 11 kV network in the load centre, it is planned to have 4 rings of 8 kms each in case of 40 MVA DSS and 4 rings of 4 kms each in case of 20 MVA DSS. Thus, 32 km of 11 kV network would be laid for every 40 MVA DSS and 16 km of 11 kV network would be laid for every 20 MVA DSS.

Computation of 11 kV Cable:

The table below provides the proposed 11 kV HT cable requirement in the Licence Area:

Table 8: Proposed 11 kV HT Cable requirement

Proposed 11kV HT Cable			
Particulars		Units	
Number of 20 MVA DSS Proposed	a	Nos.	17
11kV cable per DSS	b	km	16
11 kV cable in Length for 20 MVA DSS	c=a*b	km	272
Number of 40 MVA DSS Proposed	d	Nos.	5
11kV cable per DSS	e	km	32
11 kV cable in Length for 20 MVA DSS	f=d*e	km	160
11 kV cable in Length	g=c+f	km	432
Range of 11 kV cables planned		km	396 to 484

4.3.4 CSS

As part of the original Network Rollout Plan submitted along with the licence application, Tata Power-D had considered installation of 24 CSS per DSS as part of the backbone infrastructure development. Thereafter, with the directions of Hon'ble Commission to increase the reach at LT level, Tata Power-D considered the respective CSS: DSS ratio of 1, considering the similar ratio of other utilities in Mumbai. However, after the judgment of the Hon'ble ATE in Appeal No. 229 and 246 of 2012, Tata Power-D has revised its proposed CSS capacity addition based on the contract demand booked by the prospective consumers and in order to optimise the loading of assets wherein a substantial investment has been done in compliance to the Hon'ble Commission Order in Case No. 151 of 2011.

Computation of CSS & its Capacity:

The details of the proposed CSS capacity in the Licence Area is based on the contract demand booked with Tata Power-D by new consumer is as given in the table below:

Table 9: Proposed CSS Capacity

Proposed CSS Capacity			
Particulars		Units	
CSS of 0.5 MVA proposed	a	Nos.	330
Capacity proposed of 0.5 MVA CSS	b=a*0.5	MVA	165
CSS of 1 MVA or more proposed	c	Nos.	283
Capacity proposed of 1 MVA or more for each CSS	d	MVA	574
Additional CSS Capacity proposed	e=b+d	MVA	739
Range of CSS Planned		MVA	666 to 813

4.3.5 LT Network

Tata Power in their Business Plan submission laid stress on the backbone network development i.e. HT network upto 11 kV and considered development of LT network based on the consumers who apply to Tata Power-D. Thereafter, as directed by the Hon'ble Commission, Tata Power-D proposed to develop the LT network so as to reach upto 50% of the load. However, after the judgment of the Hon'ble ATE in Appeal No. 229 and 246 of 2012, Tata Power-D has revised its proposed LT network addition to only new consumers and acquiring other consumers for optimising the loading of assets, wherein a substantial investment has been done in pursuance to the direction of the Hon'ble Commission in its Order in Case No. 151 of 2011. Accordingly, the LT network proposed to be added is 509 kms.

Table 10: Proposed LT Network

Proposed LT Network		
Particulars	Units	
Total LT Network proposed	km	509
Range of LT NW planned	km	459 to 561

Considering the above, the total network addition proposed by Tata Power-D in this Network Rollout Plan is as shown in the following table:

Table 11: Proposed Network Addition

Particulars	Units	Total
DSS Capacity Addition	MVA	540
CSS Capacity Addition	MVA	739
33 kV Cable Network	kms	220
11 kV Cable Network	kms	432
LT Cable Network	kms	509

5 PHASING OF NETWORK ROLLOUT PLAN

5.1 PHASING OF NETWORK ROLLOUT PLAN

5.1.1 In the previous chapter, Tata Power-D has arrived at the quantum of various network components required to enable Tata Power to develop the network in line with the various Regulations of the Hon'ble Commission and direction of the Hon'ble ATE. Network Development shall be done based on the demand from new consumers and optimising the loading of assets where substantial investments have been incurred by Tata Power-D in pursuance of the directions of the Hon'ble Commission. For developing this network various parameters have to be considered to decide the priority in which the network would be developed such the required capability and spread is reached in an optimum time period.

5.1.2 Based on the above criteria, Tata Power has adopted two step approach for proritisation of network development activities:

(a) Approach for HT network development (Backbone network)

(b) Approach for LT network development (LT network)

5.1.3 Approach for HT Network development

- Completion of the network for which significant investments have already been accomplished/ planned to feed the consumers already booked.
- Backbone network required to support expansion to support growth in demand.

5.1.4 Approach for LT Network development

- Network required to cater to growth in demand
- Last mile connectivity to load existing backbone network
- Higher priority would be given to areas where the slum population is on the higher side and existing LT network of Tata Power-D is also available to a considerable extent. This would enable reach of LT network to reach to low end consumers to a larger extent.

5.1.5 Such two step approach would help Tata Power develop HT network as well as LT network in high priority areas simultaneously. Further, the phasing of the network development activities has been prioritised yearly depending on the practicability of developing the network in a city of South Mumbai. Considering these aspects like time period available during the year for laying the network and permissions for excavating roads for laying network, the year-wise phasing of network laying activities have been done. The year-wise phasing of network development activities is described below.

5.1.6 Since it is a plan, which by definition is considered as estimated targets, Tata Power-D considers it very prudent to have a range to be targeted and monitor it on cumulative basis from year to year.

5.2 NETWORK ROLLOUT PLAN

5.2.1 The detailed Network Rollout Plan specifying the number of DSS/CSS additional HT/LT network (in ckt km) to be laid is as shown in the table below:

5.2.2 The phasing of Network Rollout Plan is tabulated below:

Table 12: Phasing of Network Rollout Plan

Particulars		FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20	FY 2020-21	Total
Distribution Substation (DSS) -40 MVA	Nos.	0	1	0	2	1	0	1	5
Distribution Substation (DSS) -20 MVA	Nos.	0	2	4	1	3	4	3	17
Consumer Substation (CSS) - 0.5 MVA	Nos.	2	85	77	93	22	22	25	330
Consumer Substation (CSS) - 1 MVA	Nos.	10	67	60	60	27	52	7	283
Additional CSS	Nos.	0	58	61	67	48	54	3	291
33 kV Cable Network	kms	0	30	40	20	50	40	40	220
11 kV Cable Network	kms	0	64	64	32	96	64	112	432
LT Cable Network	kms	102	124	87	60	41	61	34	509

Capital Expenditure

5.2.3 To arrive at the capital expenditure required to execute the network rollout plan, Tata Power-D has considered the cost for each of the network component as submitted in the Business Plan for license application. Considering the network components cost and the phasing of physical network given above, the phasing of capital expenditure is given in the table below

Table 13: Phasing of Capex

CAPEX of Network Rollout Plan Mumbai (Rs. Crs)								
Particulars	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20	FY 2020-21	Total
No. of Substations / Cables								
Distribution Substation (DSS) -40 MVA	0	25	0	51	25	0	25	127
Distribution Substation (DSS) -20 MVA	0	25	51	13	38	51	38	216
Consumer Substation (CSS) - 0.5 MVA	1	35	30	37	9	9	10	130
Consumer Substation (CSS) - 1 MVA or more	6	40	35	35	16	31	4	167
Additonal CSS	0	7	7	8	6	6	0	35
33 kV Cable Network	0	22	30	15	37	30	30	163
11 kV Cable Network	0	53	53	26	79	53	92	356
LT Cable Network	37	45	32	22	15	22	12	186
Total CAPEX	44	253	238	207	225	201	212	1380

The overall capital expenditure over a period of 7 years would work out in the range of Rs. 1380 crore.

5.2.4 Based on the changes in the market rate of equipment which are governed by demand-supply dynamics, Tata Power submits that, as is the current practice, it would submit Detailed Project Reports (DPRs) for "in principle" clearance of the Hon'ble Commission prior to executing the approved network rollout plan and the capex inclusive of actual inflation parameters would be included as the part of each DPR.

6 RISK MATRIX AND MITIGATION PLAN

6.1 RISK MATRIX AND MITIGATION PLAN

6.1.1 Tata Power-D submits that certain risks prevail in the network rollout plan which needs to be addressed. Tata Power-D will include certain guiding principles so that the risk tolerance level, occurrence, progress and status of all risks will be studied properly and appropriate action can be taken to solve the problem. The risk assessed in the following table have been categorised in low, medium and high categories the risk mitigation identified is as follow:

Table 14: Level of Risk and Risk Mitigation

Sr. No.	Type of Risk	Level of risk	Explanation and Proposed Risk Mitigation Mechanism identified
1	Delay in excavation permissions	High	Due to extreme monsoon in Mumbai, the Municipal authorities grant road excavation permissions only during dry season i.e. from October to April. Further, during last two year Tata Power-D has faced delays in getting permissions due to various administrative issues within the Municipal Authorities. This has laid to inordinate delay in permissions and thereby reducing the effective period of network laying to about 90-100 days. Tata Power would to take all necessary actions in advance to get permissions on expeditiously.
2	Infrastructure of Other Utilities (Gas, Telecom, Water)	Medium	At many places where other layout of road, gas line, telecom line, water pipes are also been laid out and which comes under other government bodies jurisdiction such as MCGM, BSNL etc. and these cannot be accessed properly without their proper data and maps. Tata Power-D has been taking various steps during erection and commissioning of network so that the public may not be affected. In addition, Tata Power is advocating for getting separate utility corridors in collaboration with other utilities.
3	Road Traffic (during day time work)	Low	While working on road side during day time, some hindrances are present which result in a traffic jam on the road. Tata Power-D is working with proper safety measures to enhance the safety of the road users and try to complete its network strengthening plan in proper manner.

Sr. No	Type of Risk	Level of risk	Explanation and Proposed Risk Mitigation Mechanism identified
4	Safety Aspects	High	Working in electrical field, safety is of major concern. Tata Power-D is taking all steps to ensure safety of its electrical network and following all required guidelines for safety such as maintaining proper clearances, earthing of transformers etc.

6.2 SUPPORT FROM HON'BLE COMMISSION & PERIODIC REVIEW

6.2.1 Tata Power-D submits that while the network rollout plan has been prepared incorporating the direction of the Hon'ble ATE, there are certain external factors where support/ guidance of Hon'ble Commission would be required on periodic basis to implement the plan in full earnest and spirit.

- ✓ **Approval of Authorities:** In case appropriate approvals are not obtained from different authorities for laying of LT cable and setting up substations in particular area, even after repeated attempts by Tata Power-D to get those approvals, the phasing of network rollout plan will be diverted to areas where such approvals have been obtained. Tata Power-D would approach Hon'ble Commission on periodic basis as and when there is need felt for guidance / interference in the matter. Tata Power-D to this extent also seeks flexibility to change its plan internally between areas to achieve the objective and meet the physical target.

Tata Power-D would like to submit Hon'ble Commission, the summary of the approvals sought and the time taken by the authorities for such approval for reference purpose.

Table 15: Correspondence Status with Authorities

Agency	No. of applications		No. of permission		No. of	
	(Nos)	(Km)	(Nos)	(Km)	(Nos)	% of total
MCGM	2181	258	336	40	1845	85%
MBMC	60	24	52	22	8	13%
MMRDA	14	7	5	1	9	64%
PWD	27	12	1	3	26	96%
Private	56	16	7	4	49	88%
Grand total	2338	317	401	70	1937	83%

As can be seen, only 17% of permissions are received from authorities.

- ✓ **Consumer Choice:** Tata Power-D would like to submit that through this network rollout plan it will make all efforts to ensure that the network is developed to exclusively meet consumer requirements. Ultimately it would be the consumer who would exercise his choice, which is beyond the control of Tata Power.

7 TECHNOLOGICAL INTERVENTIONS ADOPTED BY TATA POWER

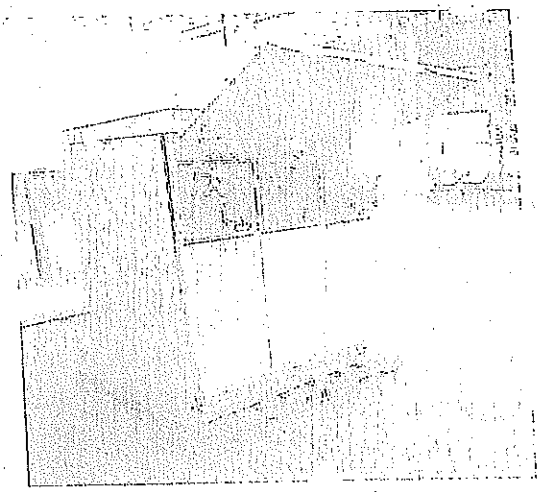
7.1 TECHNOLOGY INTERVENTIONS

Tata Power-D has undertaken following initiatives and technology infusion to assist in network augmentation and expansion:

7.1.1 33 kV & 11 kV Ring Main Unit (RMU)

Conventional Air Insulated (AI) switchgear used for isolation is huge in size and does not fit in the optimum solution to be offered in a limited foot print space. Therefore, Tata Power-D has introduced 33 kV and 11 kV RMUs both Isolator type and breaker type into its distribution system and use them to form the ring network. Generally, a 3 way RMU has 3nos of switches (Circuit Breakers or Isolators or LBS). Of these two are used as incomers with mechanical or electrical interlock and one as outgoing to the load.

Figure 11: Ring Main Unit



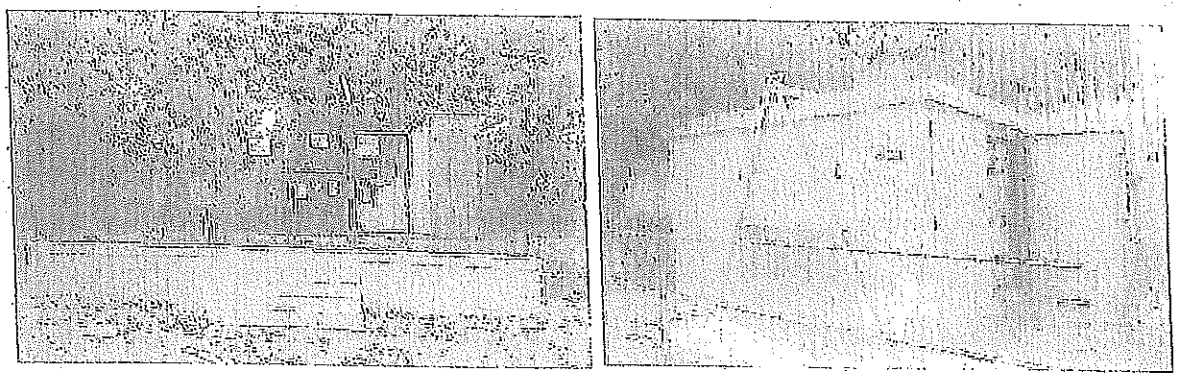
7.1.2 Packaged Substation

For addressing space constraint challenges in Mumbai, packaged substation is more useful. Typical CSS requires area of 8 X 5 Mtrs. However, unitized substation is one such equipment in which all the Units i.e., HT breaker, Transformer and LT breaker come in a single container with partitions in between and type tested. These Packaged Substations occupy a foot print of only 3.5 X 2.5 Mtrs resulting in saving of almost 75 % of foot print area and also serving the purpose of both the utility and the consumer.

Further, Packaged Substation is a readymade solution for commissioning a short period of time as against the conventional Sub-station which takes about 2 months including civil construction.

It may also be noted that in case of any emergency, these Packaged Substation can be easily lifted up and can be replaced with a new one. While Packaged Substation offer all the convenience, they are also cheaper than the conventional indoor Sub-Stations due to lesser civil cost and installation cost.

Figure 12: Packaged sub-station



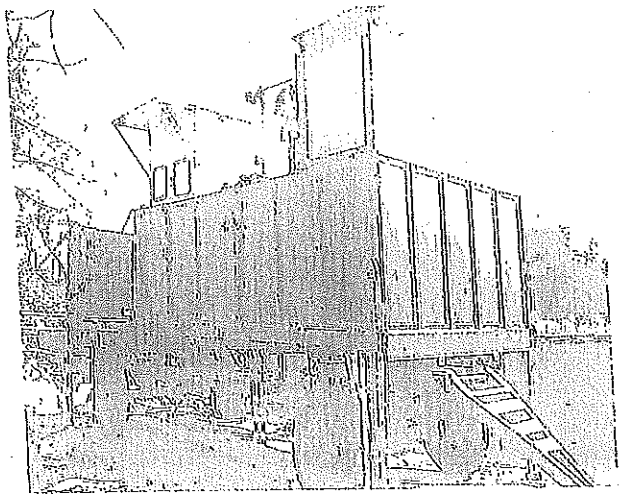
Conventional Sub-station

Packaged Sub-station

7.1.3 Mobile Substation-

Mobile substation has been introduced in the system so that the period required for establishing a conventional CSS can be drastically reduced. In case of a transformer failure in an existing CSS, the mobile substation can be used as a standby arrangement within a short time thereby ensuring faster restoration of supply. It comprises of the 11 kV RMU, 11 /0.4 kV transformer and Low Tension Feeder Pillar / Switch Fuse Unit mounted on a mobile trolley ready to be charged by connecting the HT and LT cables only.

Figure 13: Mobile Substation



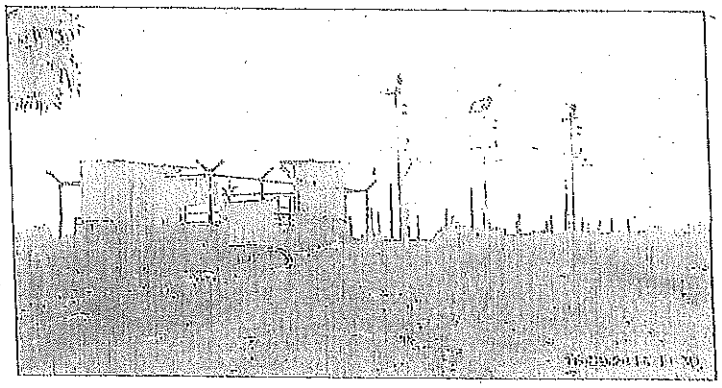
7.1.4 Ester filled Transformers

Tata Power-D has introduced natural esters as an insulating medium in distribution transformers. Natural Esters are fire safe and environmentally benign fluids which make the transformers virtually fire safe. By virtue of its high fire and flash point, this transformer can be loaded above 100% continuously as compared to the conventional mineral oil filled transformers. It also reduces the footprint of the transformer. Tata Power-D has installed two such stations with ester filled transformers.

7.1.5 HVDS (High voltage distribution scheme)

HVDS has been introduced in the Mumbai distribution to overcome the CSS space requirement and further the need for laying underground cables in narrow bylanes and in congested areas. This system typically comprises of single phase HV transformers of the order of 25 kVA and the LT line being extended from the secondary of the transformer to the nearest consumer. This also has an added advantage of reducing the losses by way of almost LT less distribution.

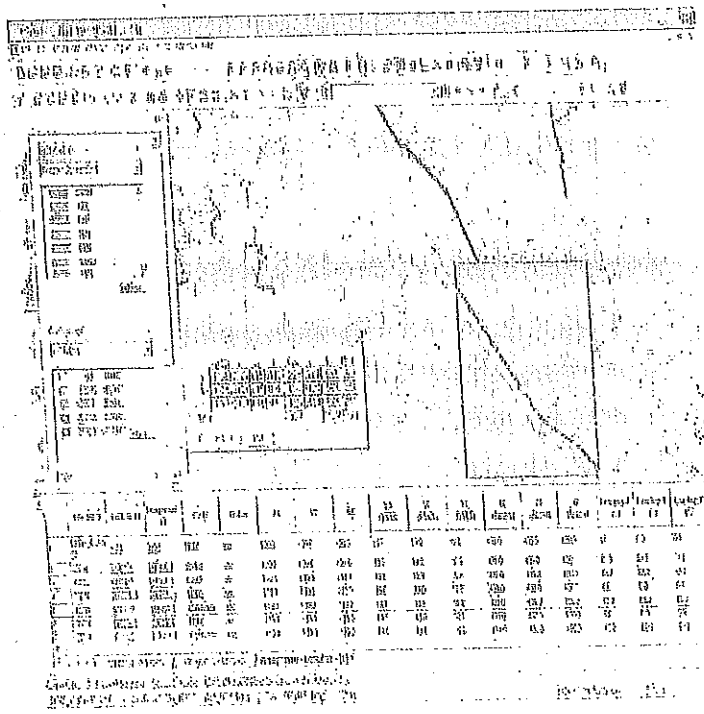
Figure 14: HVDS work in Ambojwadi Slum



7.1.6 Network planning Software tool –Cymedist with GIS application manager

CYMEDIST is an analysis package for distribution electric network planning and studies such as Load Flow, Short Circuit, Load Allocation, Load Growth, Fault calculations etc. Load Flow Studies are being done using this tool on the updated network mapped in GIS which helps in determining the requirement to strengthen the network in present and future..

Figure 15: Cymedist Software



Design of new distribution project schemes is being done through Geographical Information System (GIS) Application called Design Manager. Its major benefit being that scheme design, conceptualization, geographical location, electrical network and estimate of the scheme are a single system generated document. Use of this application results in designing the project as well as provides a graphical and technical analysis of the manner in which the network expansion would merge with the present network.

7.1.7 SCADA (Supervisory Control And Data Acquisition)

SCADA deployment covers network elements up to 33 / 11 kV substations including Outgoing 11 KV feeders. It enables remote monitoring and control of various network elements, obviating the need for manned substations. SCADA is also an effective tool, for condition monitoring of equipment. Network disturbances are immediately identified and remote operations facilitate quick restoration of supply. Remote operation on load tap changers and switching operations on capacitor banks at night time leads to better voltage profile at 11 kV level.

7.1.8 Horizontal Directional Drilling (HDD)

In order to lay cables across busy highways, where road excavation is not possible HDD technology has been effectively utilized for laying cables without disrupting the road traffic.

7.1.9 Automatic Meter Reading (AMR) / Automatic Meter Interface (AMI)

AMR helps in acquiring meter data from consumer meters automatically from a remote location, thus avoiding any human intervention. This ensures use of accurate meter data for billing purposes and generates exceptions and MIS reports for proper planning, monitoring, decision support and taking corrective actions.

This system also helps in carrying out Energy Audits, analyze energy consumption and load profile of various consumers and detect the metering abnormalities.

7.1.10 Use of all weather meter panels

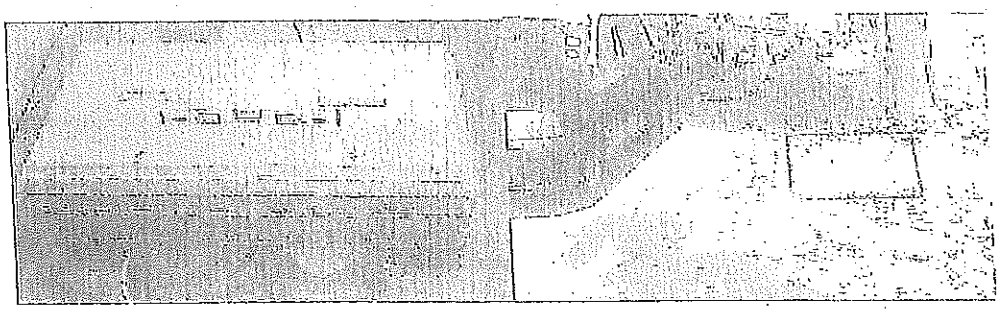
In some of the area where Room space for meter installation in the building not available, these weather proof meter panels has installed in the building premises. It also helps in easy identification of the consumer meter to the O & M staff as there are two licensees working in the same area.

Figure 16: Meter Panel

7.1.11 Installation of underground feeder pillars (link Box)

The installation of underground feeder pillar (link Box) with LT distribution network with a compact and fully insulated service pillar will help to enhance the safety of the consumer and also helps to reduce the electricity theft by which the electrical losses will come down. In some area where space is a constraint, this technique is very useful for LT network development and to achieve the last mile connectivity in smooth manner.

Figure 17: underground feeder pillar

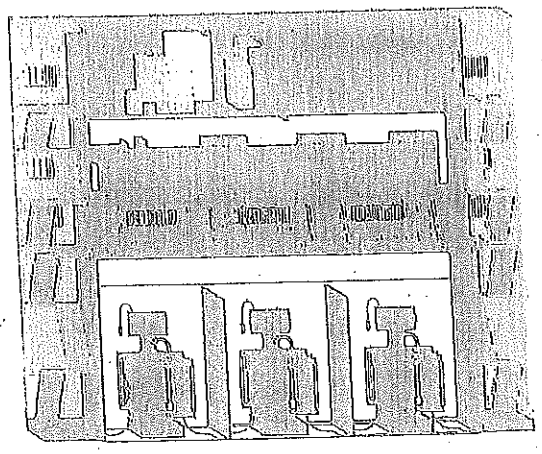


7.1.12 3-tier DSS & E-house

In a conventional DSS design, most of the area is occupied by transformers and switchgear room. A 3-tier DSS design requires area only for Power Transformer and all the switchgear as well as all the auxiliary equipment is placed on various tiers above as follows:

- Grounds Floor - Power Transformer;
- Upper floor - cable cellar;
- First floor – Switchgear room;
- Second floor – Auxiliary room;

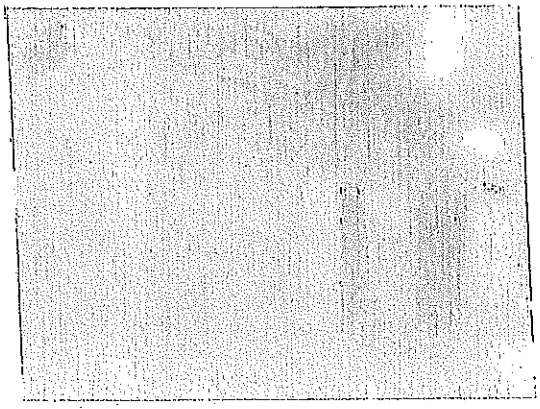
Figure 18: 3-Tier DSS



This 3-Tier DSS design has evolved to reduce the footprint area by almost 50%.

Similarly, Electrical house (E-house) substation is being implemented by Tata power which almost reduces the space requirement by 20 % and gestation period is also considerably reduced. Basically, (E-House) is a prefabricated walk-in modular outdoor enclosure to house a medium voltage (MV) and low voltage (LV) switchgear as well as auxiliary equipment. It can be skid or wheel mounted and is ready to operate in the field with minimum installation, commissioning and start up time - as an alternative to traditional on-site building construction (concrete block, brick construction or similar).

Figure 19: E-house



7.1.13 Distribution Management System (DMS)

Tata power is in the advanced stage of implementation of DMS in its area of distribution. DMS is used for the monitoring and control functionality of SCADA to CSS, Remote Terminal Units and Fault passage indicators (FPI's) which are installed at DSS. They can be communicated with SCADA control center either is through packet based mobile network (CDMA / GPRS) or Optical fiber cable connection. Implementation of DMS along with Fault passage indicator reduces the time taken to restore the outages due to 11 kV faults since the fault section can be identified and isolated through the system immediately.

7.1.14 Outage Management System (OMS)

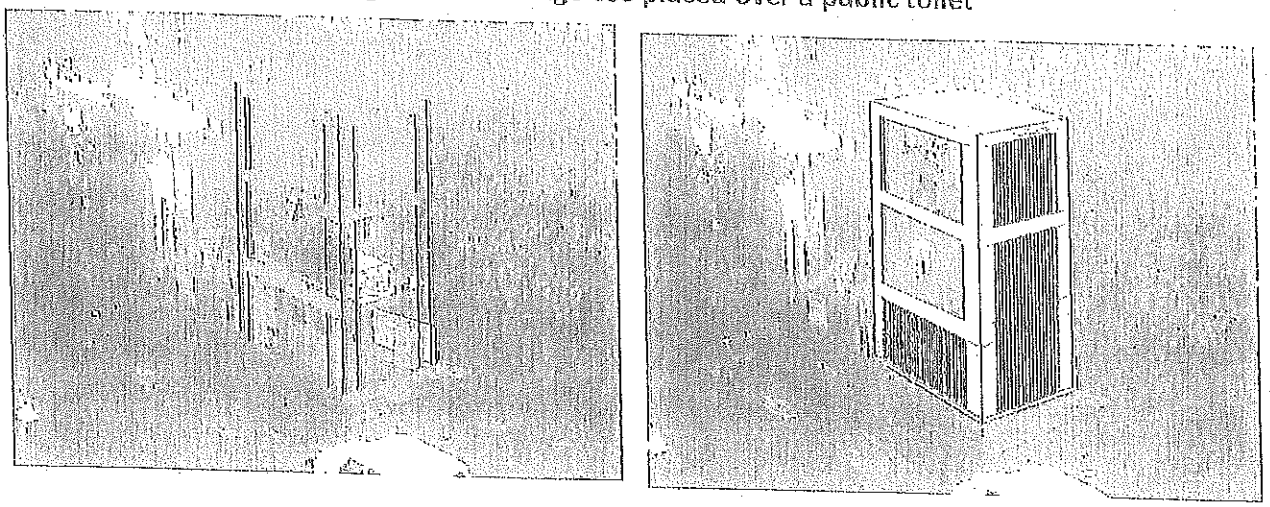
An Outage Management System helps in quicker identification and restoration in case of any failure of power supply to a particular area. As Tata power has modeled its entire distribution network on Geographic Information System (GIS) and identification of exact location of fault and merging the data of outage calls received from consumers, this system predicts the locations of consumers affected by outages. Some of the Advantages of OMS are:

- Prediction of location of breaker that opened upon failure.
- Prioritizing restoration efforts and managing resources based upon criteria such as locations of emergency facilities, size of outages, and duration of outages
- Providing information on extent of outages and number of consumers impacted to management, media and regulators
- Calculation & management of estimation of restoration times and Crew required for restoration.

7.1.15 Multi civic Amenities Substation

By using public amenities such as Public Toilet, Tata Power is intending to use the space above it for the installation of package CSS in congested areas. In this technique, erection of platform would be done above the public toilet on 4 nos of columns around its periphery without disturbing the existing toilet structure and setting up the package Consume substation above it. Tata Power-D is making all efforts to get necessary clearance from relevant authorities and Tata Power-D would implement once the same are in place.

Figure 20: Package CSS placed over a public toilet



8 CONSUMER REACH

8.1 NEEDS FOR SEEKING APPLICATION

8.1.1 Tata Power-D wishes to serve all categories of consumers who wishes to take supply on it wires and provide them a choice of network. However, based on the experience of Tata Power-D in last 4-5 years, it has been observed that residential consumers have exhibited certain inertia to opt migrating to another network. This inertia is due to several reasons like inadequate awareness, difficulties in making available space for meters and other associated equipments, payment of service connection charges, etc. While the issues of space availability are proposed to be addressed by technology interventions presented in subsequent chapter, this chapter deals with the specific efforts that Tata Power-D plans to undertake to spread awareness and enroll consumers on its network.

8.2 CONSUMER AWARENESS APPROACH:

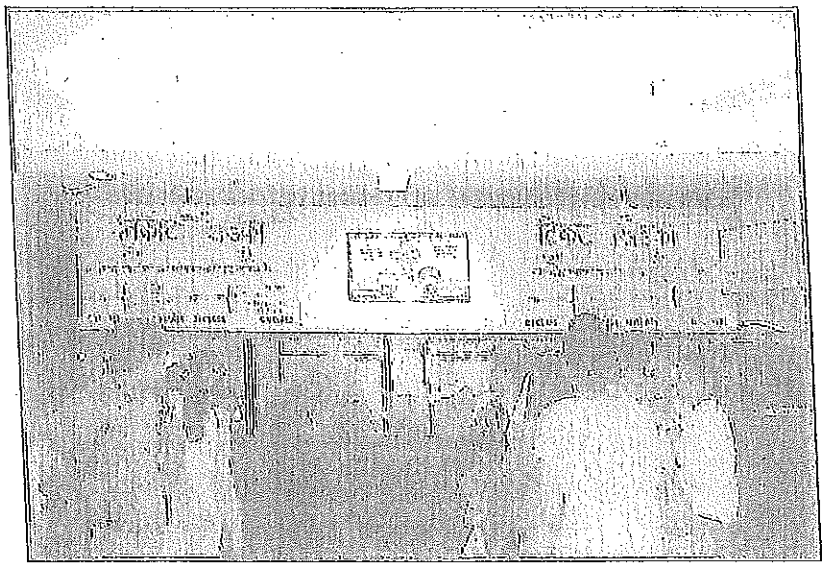
8.2.1 Mass Awareness:

For providing awareness to consumers in mass, Tata Power is already using various tools and would continue to do as under:

a) **Advertisement in News Papers:** Tata Power giving advertisement in Hindi and Marathi language in local newspapers for mass awareness of public at large.

b) **Digital Signage at Strategic Railway Stations:** Tata Power digital signage displaying ward specific Consumer Relation Centre (CRC) options right near the respective Railway Station's Ticket window, as appropriate.

Figure 21: Digital Signage – Railway Station

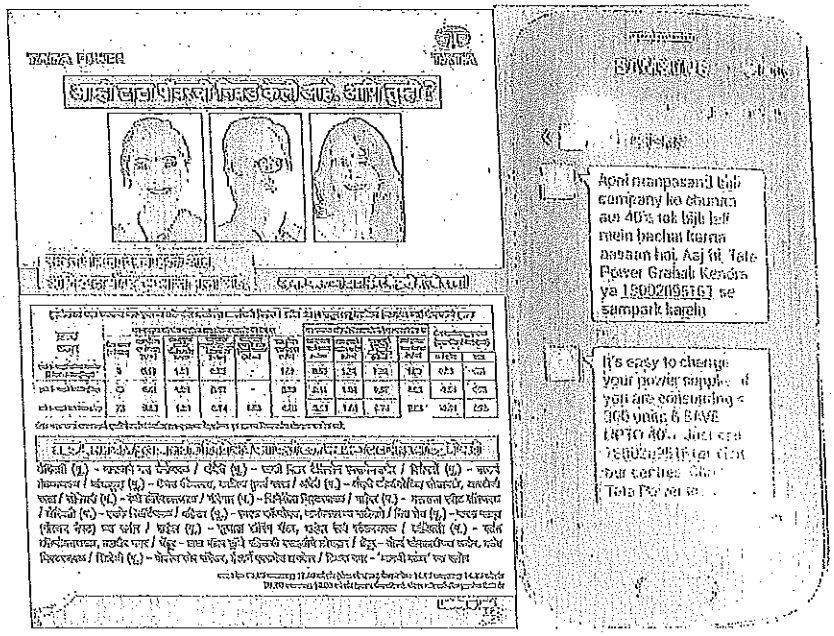


8.2.2 Area Specific Approach:

For the areas where acquisition is planned in the weeks' time, Tata Power would also utilize consumer specific tools given below for awareness in the area:

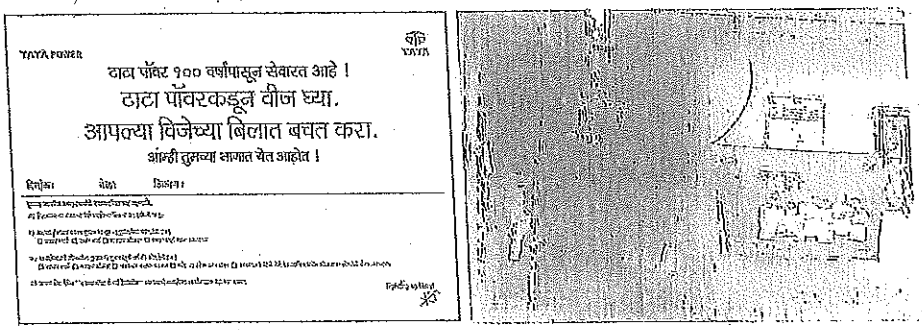
1) **News Paper Insertions:** Tata Power would distribute pamphlets through newspaper inserts in the area where low end customers are to be acquired and when considered appropriate. This activity is carried out one week in advance of the acquisition exercise.

Figure 22: Distribution of Pamphlets through Newspaper



2) **Door to Door Pamphlet Distribution**: As a unique proposition, Tata Power through its Distribution Customer Acquisition team reaches out at the door steps of the consumer through on-site special Week-end Camps or door-to-door campaign. This is a benchmark of consumer acquisition in distribution sector of India.

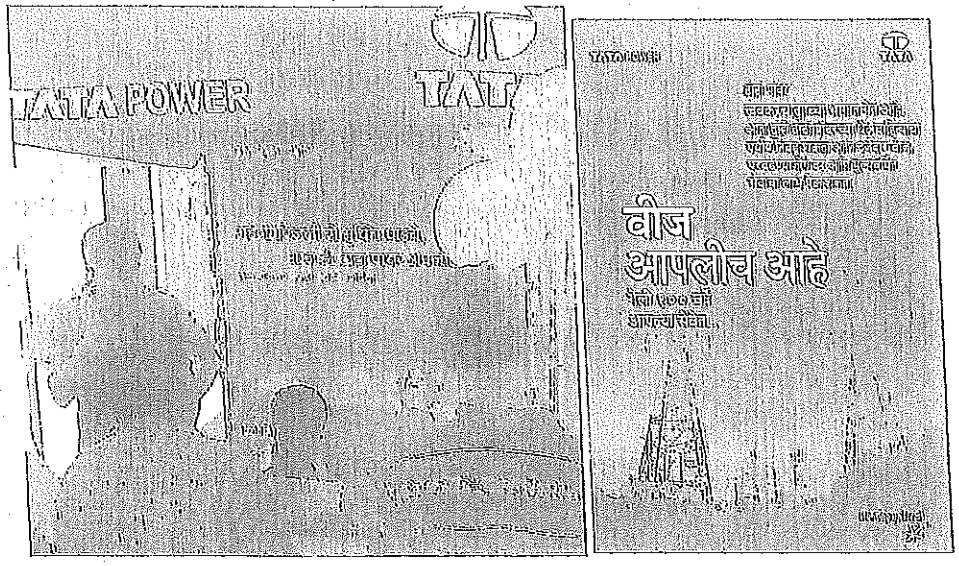
Figure 23: Distribution of Pamphlets



3) **Display of Banners/ Posters within premises**: In the low end area where mass acquisition is planned, Tata Power marketing team would display posters / banners with the details of camps timing and location for public benefit and awareness.

4) **Instabooth (Foldable and Portable)**: Tata Power is utilizing Instabooths during camps, they are easy to assemble on-site and also easy to move from one location to another location. Instabooths are branded with Tata Logo also having small advertisement on the backside for consumer awareness.

Figure 24: Instabooths for Consumer Awareness



Tata Power special week end Guidance cum Application collection camps are organized for addressing the mass public and also utilized for the mass awareness cum application collections. All the above approaches for area specific will be utilized for these camps.

Apart from the above tools, Tata Power in the given regulatory frame work, will make itself available through various touch points thereby ensuring that Tata Power is available to these Potential & facilitate customer to take decision in availing Tata supply. e.g. 28 Nos. of CRCs/ BPC/ Call centres/ Web Site, etc.