adani™

Ref: APML/MERC/15072014
Date: July 15, 2014

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

Subject: Submission of Petition for Amendment of Transmission License No. 2 of 2009

Dear Sir

Please find enclosed herewith the Petition (1 Original + 5 Copies) for amendment of Transmission License No. 2 of 2009 issued to Adani Power Maharashtra Limited (APML) on July 6, 2009 (amended on March 30, 2011) by the Hon'ble Commission.

Further, it is submitted that the filing fees for the application for amendment of License of Rs. 1,00,000 (Rupees One Lakh Only) has been remitted through RTGS in the Hon'ble Commission's account. Copy of the transaction towards application fees is enclosed herewith.

Kindly accept the application and acknowledge the same.

Thanking you,

Yours faithfully,
For Adani Power Maharashtra Limited

Jignesh Langalia
Authorized Signatory

Encl:
1. Affidavit
2. Proof of payment of application fees through RTGS

Adani Power Maharashtra Ltd
Achalraj
Opp Mayor Bungalow, Law Garden
Ahmedabad 380 006
Gujarat, India

Tel +91 79 2555 7555
Fax +91 79 2555 7177
info@adani.com
www.adani.com

BEFORE
THE MAHARASHTRA ELECTRICITY REGULATORY COMMISSION
MUMBAI

Filing No: S. No. 4578 of 2014
Case No:

VIJAY C. SHAH
NOTARY
GOVT. OF INDIA

IN THE MATTER OF

15 JUL 2014

Application for amendment of "Transmission License for Adani Power Maharashtra Limited (License No. 2 of 2009)" granted u/s 14 of the Electricity Act, 2003 and Maharashtra Electricity Regulatory Commission (Transmission License Conditions) Regulations, 2004

AND

IN THE MATTER OF

Adani Power Maharashtra Limited
"Adani House"
Near Mithakhali Six Roads, Navrangpura
Ahmedabad – 380 009 THE APPLICANT

I, Jignesh Langalia, Son of Shri Dhansukhlal Langalia aged 38 years, being the authorized signatory of the Adani Power Maharashtra Limited having office at Shikhar, Nr. Mithakhali Six Roads, Navrangpura Ahmedabad – 380009, do hereby solemnly affirm and state as under:

1) I am an Authorized Signatory of Adani Power Maharashtra Limited, the applicant in the above matter, and I am duly authorized and competent to make this Affidavit.

2) The statements made in the Petition are true to my knowledge and belief and statements made in paragraphs therein are based on information and I believe them to be true.

3) I say that there are no proceedings pending in any court of law/tribunal or arbitrator or any other authority, wherein the Petitioners are a party and where issues arising and/or relief sought are identical or similar to the issues arising in the matter pending before the Commission.

NOTARY
VIJAY C. SHAH
AHMEDABAD
GUJARAT STATE
REGD. 2260/02
GOVT. OF INDIA

(DEPONENT)

VERIFICATION

Solemnly affirm at Ahmedabad on 15th day of July, 2014 that the content of the above affidavit are true to my knowledge, no part of it is false and nothing material has been concealed thereof.

(DEPONENT)

NOTARIAL NOTARIAL NOTARIAL NOTARIAL

NOTARY
VIJAY C. SHAH
AHMEDABAD
GUJARAT STATE
REGD. NO. 2260
GOVT. OF INDIA

SOLEMNLY AFFIRMED
BEFORE ME

VIJAY C. SHAH
NOTARY
GOVT. OF INDIA
15 JUL 2014

BEFORE
THE MAHARASHTRA ELECTRICITY REGULATORY COMMISSION
MUMBAI

Filing No:
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IN THE MATTER OF

Application for amendment of "Transmission License of Adani Power Maharashtra Limited (License No. 2 of 2009)" granted u/s 14 of the Electricity Act, 2003 and Maharashtra Electricity Regulatory Commission (Transmission License Conditions) Regulations, 2004

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BEFORE
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Application for amendment of "Transmission License for Adani Power Maharashtra Limited (License No. 2 of 2009)" granted u/s 14 of the Electricity Act, 2003 and Maharashtra Electricity Regulatory Commission (Transmission License Conditions) Regulations, 2004

AND

IN THE MATTER OF

Adani Power Maharashtra Limited
"Adani House"
Near Mithakhali Six Roads, Navrangpura
Ahmedabad – 380 009 THE APPLICANT

The Petitioner most respectfully submits as under:

1. Adani Power Maharashtra Limited (APML), a subsidiary of Adani Power Limited was granted the Transmission License No. 2 of 2009 vide the Hon'ble Commission's Order dated July 06, 2009. A copy of the License No. 2 of 2009 dated July 06, 2009 is attached herewith and marked as Annexure 1.

2. Subsequently, in view of the proposed development of 765 kV transmission system, APML-T's Transmission License was amended on March 30, 2011 to establish and operate the following Transmission lines inclusive of related infrastructure:

    a. 400 kV D/C Transmission Line with quad conductor from Tiroda (Gondia) to 400 kV Warora Switching Station;

    b. 2 Nos., 400 kV bays for the above two D/C Transmission lines at Tiroda Project switchyard;

c. 2 Nos. 400 kV bays for Tiroda-Warora D/C Transmission lines at Warora switching station;

A copy of the said Transmission License amendment and the relevant Order dated March 30, 2011 is attached herewith and marked as Annexure 2.

3. Due to high voltage prevailing in Wardha and Warora areas coupled with the line capacitance at the time of commissioning of the Tiroda-Warora Transmission system, it became imperative to compensate the impact of the same by way of installation of Bus Reactors at Tiroda end.

4. WRLDC conducted an analysis on the system before charging of the said 400 kV Tiroda-Warora Transmission Line. It was observed in the analysis that charging of the line through Warora Substation will raise the open-end voltage to 430 kV. Further, in a study conducted, it was revealed that with 2 x 80 MVAR Bus Reactors, the voltage at Warora and Tiroda end would be at 410 kV and 401 kV respectively. A copy of letter dated August 18, 2012 along with the study carried out by WRLDC and instructions of MSLDC is attached herewith and marked as Annexure 3.

5. Accordingly, APML-T commissioned the above mentioned Transmission system as per License along with two Bus Reactors at the Tiroda end on August 26, 2012. Although the Bus Reactors were essential for charging and operation of the Transmission system under License, the same was not being reflected in the Transmission License No. 2 of 2009 of APML-T.

6. Requirement of such Bus Reactors as intra-State Transmission system to reduce the high voltage problems during off peak conditions during line charging and light load conditions have also been confirmed and agreed by MSETCL/STU vide its letter dated November 19, 2012 to MSEDCL with a copy to APML. The same is attached herewith and marked as Annexure 4.

7. It is also important to note that during the proceedings of Case No. 51 of 2013, the Hon'ble Commission constituted a committee to look at the broader aspects of provision of shunt compensation for Transmission and Distribution system. The Report prepared by the Committee headed by Mr. S. A. Soman, IIT, Mumbai covers the requirement of shunt compensation in Extra High Voltage (EHV) AC Transmission. The said requirement was emphasized with particular reference to the 400 kV D/C Tiroda - Warora Transmission line. The Report clearly establishes that the Shunt Reactors were essential to enable operationalization of APML's Transmission system. The relevant observations made at para 6.3 of the Report are extracted herein below:

"

- ***On the other hand, in an EHV transmission system, voltage rise is observed at receiving end for light load conditions (below SIL) due to dominance of shunt capacitive VARs.***
- ***The capacitive VARs generated by EHV transmission lines, may require compensation by inductive VARs, to maintain proper regulation and improve voltage profile of the system.***
- ***Shunt reactors are also required during charging of EHV transmission lines to control the transient over voltages that are likely to occur when such lines are energised.***
- *In case of the Tiroda-Warora line, it should be noted that there is no load on the Warora 400 kV bus and radial connection continues upto Wardha. Hence, the line is in effect the Tiroda- Wardha line with a line length of 296.65 km. If this line length is considered, the voltage rise, as per Fig 6, at receiving end is approximately 5.5 % (this is under the assumption that the Wardha - Warora line has identical parameters as Tiroda - Wardha Line).*

- *The 400 kV bus voltages around Wardha are consistently higher than 400 kV due to the presence of large generation capacity and low loading levels. Further 765 kV substation is located at Wardha and 1200 kV is likely to come up in the near future."*

8. A copy of said report is attached herewith and marked as Annexure 5.

9. It is to be noted that the Bus Reactors have been operated as per the instructions of MSLDC only.

10. Further, it is important to note the Hon'ble Commission's ruling in the Order in Case No. 51 of 2013 regarding Bus Reactors. The relevant portion of the Order is extracted herein below:

    "Summary of the Commission's Ruling:

    31. The bus reactors which are part of intra-state transmission system *and being operated as per instructions from SLDC for controlling the system voltages are assisting the STU / SLDC to maintain the grid voltage. Therefore …"*

11. Thereafter, APML-T in its Mid-term Performance Review Petition, proposed inclusion of the said Bus Reactors as a part of APML's Transmission system. APML-T also provided the Statutory Auditor's Certificate to ascertain the cost of such Bus Reactors in the said Petition itself. The same is also attached herewith and marked as Annexure 6.

12. Subsequently, the Hon'ble Commission in its Order on the Mid-term Performance Review dated July 03, 2014 has agreed that the Commissioning of two Bus Reactors at Tiroda was necessary for smooth functioning of the Transmission system as the same has been highlighted in various Technical Reports, correspondences from WRLDC/SLDC and as stipulated in the Commission's Order in Case No. 51 of 2013. The Hon'ble commission further observed that although it understands the technical necessity of Bus Reactors it cannot approve

its cost in the present proceeding without undertaking appropriate regulatory process for amendment of Transmission License (for inclusion of such Bus Reactors in the Licensed Transmission Assets). The relevant portion of the Hon'ble Commission's Order is extracted herein below for ready reference:

> *".....The Commission has scrutinised the submissions and **observed that commissioning of the two bus reactors at Tiroda was necessary for smooth functioning of the transmission line** which has been highlighted in various technical reports, letter correspondence from WRLDC/SLDC, and as stipulated within the Commission's Order in Case No. 51 of 2013. **The Commission agrees that without bus reactors 400 kV Tiroda-Warora line could not be charged.** The only issue which came before the Commission was the fact that, the two bus reactors were not included as a part of in principally approved scope of work. Hence, the corresponding capex worth Rs 23.24 Crore was not approved earlier. The Commission had highlighted this fact during the TVS, that the two concerned bus reactors at Tiroda are not covered as part of the present Transmission Licence. Though, the Commission understands the technical requirement of the two 400 kV Bus Reactors, however, the same cannot be considered under the cost of additional capitalization, under present process without undertaking regulatory process of amendment of the Transmission Licence. Unless bus reactors and associated bays are included as part of the asset of the Transmission Licensee (APML-T), it would not be appropriate for the Commission to allow the capitalisation of the costs and other associated costs thereof as part of present Mid-Term Review process. However, these costs including cost of additional capitalisation towards bus reactors and associated bays can be considered at the time of final true up at the end of the control period, upon due regulatory scrutiny and prudence check*

only after amendment to the Transmission Licence to incorporate such assets as a part of the Transmission Licence……"

13. The Hon'ble Commission therefore directed APML to initiate the process to amend its Transmission License to reflect the addition of two bays for Bus Reactors at Tiroda Substation as a part of Transmission License Asset. Relevant portion of the said Order is extracted herein below for ready reference:

"…..The additional 2 (two) bays highlighted by APML-T, which belongs to the bays for bus reactors are not considered at this moment, as presently these do not form part of the APML-T Transmission Licence No. 2 of 2009, issued by the Commission. The Commission would consider the same, at the time of final truing of the MYT period, in accordance with the Transmission Licence and amendment thereof, if any being issued to APML-T. ***APML-T would be required to initiate process to amend its Transmission Licence to reflect the addition of these two bays for bus reactors at Tiroda SS as part transmission asset."***

…..

14. In view of the above direction by the Hon'ble Commission, APML is filing the present Petition for amendment of the Transmission License No. 2 of 2009 for inclusion of 2 bays for Bus Reactors at Tiroda Substation as a part of Licensed Transmission Assets.

15. Accordingly, we request the Hon'ble Commission to suitably amend the Transmission License of APML as per following:

Existing Area of Transmission	**Amended Area of Transmission Proposed**

Existing Area of Transmission	Amended Area of Transmission Proposed
a. 400 KV Double Circuit Transmission Line with quad conductor from Tiroda (Gondia) to 400 KV Warora Switching Station b. 2 Nos., 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Tiroda Project Switchyard c. 2 Nos. 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Warora switching station	a. 400 KV Double Circuit Transmission Line with quad conductor from Tiroda (Gondia) to 400 KV Warora Switching Station b. 2 Nos., 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Tiroda Project Switchyard c. 2 Nos. 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Warora switching station d. **2 x 80 MVAR Bus Reactors along with associated bays at Tiroda Substation**

Regulatory Provisions:

16. Proviso 1 of Section 18 of the Electricity Act, 2003 stipulates that the Commission may amend the terms and conditions of a license if it is in public interest. The same is reproduced below for ready reference:

"18 (1) Where in its opinion the public interest so permits, the Appropriate Commission, may, on the application of the licensee or otherwise, make such alterations and amendments in the terms and conditions of a license as it thinks fit"

17. Proviso 2 (a) of Section 18 of the Electricity Act, 2003 stipulates that the Licensee shall publish a Notice of such application with particulars as may be specified. The same is reproduced below for ready reference:

"18 (2) Before any alterations or amendments in the license are made under this section, the following provisions shall have effect namely:-

(a) where the licensee has made an application under sub-section (1) proposing any alteration or modifications in his license,

the licensee shall publish a notice of such application with such particulars and in such manner as may be specified;"

18. Further, Section 7 of the MERC (Transmission License Conditions) Regulations, 2004 stipulates as under:

"7.1 A notice pursuant to clause (a) sub-section (2) of Section 18 of the Act shall be published in not less than two (2) daily English language newspapers and two (2) daily Marathi language newspapers in the area of transmission.

7.2 …. Provided that the Commission may, within a period of four (4) days from the receipt of application, require such additional particulars to be contained in the notice, as it may deem appropriate having regard to the specific circumstances of the case."

19. APML-T confirms that such amendment in the Transmission License is not in violation of any provision of Section 18 of the Electricity Act, 2003.

20. The Draft Notice for such application is enclosed herewith as Annexure 7 for perusal of the Hon'ble Commission. Upon approval from the Hon'ble Commission, the same shall be published pursuant to Regulation 7 of the MERC (Transmission License Conditions) Regulations, 2004.

21. It is to be noted that APML has paid the Transmission License Fees for FY 2014-15 for the said License on April 01, 2014 vide letter Ref: APML/MERC/31032014 dated March 31, 2014 and has complied with all the conditions specified in the License.

22. Fees as per Schedule 1 (Sr. No. 5) of the Maharashtra Electricity Regulatory Commission (Fees and Charges) Regulations, 2004 in accordance with Application for amendment of License under Section 18 of the Act has been remitted through RTGS to the Hon'ble Commission's Account.

Prayers

23. In view of the above, the Petitioner respectfully prays that the Hon'ble Commission may be pleased to:

a. Approve the notice for amendment of "Transmission License for Adani Power Maharashtra Limited (License No. 2 of 2009)"

b. Amend the "Transmission License for Adani Power Maharashtra Limited (License No. 2 of 2009)" granted u/s 14 of the Electricity Act, 2003 and Maharashtra Electricity Regulatory Commission (Transmission License Conditions) Regulations, 2004 as follows:

   i. 400 KV Double Circuit Transmission Line with quad conductor from Tiroda (Gondia) to 400 KV Warora Switching Station

   ii. 2 Nos., 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Tiroda Project Switchyard

   iii. 2 Nos. 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Warora switching station

   iv. 2 x 80 MVAR Bus Reactors along with associated bays at Tiroda Substation

c. Condone any inadvertent omissions/ errors/ shortcomings and permit Adani Power Maharashtra Limited to add/ modify/ change/ alter this filing and make further submissions as may be required at a future date.

d. Pass such further Orders, as the Hon'ble Commission may deem fit and proper keeping in view the facts and observations of the case.

Place: Ahmedabad
Date: July 15, 2014

(Jignesh Langalia)
Applicant

MAHARASHTRA ELECTRICITY REGULATORY COMMISSION

World Trade Centre, Centre No.1, 13th Floor, Cuffe Parade, Mumbai - 400 005
Tel. No. 022 22163964/65/69 – Fax 022 22163976
E-mail mercindia@mercindia.org.in
Website: www.mercindia.org.in

TRANSMISSION LICENCE NO. 2 OF 2009

LICENCE FOR TRANSMISSION OF ELECTRICITY IN THE STATE OF MAHARASHTRA

Dated: July 6, 2009

Licence granted by the Maharashtra Electricity Regulatory Commission under Section 14 of the Electricity Act, 2003 (36 of 2003) to **Adani Power Maharashtra Limited,** having its registered office at Adani Power Maharashtra Limited, Adani House, Near Mithakali Six Roads, Navrangpura, Ahmedabad, Gujarat 380009 to transmit electricity within the area of transmission (as defined in this License, under Part II, section 3, "Area of Transmission") and with the powers and upon the terms and conditions specified herein.

Part I: General

1. Short title

This Licence may be called the **Transmission Licence for Adani Power Maharashtra Limited** (**Licence No. 2 of 2009**).

2. Definitions

All the definitions specified under "Section 3. Definitions" of Maharashtra Regulatory Commission (Transmission Licence Conditions) Regulations, 2004 as amended in 2006 ("Transmission Licence Conditions Regulations"), shall be applicable for this Licence.

Words or expressions used therein and not defined shall have the meanings assigned to them in the Act.

Part II: General Terms and Conditions

3. Area of transmission

The Licence authorizes the Transmission Licensee to establish and operate the following transmission lines inclusive of related infrastructure:

- 400 KV Double Circuit Transmission Line with quad conductor from Tiroda(Gondia) to proposed 400 KV Koradi-II substation;
- 400 KV Double Circuit Transmission Line with quad conductor from Tiroda(Gondia) to proposed 400 KV Warora Switching Station;
- 4 Nos., 400 KV bays for the above two Double Circuit Transmission lines at Tiroda Project switchyard;
- 2 Nos. 400 KV bays for Tiroda-Koradi-II Double Circuit Transmission lines at Koradi-II sub station;
- 2 Nos. 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Warora switching station;

NOTE :

1. The Transmission Licensee shall execute Connection Agreements with the other Licensees regarding the interconnection points of the above lines / bays, defining and documenting therein the exact details of the boundaries and interface points.
2. The Transmission Licensee shall obtain permission for installing the above transmission system from the Central Electricity Authority (CEA) by submitting the required details as called for, by following the "**Procedure for obtaining authorization U/s 164 of the Electricity Act 2003"** issued by the Ministry of Power.

4. Commencement and term of licence

The Licence shall come into force from the date of licence and, unless revoked earlier by the Commission in accordance with the provisions of Section 19 of the Act, shall remain in force for the period specified under sub-section (8) of Section 15 of the Act.

5. Duties

5.1 The Transmission Licensee shall comply with all the applicable provisions of the Act, the rules prescribed thereunder and all regulations, orders and directions issued by the Commission from time to time.

5.2 The Transmission Licensee shall as soon as practicable, report to the Commission,-

(a) any significant change in its circumstances which may affect the Transmission Licensee's ability to meet its obligations under the Act, the rules and regulations thereunder, directions and orders issued by the Commission, agreements or the Licence;

(b) any material breach, or likelihood thereof, of the provisions of the Act, the rules and the regulations thereunder, directions and orders issued by the Commission, agreement or the Licence, which was reasonably within its knowledge, along with the reasons therefor, as soon as practicable; and

(c) any change in management control or major change in the shareholding pattern of the Transmission Licensee than that proposed under the Transmission Licence Application.

Explanation I – for the purpose of this clause, "management control" shall include the right to appoint majority of the directors or to control the management or policy decisions of the Transmission Licensee, including by virtue of shareholding or management rights or shareholders' agreement or partnership deed or trust deed or voting agreement or in any other manner;

Explanation II – for the purpose of this clause, "major change in shareholding pattern" shall mean the acquisition, by such person as specified in Regulation 7 of the Securities and Exchange Board of India (Substantial Acquisition of Shares and Takeovers) Regulations, 1997, as in force from time to time, of such per cent of shares or voting rights in the Transmission Licensee as would entail a disclosure under sub-regulation (1) of that Regulation.

5.3 The Transmission Licensee shall seek the approval of the Commission before creating any encumbrance on the assets of the Licensed Business, except where such encumbrance is created for the purpose of the Licensed Business.

5.4 The Transmission Licensee may engage any of its subsidiaries or holding company or a subsidiary of such holding company to provide any goods or services to the Transmission Licensee in connection with the Licensed Business, subject to the following conditions and in compliance with the stipulations under "Part III: Specific Conditions of Licence":

(a) that the transaction shall be undertaken on an "arm's-length basis" and at a value that is fair and reasonable in the circumstances, which for the purposes of this clause, shall mean with respect to any specific transaction, substantially on terms that would be obtained between the Transmission Licensee and a third party unrelated to and unconnected with the Transmission Licensee;

(b) that the Transmission Licensee shall report to the Commission, for each financial year, the details of all transactions of the nature referred to in this Regulation entered into during the financial year;

(c) that the Transmission Licensee shall submit to the Commission, for each financial year, a certificate from a Chartered Accountant as regards compliance with the requirement of clause (a) above .

Explanation – for the purpose of this clause, the terms "subsidiary" and "holding company" shall have the same meaning as under Section 4 of the Companies Act, 1956.

6. Street works

The Transmission Licensee may, undertake works upon any streets or parts of streets, railways, canals or waterways or parts thereof, either in the domain of Central Government, State Government, Semi government and Municipal bodies or in private domain, only after obtaining all statutory permissions required to be obtained for undertaking such work.

7. Accounts

7.1 The financial year of the Transmission Licensee shall run from the first of April to the following thirty-first of March.

7.2 The Transmission Licensee shall, in respect of the Licensed Business and the Other Business:

(a) keep such Allocation Statement as would be required, so that the revenues, costs, assets, liabilities, reserves and provisions for, or reasonably attributable to the Licensed Business are separately identifiable in the books of the Transmission Licensee;

(b) adopt a fair and transparent cost allocation mechanism for the reasonable allocation of joint and common costs between the Licensed Business and the Other Business;

(c) prepare on a consistent basis the Accounting Statements in accordance with the provisions of the Companies Act, 1956 and/or the standards or guidelines of the Institute of Chartered Accountants of India.

Explanation – References in this Licence Condition 7.2 to costs or liabilities of, or reasonably attributable to Licensed Business or Other Business shall be construed as excluding taxation, and capital liabilities which do not relate principally to such Business and interest thereon.

7.3 The Transmission Licensee shall upon request by any person make available a copy of its Accounting Statements to any person who may require it at a reasonable price not to exceed the photocopying charges.

8. Provision of Information to the Commission

The Transmission Licensee shall furnish to the Commission such information, documents and details related to the Licensed Business and/or the Other Business of the Transmission Licensee as the Commission may require.

9. Licence Fees

During the period of validity of the licence, the Transmission Licensee shall, by the 10th of April of every year, or such further period as the Commission may allow, pay to the Commission such licence fees as may be specified in MERC (Fees and Charges)

Regulations, 2004 under Clause 3 of Schedule 1, which is reproduced below, or any subsequent amendments thereof:

S. No. ***(1)***	***Description*** ***(2)***	***Fees (in Rupees)*** ***(3)***
3.	*Annual Licence Fees for :* *(i) Transmission Licence* *.....* *Provided that the annual licence fee shall be payable in advance, at the commencement of the financial year, by all Licensees, including licensees referred to in the first, second, third, fourth and fifth provisos to Section 14 of the Act:* *Provided further that in the case of a Transmission Licence, the annual licence fee shall be calculated based on the approved/ estimated aggregate quantum of transmission capacity contracts for the ensuing financial year:* …… …… ……	*(i) Rs 1,000 per MW of Transmission capacity contracts in force during the year or part thereof, subject to a minimum of Rs 1,00,000 and maximum of Rs 20,00,000*

10. Decision on Interpretation of Licence

The interpretation of the Licence and the terms and conditions thereof shall be as determined by the Commission.

Part III: Specific Conditions of Licence

11. Construction of Transmission System through Competitive Procurement Basis

11.1 The Transmission Licensee shall comply with the procedure for obtaining authorization under Section 164 of the EA 2003. Accordingly, the licensee shall cause the transmission scheme to be published in the Official Gazette of GOM and in at least

two local daily newspapers along with a notice of the date, not being less than two months after the date of such publication, before which any interested person may make a representation on such scheme. The licensee shall take into consideration the objections/ representations, before finalizing the optimal route alignment. Thereafter the licensee shall submit a certificate along with an application under Section 164 to this effect. The licensee will submit to the Central Electricity Authority the following documents :

(i) Newspaper publications of Scheme.

(ii) Authenticated maps showing the details of selected route alignment of the transmission lines.

(iii) Justification of the selection of the route alignment.

11.2 The licensee shall obtain all the necessary permits, Statutory Clearances such as the clearance of Ministry of Environment and Forests, Right of way clearance etc and shall organise the construction management, cash flow and Investment plan in such way as to optimise on all the costs and interests thereon.

The construction and commissioning of the transmission system shall be executed through suitable packages, and contracts for these packages shall be awarded through Competitive Bidding basis. The licensee shall ensure that the Contractors hired for the purpose possess the necessary specialised skills for satisfactory execution of jobs awarded to them.

(P.B. Patil)
Secretary, MERC

Maharashtra Electricity Regulatory Commission, Mumbai
Dated: July 6, 2009

MAHARASHTRA ELECTRICITY REGULATORY COMMISSION
World Trade Centre, Centre No.1, 13th Floor, Cuffe Parade, Mumbai - 400 005
Tel. No. 022 22163964/65/69 – Fax 022 22163976
E-mail mercindia@mercindia.org.in
Website: www.mercindia.org.in

Amendment to Transmission Licence No. 2 of 2009 dated July 6, 2009

In pursuance of the Commission's Order dated July 6, 2009 in Case No. 138 of 2008 granting Transmission Licence No. 2 of 2009 dated July 6, 2009 to M/s. Adani Power Maharashtra Limited ("Transmission Licensee") for development of 400 kV Tiroda - Koradi and Tiroda - Warora double circuit Transmission lines; Order dated [30th March 2011] in Case No. 62 of 2010 amending Transmission Licence No. 2 of 2009 of the Transmission Licensee; [and Order dated September 21, 2010 granting Transmission Licence No.1 of 2010 to Maharashtra Eastern Grid Power Transmission Company Limited dated for development of 765kV transmission system], and in partial modification of Transmission Licence No. 2 of 2009 issued to M/s. Adani Power Maharashtra Limited having Registered office at Adani House, Near Mithakali Six Roads, Navrangpura, Ahmedabad 380 009, for transmission of electricity in the State of Maharashtra, the revised 'Area of transmission' authorizes the said Transmission Licensee to establish and operate the following transmission lines inclusive of related infrastructure:

- 400 KV Double Circuit Transmission Line with quad conductor from Tiroda(Gondia) to proposed 400 KV Warora Switching Station;
- 2 Nos. 400 KV bays for above Tiroda-Warora Double Circuit Transmission lines at Tiroda Project switchyard;
- 2 Nos. 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Warora switching station.

2. This amendment shall be read as part and parcel of the Transmission Licence No. 2 of 2009 dated July 6, 2009.

Registrar, MERC

Maharashtra Electricity Regulatory Commission, Mumbai
Dated: 30th March, 2011

Before the

MAHARASHTRA ELECTRICITY REGULATORY COMMISSION

World Trade Centre, Centre No.1, 13th Floor, Cuffe Parade, Mumbai - 400 005
Tel. No. 022 22163964/65/69 – Fax 022 22163976
E-mail mercindia@mercindia.org.in
Website: www.mercindia.org.in

Case No. 62 of 2010

In the matter of
Application of M/s. Adani Power Maharashtra Limited for amendment of "Transmission Licence for Adani Power Maharashtra Limited (Licence No. 2 of 2009)"

Shri V.P. Raja, Chairman
Shri Vijay L. Sonavane, Member

M/s Adani Power Maharashtra Limited
Registered office:
Adani House
Near Mithakali Six Roads
Navrangpura, Ahmedabad 380 009 …….. Applicant

ORDER

Dated: March 30, 2011

M/s Adani Power Maharashtra Limited (APML) submitted an application to the Commission on October 7, 2010 in accordance with Regulation 7 of Maharashtra Electricity Regulatory Commission (Transmission Licence Conditions) Regulations, 2004 as amended in 2006 ("Transmission Licence Conditions Regulations") for amendment of "Transmission Licence for Adani Power Maharashtra Limited (Licence No. 2 of 2009)".

2. The prayers set out in the application are as follows:-
"

a) *Approve the notice for amendment of "Transmission License for Adani Power Maharashtra Limited (License No. 2 of 2009)"*

b) *Amend the "Transmission License for Adani Power Maharashtra Limited (License No. 2 of 2009)" granted u/s 14 of the Electricity Act, 2003 and Maharashtra Electricity Regulatory Commission (Transmission License Conditions) Regulations, 2004*

c) *Condone any inadvertent omissions/ errors/ shortcomings and permit Adani Power Maharashtra Limited to add/ modify/ change/ alter this filing and make further submissions as may be required at a future date."*

3. M/s Adani Power Maharashtra Limited (APML), in its application stated as under:

a. The applicant (APML), is a subsidiary of Adani Power Limited engaged in development of 3300MW (Phase I: 3x660MW; Phase II: 2 x 660MW) coal based thermal power project at Tiroda, District Gondia, Maharashtra. The project was initially envisaged to have capacity of 1980MW (3 x 660MW).

b. The applicant further submitted that, in order to expedite the process of establishing the transmission line to evacuate the power from the initially envisaged capacity of Phase I (1980MW: 3x 660MW), APML submitted an application to the Commission on February 6, 2009 for grant of Transmission Licence under Section 14 of EA 2003. The Commission vide its Order dated July 6, 2009 granted Transmission Licence to APML and authorised the licensee to establish and operate the following transmission lines inclusive of related infrastructure.

- 400 KV Double Circuit Transmission Line with quad conductor from Tiroda(Gondia) to proposed 400 KV Koradi-II substation;
- 400 KV Double Circuit Transmission Line with quad conductor from Tiroda(Gondia) to proposed 400 KV Warora Switching Station;
- 4 Nos., 400 KV bays for the above two Double Circuit Transmission lines at Tiroda Project switchyard;
- 2 Nos. 400 KV bays for Tiroda-Koradi-II Double Circuit Transmission lines at Koradi-II substation;
- 2 Nos. 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Warora switching station;

c. APML submitted that, it decided to expand the thermal project by implementing Phase II of the Tiroda Project (2x660MW). In view of the expansion, APML approached Maharashtra State Electricity Transmission Company Limited (MSETCL) in its capacity as State Transmission Utility (STU) with a request to plan evacuation system for additional capacity of 1320MW (2 x660MW) for Phase II. Accordingly, STU/MSETCL reviewed the power evacuation scheme and planned intra-State 765kV transmission system consisting of two 765kV single circuit lines from Tiroda to Aurangabad via Koradi and Akola. In view of the proposed development of 765kV transmission system, STU advised APML, vide letter dated December 5, 2009 that the 400kV D/C Tiroda-Koradi-II Transmission line with the

two associated 400kV bays each at Tiroda and Koradi ends will not be required any more.

d. APML submitted that Maharashtra Eastern Grid Power Transmission Company Limited (MEGPTCL) proposed to develop the 765kV intra-State transmission system (InSts) comprising of 2 x 765kV S/C Tiroda-Koradi- Akola- Aurangabad transmission lines along with associated substations & bays for evacuation of power from projects in North-Eastern Maharashtra and an application was made to the Commission on February 17, 2010 for grant of Transmission Licence under Section 14 of the EA 2003 for the development of 765kV intra-State transmission system. After the Technical Validation System, held on April 17, 2010 and public hearing held on August 17, 2010 the Commission granted transmission licence to MEGPTCL (Transmission Licence No.1 of 2010) dated September 21, 2010 for development of this 765kV transmission system.

e. APML stated that, as a result of development of a separate 765kV system as approved by the Commission in the licence of MEGPTCL, the 400kV D/C Tiroda Koradi II transmission line and associated 400kV bays at Tiroda and Koradi II would not be required. Therefore, APML requested the Commission to suitably amend the "Transmission Licence for Adani Power Maharashtra Limited (Licence No. 2 of 2009)" granted by the Commission earlier to exclude the following from the licence:

    i. 400 KV Double Circuit Transmission Line with quad conductor from Tiroda(Gondia) to proposed 400 KV Koradi-II substation;
    ii. 2 Nos. 400 KV bays for Tiroda-Koradi-II Double Circuit Transmission lines at Tiroda substation;
    iii. 2 Nos. 400 KV bays for Tiroda-Koradi-II Double Circuit Transmission lines at Koradi-II substation;

    APML further submitted that the amended licence would authorise the transmission licensee to establish and operate the following transmission lines inclusive of related infrastructure:

    i. 400 KV Double Circuit Transmission Line with quad conductor from Tiroda(Gondia) to proposed 400 KV Warora Switching Station;
    ii. 2 Nos. 400 KV bays for Tiroda-Warora Double Circuit Transmission line at Tiroda Project switchyard;
    iii. 2 Nos. 400 KV bays for Tiroda-Warora Double Circuit Transmission line at Warora switching station.

f. In accordance with Section 18 of the EA 2003 and Regulation 7 of the MERC (Transmission Licence Conditions) Regulations, 2004, APML submitted draft of notice to the Commission. APML further stated that, upon approval from the Commission, the draft notice submitted along with the application shall be published pursuant to Regulation 7 of MERC (Transmission Licence Conditions) Regulations, 2004.

g. APML stated that it has complied with all conditions specified in the licence and further submitted that it has expedited the following activities under the scope of the licence:
   i. Submission of fees
   ii. Completion of Detailed survey on the route of the lines
   iii. Application for forest approval
   iv. Received approval under Section 68 & Section 164 of the EA 2003 from the Government of Maharashtra
   v. Submission of Capex approval to the Commission
   vi. Award of EPC contracts to consortium of Powergen Infrastructure and Gammon India Limited in September 2009
   vii. The scheduled date of commissioning is March 2011

4. Under Regulation 7 of the MERC (Transmission Licence Conditions) Regulations, 2004, the Commission being empowered to require such additional particulars to be contained in the notice, as it may deem appropriate having regard to the specific circumstances of the case, the Commission vide its letter dated November 1, 2010 sent the reviewed and modified draft public notice to the applicant for publishing the same and further asked the applicant to submit the proof of compliance under the said Regulation 7 to the Commission along with copy of notice as published.

5. APML vide its letter dated November 12, 2010 informed that it has published Notices on November 3, 2010, for amendment of transmission licence in two (2) daily English newspapers (Indian express and Lokmat Times, Nagpur) and in two (2) daily Marathi newspapers (Loksatta, Nagpur and Deshonnati, Gondia) in proposed area of transmission.

6. The Commission received objections and suggestions from twenty four objectors. Almost everyone stated that they have objection on the amendment of the licence. One of the objectors stated that because a matter is pending in the High Court, the amendment of the licence should not be granted. Most of the objectors submitted that the Tahsildar, Tiroda has issued letter to the licensee to stop all work and they have objection to the amendment of the licence. Another objector, Shri Shetra Kashighat Sansthan Garada, Tal. Tiroda Dist. Gondia by referring to Section 54 of the Electricity Act, 2003 stated that the line should be routed excluding the area where 100 or more people gather. He further requested that an enquiry should be carried out in the matter. Another objector, Shri Mohanlal Gaynachandani objected on the amendment of licence citing various reasons such as (i) the public hearing should be held at the local place (ii) area map, licence copy & related document to be sent to local institutions as per Indian Electricity Rules, Rule 22 (c) within 30 days after grant of licence, (iii) concerned citizens/farmers are supposed to be supplied with map, licence, information, at reasonable rate (iv) although the power project is located in Maharashtra & associate transmission system is intra-State, entire electricity will be distributed to Haryana & Gujarat, which is totally wrong (v) APML's installation of 4^{th} & 5^{th} units is uncertain due

to non availability of water. Inspite of this situation granting of licence & subsequent amendment seems to be asymmetrical.(vi) APML has conducted the survey secretly, etc. Bharashtachar Virodhi Jan Andolan Nyas (Maharashtra) submitted that the licence should be stayed and an enquiry should be conducted along with public hearing.

7. APML vide its letter dated December 13, 2010 stated that it has published notices inviting written objections from persons desirous of making any objection with reference to amended application to the Commission, with copy being given to APML, within 30 days from the date of publication of the said notice. However, APML has not received any comments/objections to the application so far. APML further requested the Commission to take suitable action for amendment of the transmission licence.

8. Photocopies of Objections received by the Commission from various people/organisations in response to the public notice issued by APML regarding the amendment of transmission licence were handed over to APML with a request to forward its comments on the same to the Commission.

9. APML vide its letter January 17, 2011 stated that the objections as raised bear no relevance to the Notice published by APML on November 3, 2010 for amendment of Transmission Licence No. 2 of 2009. APML further stated that the nature of concerns raised by the respective stakeholders pertain to objections that are to be raised during the procedure for obtaining approval u/s 164 of the Electricity Act, 2003 and Right of way for implementation of the transmission project. APML further clarified that it has already obtained approval u/s 164 of the Electricity Act, 2003 from the Government of Maharashtra vide GoM Order dated April 30, 2010, after addressing such concerns in the area of the transmission project. APML requested the Commission to take suitable action for amendment of the transmission licence.

10. The Commission,in the interest of transparency, published Public Notices on January 31, 2011 in newspapers with copies of the notice sent individually to all the objectors (24 objectors mentioned above) in the present case.

11. The Public Notice as above and soft copy of the application were also posted on the Commission's website. It was also intimated vide the above mentioned Public Notice that the Public Hearing in the matter would be held on Thursday, March 3, 2011, at 11:00 hours at the Commission's office at World Trade Centre, Cuffe Parade, Mumbai 400 005. It was further clarified in the said notice that if the persons / objectors (24 No.s) and any other person wished to be heard in relation to the application filed by APML he/she should be present in the scheduled hearing.

12. Additionally, letters in Marathi informing the objectors about the hearing as scheduled along with the Copies of the notice in Marathi were sent on February 1, 2011.

13. The Secretary, Shri Shetra Kashighat Sansthan Garada, Tal. Tiroda Dist. Gondia (one of the Objectors) vide its letter dated February 9, 2011 stated that all the objectors have to leave for Mumbai to attend the hearing on the day of Maha Shivaratri. He further requested to postpone the hearing citing the religious grounds, as his Sansthan conducts religious gathering on the day of Maha Shivaratri.

14. APML, Nagpur vide its letter dated February 14, 2011 to the Commission replied with the reference to Sh. Sunil Barapatre letter. In the said letter it is mentioned that the work of 400kV Tiroda-Warora transmission line is going as per licence granted, the Government directions, as per the Electricity Act 2003 and as per the provisions of Electricity Rules 2005. It is further submitted that due to resistance of a few people in that area, work has not been started and also alignment of transmission line have not been finalised. While finalising alignment and erecting the transmission line safe distance from the residential area, social places, and temple shall be maintained as per the Act, rules & regulations. But in order to move forward, the route will have to be finalised; however, due to resistance of a few people since last one year the route has yet not been finalised.

15. Secretary, Shri Shetra Kashighat Sansthan Garada, Tal. Tiroda Dist. Gondia was intimated, vide the Commission's letter dated March 1, 2011, that the hearing will be conducted on the scheduled time and date and no adjournment would be granted.

16. The Commission did not receive any comments or objections/suggestions in response to the above mentioned notice issued by the Commission till the date of the hearing.

17. The Public Hearing in the matter was held on March 3, 2011. Shri R. K. Madan represented M/s Adani Power Maharashtra Limited. During the public hearing out of the present objectors, few read out the already submitted written objections. Few submitted that all of them have not been served with the Land survey notice at one time, but were served rather at random fashion. Objectors also submitted that the proposed transmission line passes through the residential area close to the houses. They also complained that APML does not have the project office in the nearby vicinity. However, all the objectors in the end stated that they have no problem for the new developments such as new generating stations, transmission lines, etc., as they bring prosperity to the area, and they are ready to co-operate provided their grievances and inconvenience caused to them are solved. Shri R K Madan submitted that present application for amendment of transmission licence is based on STU recommendations. He informed the Commission that the work of transmission line erection is being handled by the contractors. He further assured that the APML will make all possible efforts to solve the grievances of affected objectors by involvement of company's senior and experienced officers involved in ground work. He also stressed the fact the Adanis have excellent track record of executing major extra high voltage transmission lines successfully all over the India, wherein they have addressed RoW and related problems.

18. The Commission had issued the "Transmission Licence for Adani Power Maharashtra Limited (Licence No. 2 of 2009)"vide its Order dated July 6, 2009 in Case No. 138 of 2008, for which the applicant had submitted the application on February 6, 2009. It was stated in the aforesaid order that the transmission system for which transmission licence application has been made, is meant for the evacuation of 1980 MW (3 x 660MW) generation from Tiroda Thermal Power project. The Commission while granting the licence had followed due regulatory process, wherein the STU had been asked to submit its recommendations for the proposed transmission lines. In reply STU had stated that they have already issued consent to APML for the establishment of transmission lines, as the proposed arrangement of transmission lines is most optimal and technically feasible. It is also important to mention that as mandated by the EA 2003, the public notice in local newspapers was published before the grant of licence. In response, no objection/comment was received even till date of the hearing on July 6, 2009.

19. Subsequently, M/s Maharashtra Eastern Grid Power Transmission Company Limited (MEGPTCL) submitted an application on February 18, 2010, for grant of Transmission licence for development of 765kV intra-State transmission network in the Eastern part of State of Maharashtra comprising of 2 x 765kV S/C Tiroda-Koradi-Akola-Aurangabad lines along with associated substations and bays to evacuate power from five power plants with total capacity of 8100 MW which includes APML power plant. APML's proposed plant configuration was changed from 1980 MW (Phase-I, 3x660MW) to 3300 MW capacity with the addition of Phase-II (2x660MW). However, during the discussion on the above application by MEGPTCL for transmission licence (Case No.118 of 2009), it was observed that Transmission Licence No.2 of 2009 was already issued to APML by the Commission for construction of 2 Nos. 400 KV D/C transmission lines from Tiroda. The capacity of one of these 400kV lines, namely, 400kV Tiroda-Koradi-II D/C transmission line is inadequate to evacuate the enhanced generation capacity. Further, the power which was to be evacuated on one of this line can be evacuated through the proposed 765kV transmission system by MEGPTCL. Hence, the STU recommended the deletion of this line. The relevant portion of the Order dated September 14, 2010 is reproduced below:

> *"5. Subsequently, in view of the proposed development of 765 KV transmission system as mentioned above, the State Transmission Utility ("STU") had advised vide its letter ref. No. MSETCL/CO/STU/302B/16499 dated 5th December, 2009 to APML that the 400 KV Tiroda – Koradi-II D/C line will not be required anymore."*

20. As mandated by the EA 2003, the public notice in local newspapers was published before the grant of licence to M/s Maharashtra Eastern Grid Power Transmission Company Limited. In response, no objection/comment was received even till date of the hearing.

21. Having heard the Applicant and objectors and after considering the materials placed on record, the Commission is of the view that there is no asymmetry in the process as alleged by Mohanlal Gaynachandani at Para 5 (v) above.

22. As regards the objection of Shri Shetra Kashighat Sansthan Garada, Tal. Tiroda Dist. Gondia that the line should be routed excluding the area where 100 or more people gather, under sub-section (2) of Section 54, where any difference or dispute arises as to whether a place is or is not one in which one hundred or more persons are ordinarily likely to be assembled, the matter is to be referred to the State Government, and the decision of the State Government thereon shall be final. The provisions of this section is binding on the Government. Accordingly, these issues should be raised before the State Government.

23. The main gravamen of objectors appear to be with regard to Right of Way (RoW) and alignment of transmission towers. The Commission is of the view no purpose would be solved by holding up the licence amendment. The Applicant has made the application in accordance with Transmission Licence Conditions Regulations. The Applicant has complied with the requirements of publication of notices in newspapers. All objectors have been given the opportunity to make their submissions, suggestions and objections. It is important to note that the objectors have no objection for development of the project as according to them it will bring prosperity to the areas. However, considering the objections and suggestions and issues raised by the objectors, the Commission, directs the Applicant APML to establish a local site office (for transmission related activities) in the Tiroda area with a team of minimum three members of experienced senior people who are fluent in Marathi. The transmission line route survey and alignment of transmission towers in the disputed area need to be re-done by taking the local people into confidence and addressing their legitimate grievances.

24. All submissions, suggestions and objections have been duly considered. The Applicant has complied with the requirement of Transmission Licence Conditions Regulations for amendment of the "Transmission Licence for Adani Power Maharashtra Limited (Licence No. 2 of 2009). In fact the State Transmission Utility had advised that the 400kV D/C Tiroda-Koradi-II Transmission line with the two associated 400kV bays each at Tiroda and Koradi ends will not be required any more.

25. Considering all the materials on record, the Commission is of the view that it is in the public interest to amend the "Transmission Licence for Adani Power Maharashtra Limited (Licence No. 2 of 2009)" to the extent the following shall stand excluded from the said licence :-

(i) 400 KV Double Circuit Transmission Line with quad conductor from Tiroda(Gondia) to proposed 400 KV Koradi-II substation;

(ii) 2 Nos. 400 KV bays for Tiroda-Koradi-II Double Circuit Transmission lines at Tiroda substation;

(iii) 2 Nos. 400 KV bays for Tiroda-Koradi-II Double Circuit Transmission lines at Koradi-II substation;

The amendment of the Transmission Licence to the extent stated above shall come into effect from the date of issuance of this Order. All other conditions of the Commission's Order dated July 6, 2009 in Case No. 138 of 2008 shall continue to apply.

26. The amendment to Transmission Licence No. 2 of 2009 dated July 6, 2009 for Adani Power Maharashtra Limited is enclosed with this order.

27. The Commission directs its Registry that a copy of the amendment to Transmission Licence No. 2 of 2009 be forwarded to the Government of Maharashtra, all electricity transmission licensees and distribution licensees in the State of Maharashtra, the concerned Local authorities/ self governments (Municipal bodies) of the cities/towns through which the transmission line passes, and a copy be uploaded on the website of the Commission.

Accordingly, Case No. 62 of 2010 stands disposed of.

Sd/-	Sd/-
(Vijay L. Sonavane)	(V. P. Raja)
Member	Chairman

(P.B. Patil)
Registrar, MERC

adani™

Ref.: APML/MSETCL/18082012/068
18th August, 2012

To,

Executive Director (Operations)
Maharashtra State Electricity Transmission Company Limited,
"Prakashganga" Bandra-Kurla Complex,
Bandra (East)
Mumbai – 400051.

Kind Attn. : Shri. S. G. Kelkar

Subject: WRLDC study for Initial Charging analysis of 400kV Wardha – Warora – Tiroda Line

Dear Sir,

Greetings from Adani Power Maharashtra Ltd.

Please refer to discussion had with you regarding 400kV Tiroda dead bus charging analysis for 400kV Wardha – Warora – Tiroda line.

As advised by you, we have approached WRLDC subsequent to your letter to WRLDC for the subject matter.

Please find attached the forwarded mail from WRLDC with study result for your kind reference please.

Please note that, study has been carried out considering following:

a) 2 x 63 MVAR bus reactor at Wardha
b) 2 x 80 MVAR bus reactor at Tiroda
c) No ICT @ Warora
d) 400kV Tiroda – Warora – Wardha Quad Moose Line (279kM)

Based on the analysis, the bus voltage are in order during and even after the charging condition.

Hence, you are once again requested to kindly advise your team for charging of 400kV Wardha – Warora line and 400kV Warora – Tiroda line.

Yours sincerely,

Authorized Signatory

Cc: Director (Operations / Project)
Cc: Executive Director (Project)
Cc: CE MSLDC

Encl: WRLDC-Scanned copy of study for charging of 400kV Wardha–Warora–Tiroda

Adani Power Maharashtra Ltd
Sambhaav House
Judges Bungalow Road, Bodakdev
Ahmedabad 380 015
Gujarat, India

Tel +91 79 2555 6900
Fax +91 79 2555 7155
info@adani.com
www.adani.com

pushpa seshadri <pushpa_seshadri@hotmail.com>

17-08-2012 19:21

To <jigar.thakkar@adani.com>, uday trivedi <uday.trivedi@adani.com>

cc "agartia@gmail.com" <agartia@gmail.com>, p pentayya <ppentayya@gmail.com>, sonkavday <n.sonkavday@rediffmail.com>

bcc

Subject Study results of line charging for Tiroda-Revised

Sir,

Please ignore my earlier mail. Study results are enclosed. Charging sequence earlier given by Engg-POWERGRID also is enclosed.

Regards,
Pushpa.S
Chief Manager(MO-I)
Western Regional Load Despatch Centre,
Power System Operation Corporation Ltd.,
(A Wholly Owned Subsidiary of POWERGRID)
F-3,MIDC,Marol,
Andheri(E),Mumbai-93.

Mob:-9869404482 study-15-line charging study-Tiroda.xlsx

WRLDC/MO-I/study-15-Study for charging 400kV Wardha-Warora-Tiroda

Details of Power Plant and lines associated:-

Tiroda Stage-I = 3x660MW at 400kV level

Tiroda Stage-I = 2x660MW at 765 kV level

400kV Tiroda -Warora D/C- Quad Moose-219kms each

400kV Warora-Wardha D/C -Quad Moose-60 kms each

Bus reactor at Tiroda-2x80MVAR

Bus reactor at Wardha-2x63MVAR

Line charging MVAR for 100kms Quad Moose line 74

Warora ICTs are not available.

1. Charging from Wardha end ckt -I

Details	Before charging 400kV Wardha-Warora	After charging Wardha-Warora	Open end voltage	After closing Wardha-Warora- Tiroda
400kV Wardha	407	407.8		408
400kV Warora		409	430	410
400kV Tiroda				401

MAHATRANSCO
Maharashtra State Electricity Transmission Co. Ltd.

Chief Engineer <cesldc@mahasldc.in>

Charging of 400KV Warora-Tirora Line-2

1 message

SCE Tirora <SCE.Tirora@adani.com> Fri, Nov 9, 2012 at 9:53 PM
To: msldc_cr@mahasldc.in
Cc: cesldc@mahasldc.in, ldambazari@gmail.com, ldambazari@rediffmail.com, cpcc.wr1@gmail.com, wrldcposoco@gmail.com

	ADANI POWER MAHARASHTRA LIMITED	
STATION: APML- TIRORA	5X660 MW Super-critical	DATE: 09.11.12
DEPARTMENT : OPERATION		
Ref: APML/TR/2012/11/82		

To,
The SCE,
SLDC, Kalwa

Sub:charging of 400KV Warora-Tirora Line-2

Dear Sir,

Can we charge 400KV Warora-Tirora Line-2 without keeping Both Bus reactors in service. Please advise us.

Thanking you,
With regards,

SCE
APML/TIRORA (Control Room)
(Mobile No.09764800057)
SWYD CR MOBILE NUMBER -09765492721
SWYD CR PHONE NUMBER-07198-255294
SWYD FAX NUMBER-07198-202233
Email- sce.tirora@adani.com

Copy with compliments for kind information to:
1. The SI, ALDC, Ambazari, Nagpur

To, SI Adani Tirora
Wardha — Warora Line is taken I/S at 20:43 hrs. pl charge Warora — Tirora Line II by taking both Bus Reactor I/s.

SHIFT INCHARGE
S. L. D. C.
M.S. TRANS. CO. LTD.
KALWA.

MAHATRANSCO
Maharashtra State Electricity Transmission Co. Ltd.

Chief Engineer <cesldc@mahasldc.in>

Charging of both Bus reactors

1 message

SCE Tirora <SCE.Tirora@adani.com> Sun, Dec 30, 2012 at 6:40 PM
To: msldc_cr@mahasldc.in
Cc: cesldc@mahasldc.in, ldambazari@gmail.com, ldambazari@rediffmail.com, cpcc.wr1@gmail.com, wrldcposoco@gmail.com

	ADANI POWER MAHARASHTRA LIMITED	
STATION: APML- TIRORA	**5X660 MW Super-critical**	**DATE: 30.12.2012**
DEPARTMENT : OPERATION		
Ref: APML/TR/2012/12/095		

To,
The SCE,
SLDC, Kalwa
Sub: Charging of both Bus reactors
Dear Sir,

As per your message dated 30/12/2012 at 16:00 HRS regarding the status & willingnes to charge the Bus reactors on 400KV Buses, we want to inform you that our both the bus reactors are available on both 400KV Buses.SLDC can decide the operation of both Bus reactors as per Grid requirement.

Thanking you,
With regards,
SCE
APML/TIRORA (Control Room)
(Mobile No.09764800057)
SWYD CR MOBILE NUMBER -09765492721
SWYD CR PHONE NUMBER-07198-255294
SWYD FAX NUMBER-07198-202233
Email- sce.tirora@adani.com

To,
SCE APML TIRORA
In connection to above 400KV Warora-Tiroda-II to be charged with Bus reactor in service.
[signature]
SE MSLDC Kalwa.

MAHARASHTRA STATE ELECTRICITY TRANSMISSION CO. LTD.

PHONE : (O) 022-2659 8588 /95/5000
Extn. 5124
(P) 022-26592227
FAX : 022- 2659 2297
Email : cestu@mahatransco.in
: cesu@maharashtrastu.com

MAHATRANSCO
Maharashtra State Electricity Transmission Co. Ltd

Office of The Chief Engineer
State Transmission Utility

'Prakashganga', MSETCL
Plot no. C-19, E-Block,
Bandra Kurla Complex, Bandra (E),
Mumbai – 400051

Ref: MSETCL/CO/STU/ 16022. **Date:** 19/11/12

To,
The Chief Engineer (Commercial)
Prakashgad, MSEDCL,
Bandra (E), Mumbai-51.

Sub: 2 x 80 MVAR Bus Reactors at M/s. APML's Switchyard at Tiroda.

Ref: M/s. APML's Letter No. APML/MSETCL/CE/12/05, dtd. 08.11.12.

With reference above, regarding installation of 2 x 80 MVAR Bus Reactors at M/s. APML's Switchyard, it is to inform you that the said bus reactors are required as the part of the intra-state transmission system to reduce the high voltage problems during off peak condition due to capacitance of 400 kV D/c quad line between Tiroda to Warora (219 km). These reactors are necessary to offset the effects of line capacitance of above said lines. Also, these bus reactors are necessary not only to control the system voltage during the line charging condition but also during light load condition.

This is for your information.

Chief Engineer
State Transmission Utility

Copy swrs to:
Executive Director (Operations)/(Project), MSETCL, Prakashganga

Copy fwcs to:

M/s Adani Power Maharashtra Ltd.
Adani House, Nr Mithakhali Circle,
Navrangpura, Ahmedabad – 380 009,
Gujrat, India

Report on Reactive Power Compensation for Transmission and Distribution Lines with Specific Reference to 400 kV Tiroda - Warora Line

July 27, 2013

Abstract

This document discusses the topic of active and reactive power in AC circuits and the requirement of reactive power compensation in transmission and distribution systems. We differentiate between shunt compensation requirements of transmission and distribution circuits. This document also covers the provision of shunt compensation at Tiroda for the 400 kV Tiroda -Warora transmission line, wherein startup power requirement for the thermal station at Tiroda had to be provisioned through 400 kV STU network. The studies conducted justify the provision of shunt reactors at 400 kV Tiroda bus, as beneficial to the system operation.

Preface

Adani Power Maharashtra Limited (AMPL) is setting up a 5×660 MW power plant at Tiroda in Maharashtra. To meet the startup power requirement of this plant, power is supplied over 400 kV network from Wardha and Warora. As the existing voltage levels at 400 kV busses in the area is higher than 400 kV, shunt reactors have been provided at 400 kV Tiroda bus. For startup power requirments, AMPL is treated as a deemed customer of MSEDCL, who have applied maximum demand violation and low power factor charges. AMPL have made a representation in MERC claiming that such penalty should not levied for startup power for their plant, vide case no. 51/2013. The honourable commission then sought an opinion from Mr. S. A. Soman of IIT Bombay on the case. In a presentation made to the honourable commission on 12/07/2013, Mr.

Soman presented his findings. The honourable commission further constituted a committee to look at the broader aspects of provision of shunt compensation for transmission and distribution system. A meeting of the committee, convened by Mr. Soman was held on 19/07/2013 at IIT Bombay. The list of attendees is attached as Appendix A. This report is the outcome of the committee deliberations on 19/07/2013.

1 Introduction

This document covers the requirement of shunt compensation in Extra High Voltage (EHV) AC transmission, with particular reference to the 400 kV transmission between AMPL power plant at Tiroda and Warora. The said transmission line is 218.61 km long. Before proceeding with specific requirements of this case, we have a brief look at the basics of AC power, in order, to gain a better understanding of the issues at hand.

1.1 Instantaneous power in single phase AC circuit

Let $v(t)$ and $i(t)$ be the voltage and current at any time instant t. The instantaneous power $p(t)$ at t, is given by,

$$p(t) = v(t) \times i(t). \tag{1}$$

Let

$$v(t) = V_m \sin \omega t \tag{2}$$

$$i(t) = I_m \sin(\omega t - \phi) \tag{3}$$

$$\begin{aligned} p(t) &= V_m I_m \sin \omega t \sin(\omega t - \phi) \\ &= \frac{V_m I_m}{2} 2 \sin \omega t \sin(\omega t - \phi) \\ &= \frac{V_m}{\sqrt{2}} \frac{I_m}{\sqrt{2}} [\cos \phi - \cos(2\omega t - \phi)] \end{aligned} \tag{4}$$

It can be observed from Eqn (4) that that instantaneous power in a single phase circuit is

pulsating at twice the supply frequency. This is also shown in Fig 1. Hence we calculate the

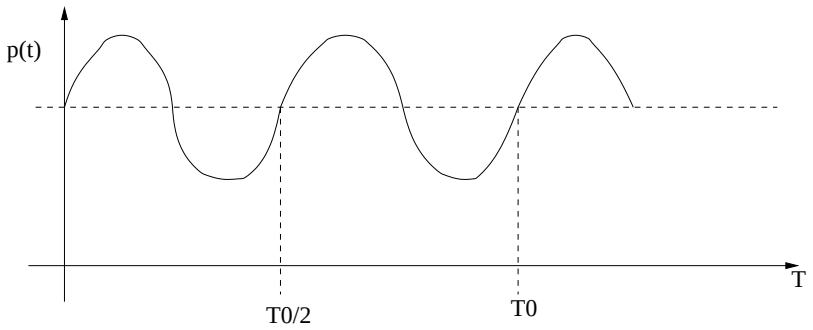

Figure 1: Plot of power with $V_{rms} = 1$, $I_{rms} = 1$ and $\phi = 30°$

average power consumed in a cycle. It is called real or active power and its unit is watts (W).

$$P_{av} = P = \frac{1}{T_0} \int_{t}^{t+T_0} P(t)dt = V_{rms} I_{rms} \cos\phi \tag{5}$$

- We define $|S| = V_{rms} I_{rms}$ as the apparent power associated with the current.
- The ratio of $\frac{P_{av}}{S}$ is called power factor.
- Power factor: $\cos\phi \in [-1, 1]$.
- If current lags voltage, we say that the power factor is lagging. If current leads voltage, we say that the power factor is leading.

2 Reactive Power

Note that active power is a product of voltage and projection of current phasor on voltage phasor as shown in Fig 2. Hence, a product of voltage phasor and quadrature component of current i.e $VI\sin\phi$ is also something that could not be realised. It is known as reactive power.

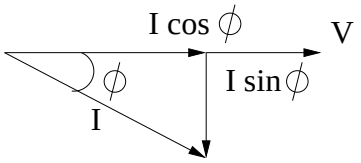

Figure 2: Active and reactive power

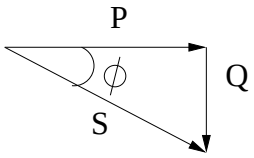

Figure 3: Apparent Power with lagging current (P +ve, Q -ve).

Now, consider

$$\begin{aligned} S &= VI^* \\ &= V_{rms}\angle 0[I_{rms}\angle -\phi]^* \\ &= V_{rms}I_{rms}\angle\phi \\ &= V_{rms}I_{rms}\cos\phi + jV_{rms}I_{rms}\sin\phi \end{aligned} \tag{6}$$

$$S = P + jQ \tag{7}$$

where $j = \sqrt{-1}$. In electrical engineering, i normally represents current. Hence, j is used to represent $\sqrt{-1}$.

Further,

$$P^2 + Q^2 = |S|^2. \tag{8}$$

Previously, while introducing the notion of apparent power, we treated it as a scalar. In fact, apparent power is a complex number.

- $\cos\phi$ and $\sin\phi$ are dimensionless. Hence, power factor has no unit.
- $Q = VI\sin\phi$ has a unit of VA. However, it is written as VAR and indicates reactive.

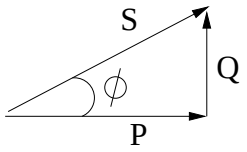

Figure 4: Apparent Power with leading current (P +ve, Q +ve).

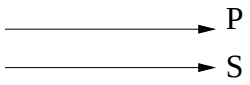

Figure 5: Apparent Power with unity power factor (P +ve, Q = 0).

- In power system, MW and MVAR are commonly used units.

To summarize, we have seen that instantaneous power in a single phase circuit is pulsating. However, in a balanced multi-phase circuit, we can make it constant. We show this by taking an example of a three phase circuit, where power is given by the following equation.

$$
\begin{aligned}
P_{total}(t) &= v_a(t)i_a(t) + v_b(t)i_b(t) + v_c(t)i_c(t) \\
&= V_m \cdot I_m \left[\cos(\omega t) \cdot \cos(\omega t - \phi) + \cos\left(\omega t - \frac{2\pi}{3}\right) \cdot \cos\left(\omega t - \phi - \frac{2\pi}{3}\right)\right] \\
&\quad + \cos\left(\omega t - \frac{4\pi}{3})\right) \cdot \cos\left(\omega t - \phi - \frac{4\pi}{3}\right)] \\
&= \frac{V_m \cdot I_m}{2}\left[\cos\phi + \cos(2\omega t - \phi) + \cos\phi + \cos\left(2\omega t - \phi - \frac{4\pi}{3}\right)\right. \\
&\quad \left. + \cos\phi + \cos\left(2\omega t - \phi + \frac{4\pi}{3}\right)\right] \\
&= 3 \cdot V_{rms} \cdot I_{rms} \cdot \cos\phi + 3 \cdot V_{rms} I_{rms} \left[\cos(2\omega t - \phi)\right. \\
&\quad \left. + \cos\left(2\omega t - \phi + \frac{2\pi}{3}\right) + \cos\left(2\omega t - \phi - \frac{2\pi}{3}\right)\right] \\
&= 3 \cdot V_m \cdot I_m \cdot \cos\phi + 0 \quad \left[\because\ \cos\theta + \cos(\theta + \frac{2\pi}{3}) + \cos(\theta - \frac{2\pi}{3}) = 0\right] \\
\Rightarrow P_{total}(t) &= 3V_m I_m \cos\phi
\end{aligned}
\tag{9}
$$

It can be easily observed that three phase instantaneous power is constant. Thus, balanced three phase circuits overcome the problem of pulsating instantaneous power. However, the issue of reactive

power remains.

3 Transmission Lines - Power Characteristics

Consider a transmission line between busses S and R, where S denotes the sending end and R, the receiving end, respectively. The line is assumed to be lossless, typically, for EHV transmission line $X/R > 10$, hence, this is a reasonable assumption. The length of the line is l, β is the phase constant of the line and its characteristic impedance is Z_C. The sending end voltage V_S and current I_S are given by [1],

$$\bar{V}_S = \bar{V}_R \cos\beta l + jZ_C\bar{I}_R \sin\beta l \tag{10}$$

$$\bar{I}_S = \bar{I}_R \cos\beta l + j(\frac{\bar{V}_R}{Z_C})\sin\beta l. \tag{11}$$

Consider a load at the receiving end given by

$$\begin{aligned} \bar{I}_R &= \frac{P_R - jQ_R}{\bar{V}_R^*} \\ \bar{V}_S &= \bar{V}_R\cos(\beta l) + j(\frac{P_R - jQ_R}{\bar{V}_R^*})Z_C\sin(\beta l) \\ \because \theta &= \beta l \end{aligned}$$

$$\implies \bar{V}_S = \bar{V}_R\cos\theta + jZ_C\sin\theta(\frac{P_R - jQ_R}{\bar{V}_R^*}) \tag{12}$$

Under load conditions, V_S will lead V_R by an angle δ known as the load angle or the transmission angle. Taking V_R as the reference,

$$\bar{V_S} = V_S e^{j\delta} = V_S(\cos\delta + j\sin\delta). \tag{13}$$

Equating real and imaginary parts of Eqns (12) and (13),

$$V_S \cos\delta = V_R \cos\theta + Z_C(\frac{Q_R}{V_R}) \sin\theta$$
$$V_S \sin\delta = Z_C(\frac{P_R}{V_R}) \sin\theta$$

Rearranging the above equation, we get,

$$\implies P_R = \frac{V_S V_R}{Z_C \sin\theta} \sin\delta. \tag{14}$$

The above expression indicates the power transferred across a line.

If we consider a short line (l ¡ 80 km), we can replace $\sin\theta$ by θ. We get

$$Z_C \sin\theta = Z_C\theta = \sqrt{\frac{L}{C}}\omega\sqrt{LC}l = \omega L l = X_L$$
$$\therefore P_R = \frac{V_S V_R}{X_L} \sin\delta$$

With the voltage magnitudes fixed, the power transferred is a function of the transmission angle δ.

Comparing the real parts of Eqns (12) and (13), we get,

$$V_S \cos\delta = V_R \cos\theta + Z_C(\frac{Q_R}{V_R}) \sin\theta$$
$$\therefore Q_R = \frac{V_R(V_S \cos\delta - V_R \cos\theta)}{Z_C \sin\theta}$$

For a short line, we get

$$Q_R = \frac{V_R(V_S \cos\delta - V_R)}{X_L}. \tag{15}$$

Thus, reactive power transfer is proportional to the voltage difference between the sending and receiving ends of a transmission line, for small values of δ. Eqns (14) and (15) also indicate that the active and reactive power flow can be regulated by controlling the voltages, phase angles and

line impedance of the transmission system.

4 EHV Transmission Lines -Voltage Rise

For a lossless line, from Eqn 10, the voltage at the open circuited receiving end (i.e., $I_R = 0$), can be expressed as,

$$V_R = \frac{V_S}{\cos\theta}. \tag{16}$$

The sending end current for this line is obtained by substituting $I_R = 0$ in Eqn (11),

$$I_S = j\frac{V_R}{Z_C}\sin\theta \tag{17}$$

$$= j\frac{V_S}{Z_C}\tan\theta. \tag{18}$$

Eqn (18) clearly indicates reactive nature of the current. This, is in fact, the capacitive line charging current.

Consider the case of a 400 kV transmission line with four (quad) ACSR Moose sub-conductors per phase. For this line, $\beta = 0.001077$ rad/km. The voltage at the open circuited (o.c.) receiving end is given in Table 1 and also shown in Fig 6.

Table 1: Voltage Rise across o.c. 400 kV Transmission Line

Length (km)	Receiving end Voltage (pu)		
	Vs=1pu	Vs=1.05 pu	Vs=1.1 pu
0	1.000	1.050	1.100
50	1.001	1.052	1.102
100	1.006	1.056	1.106
150	1.013	1.064	1.115
200	1.024	1.075	1.126
250	1.037	1.089	1.141
300	1.055	1.107	1.160
350	1.076	1.129	1.183

For the Tiroda-Warora transmission line with a length of 218.61 km, $\theta = 13.45°$ giving $V_R = 1.028$ pu for $V_S = 1.0$ pu i.e. a rise of 2.8 % at the open circuited receiving end.

Unless regulated, it should be noted that the capacitive VARs generated by a transmission line lead to an increase in voltage at the receiving end if the load is lower than its surge impedance

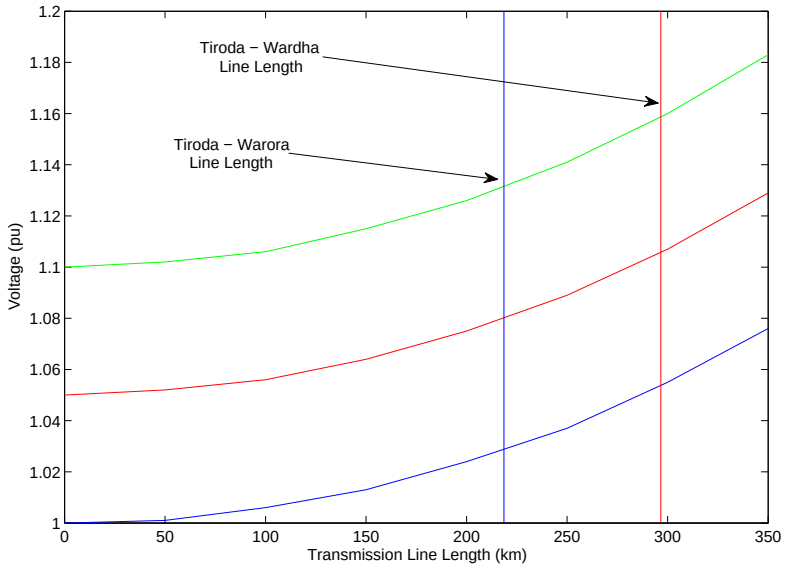

Figure 6: Voltage rise at open circuited receiving end of a 400 kV transmission line.

loading (SIL). On the other hand, a fall in voltage will be observed for loading greater than SIL. Fig 7 shows the voltage profile along a line with $V_S = V_R = 1.0$ pu. It can be observed from the figure that for $P_R < SIL$, there is a rise in the mid-point voltage and reactive power flow is towards the sending and receiving ends i.e. the line generates excess reactive power. On the other hand, for $P_R > SIL$, there is a fall in the mid-point voltage and the line absorbs reactive power. A flat voltage profile is observed for $P_R = SIL$ and $Q_S = Q_R = 0$.

Thus, there is a need for provision of reactive compensation for transmission lines, which is briefly discussed in the next section.

5 Reactive Power Compensation Issues in Transmission Systems

The reactive power compensation for transmission lines can be divided into shunt and series compensation. Series compensation is not covered in this document. We now briefly discuss shunt

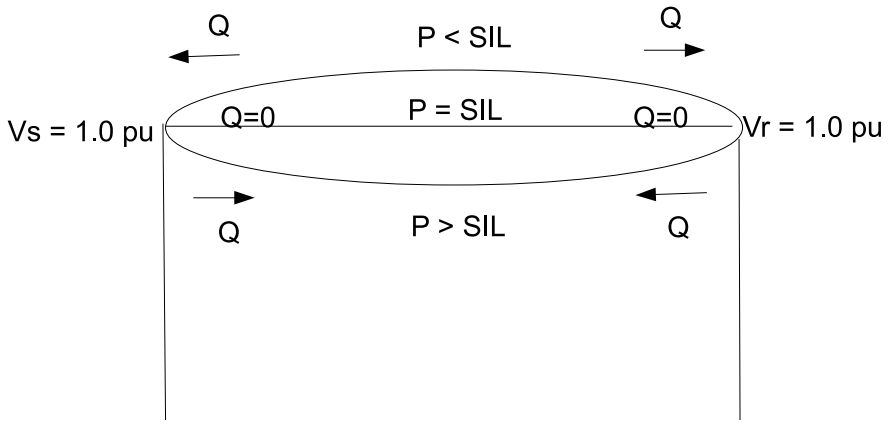

Figure 7: Voltage profile along a transmission line for different loading levels with sending and receiving end voltages regulated at 1 pu i.e., $V_S = V_R = 1.0$ pu.

compensation of transmission lines.

EHV transmission circuits have significant shunt capacitance and shunt reactors absorb capacitive reactive power and are used to reduce overvoltages, while shunt capacitors are used to correct undervoltages, arising out of inductive voltage drops in transmission and distribution lines [2].

Shunt reactors are widely used in transmission system to regulate the voltage magnitude, thus improving voltage quality. While the capacity of thermal turbo-generator sets, to absorb reactive power is limited due to end turn heating, they can supply a much higher magnitude of inductive VARs to the system (refer Fig 8 for the capability curve of a 660 MW thermal generator). However, if the lines are loaded beyond their SIL, then shunt capacitive compensation may be required.

5.1 FACTS Devices

In general, FACTS devices are used where finer control over compensation is desired. FACTS devices also help in improving transient and dynamic stability of power systems. FACTS and FACTS controllers are defined in IEEE Terms and Definitions as follows.

- Flexible AC Transmission System (FACTS): Alternating current transmission systems incorporating power electronic-based and other static controllers to enhance controllability and increase power transfer capability.

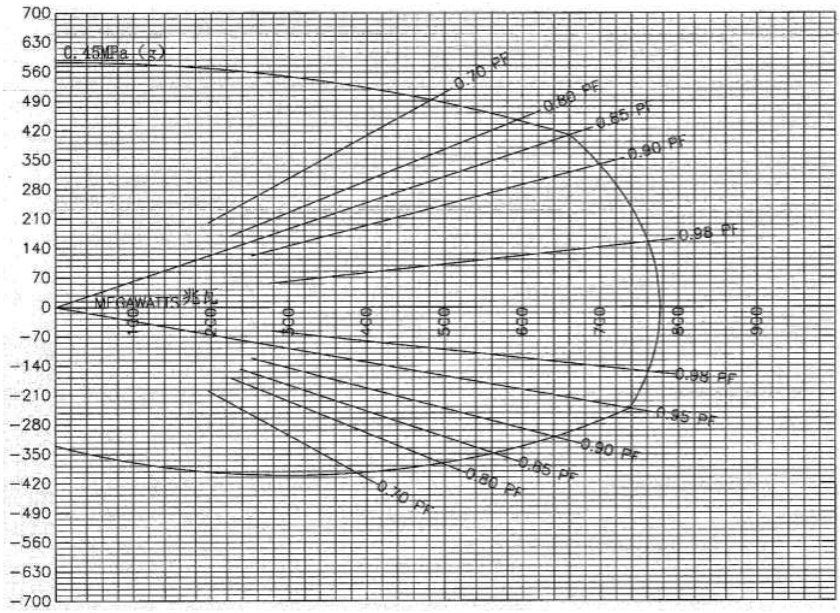

Figure 8: Capability curve of a 660 MW thermal generator set at Tiroda.

- FACTS Controller: A power electronic-based system and other static equipment that provide control of one or more AC transmission system parameters.

One type of FACTS device which are impedance type, based on thyristors are called Static Var Compensators (SVCs). SVCs are used for shunt reactive compensation. Their output can be finely adjusted to supply either inductive or capacitive current and they are typically used to control bus voltage.

5.2 Compensation by SVC at Mid point of a Transmission Line - Effect on Maximum Power Transfer Capability

Consider a transmission line as discussed in Section 3. Also consider that $V_S = V_R = V$ and the phase angle between them is δ. Further assume that dynamic shunt compensation is provided by a SVC, at the mid point of this line and its voltage is also maintained at V. Fig 9 shows a typical SVC. The transmission line is assumed lossless.

Consider the section from sending end S to the mid-point of the line, whose length is $l/2$.

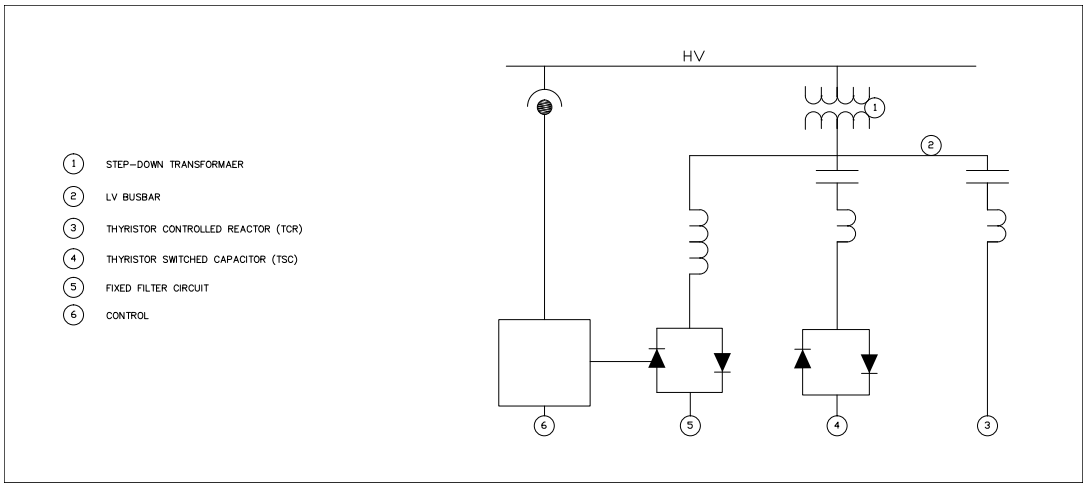

Figure 9: Typical Static VAR Compensator

Therefore for this section $\theta = \beta \times l/2$. Substituting in Eqn 14, we get,

$$P_R = \frac{V^2}{Z_C \sin\frac{\beta l}{2}} \sin\frac{\delta}{2} \tag{19}$$

$$P_R = 2\frac{V^2}{X_L} \sin\frac{\delta}{2} \tag{20}$$

Thus, it can be observed that by providing capacitive compensation at the mid point of the line, the maximum power transfer capability can be doubled, which will also be demonstrated by the following example.

Consider a 400 kV lossless transmission line with $L = 1.04$ mH/km and $C = 12$ nF/Km. For this line $Z_C = 294$ ohms. Let the line length be 300 km and the sending and receiving end voltages of this line be regulated at 1.0 pu, i.e., 400 kV. For such a line SIL = 543 MW. Now consider that $P_R = 650$ MW i.e., the load is greater than SIL. The voltage at the mid-point for this load is 397.45 kV and $\delta = 23.1°$.

If a shunt compensation is provided by means of SVC at the mid point and this voltage is also regulated to 1.0 pu, then $P_R = 1300$ MW for $\delta = 23.1°$. Thus, mid-point compensation using SVC can significantly improve power transfer capability of transmission lines.

6 Reacive Compensation for Transmission and Distribution Lines

In this section, we discuss the difference in reactive compensation required for transmission and distribution lines. First, consider a case of a simple two bus system with a source and a load We consider two cases, a 33 kV distribution system and a 400 kV transmission system with above configuration.

6.1 33 kV distribution line

We consider a 33 kV ACSR Dog pole line of 20 km with a load of 17.8 MVA (considering thermal loading of ACSR Dog). For this line $R = 0.327$ ohm/km, $X = 0.3463$ ohm/km and $B = 3.32 \times 10^{-6}$ mho/km. Notice that $X/R \approx 1$. We observe the following.

- For a load power factor of 0.8, $V_R = 0.83$ pu for $V_S = 1.0$ pu i.e. a regulation of 17% and $P_{loss} = 2.262$ MW i.e., a real power loss of 15.9 %.
- For a load power factor of 1, $V_R = 0.893$ pu for $V_S = 1.0$ pu i.e. a regulation of 11% and $P_{loss} = 1.95$ MW, a real power loss of 10.95 %.

Thus, improving power factor leads to a reduction in regulation as well as active power loss, in this case to the tune of 6% and 5 %, respectively. This example clearly shows that this length of 20 km line should not be loaded to thermal limit as loss and regulation are unsatisfactory. Thus, line loading also depends on the length of the line.

6.2 400 kV EHV transmission line

Next we consider a 400 kV ACSR quad Moose DC line of 218.61 km (with a single circuit in operation). Typically, for this line $R = 0.01479$ ohm/km, $X = 0.2549$ ohm/km and $B = 1.045 \times 10^{-3}$ mho/km. In this case $X/R \approx 17$, also notice that line suseptance is almost 300 times that of a 33 kV line.

- With V_S set to 1.0 pu, $V_R = 1.028$ pu i.e., a rise of 2.8 %, and $Q_S = -162.05$ MVAR. In this case $Q_R = 0$.

- With V_S set to 1.0 pu, $V_R = 1.131$ pu i.e., a rise of 2.8 % and $Q_S = -196.09$ MVAR. In this case also $Q_R = 0$.

- If a 160 MVAR reactor is added at receiving end bus, with the sending end voltage at 1.0 pu, $V_R = 1.07$ pu. Here, $Q_S = -2.5$ MVAR and $Q_R = 183.2$ MVAR.

- For a load of 30 MVA at 0.8 power factor (which is the approximate start up power requirement) and 160 MVAR reactor at the receiving end, with the sending end voltage at 1.0 pu, $V_R = 1.07$ pu. Here also, and $Q_S = -2.18$ MVAR and $Q_R = 183.2$ MVAR. Note that the reactive power absorbed by the shunt reactor is given by $Q_{reactor} = 160 \times |V_R|^2$.

6.3 Observations

The above comparison of transmission and distribution systems leads to the following observations.

- In a distribution system, the line susceptance is negligible and hardly any capacitive VARs are generated by the line. The inductive voltage drop due to series reactance of the line leads to a voltage drop even across very lightly loaded lines.

- Hence, in a distribution system, the inductive VARs consumed by the load need to be compensated by provision of shunt capacitors which can significantly improve regulation and line loss.[1]

- On the other hand, in an EHV transmission system, voltage rise is observed at receiving end for light load conditions (below SIL) due to dominance of shunt capacitive VARs.

- The capacitive VARs generated by EHV transmission lines, may require compensation by inductive VARs, to maintain proper regulation and improve voltage profile of the system.

- Shunt reactors are also required during charging of EHV transmission lines to control the transient overvoltages that are likely to occur when such lines are energised.

- In case of the Tiroda-Warora line, it should be noted that there is no load on the Warora 400 kV bus and radial connection continues upto Wardha. Hence, the line is in effect the Tiroda-Wardha line with a line length of 296.65 km. If this line length is considered, the voltage rise,

[1] Distribution companies have incentives and penalties so that consumer does his own reactive power management, typically by providing shunt capacitors.

as per Fig 6, at receiving end is approximately 5.5 % (this is under the assumption that the Wardha-Warora line has identical parameters as Tiroda-Wardha Line).

- The 400 kV bus voltages around Wardha are consistently higher than 400 kV due to the presence of large generation capacity and low loading levels. Further 765 kV substation is located at Wardha and 1200 kV is likely to come up in the near future.

7 Summary

We conclude the following.

- In a transmission system, reactive power management can be much more complex than distribution systems.
- Typically, distribution systems require capacitive support to compensate inductive VARs of loads. This leads to improved voltage regulation and reduction in losses.
- In contrast, transmission systems can have undervoltages or overvoltages depending on loading conditions.
- Under light loads, capacitive VARs generated by the transmission line can dominate the inductive VARS of series reactance of the line. Hence, there is a requirement of shunt inductive compensation.
- Under peak load conditions and to improve peak transmission loadability of lines, one may require capacitive compensation.
- Typically, transmission systems are connected to generators which set the voltage reference. Generators can absorb or deliver VARs within their capability curves. Reactive power absorption capability of thermal generators is significantly lower than their reactive power injection capability. Hence, during light loading conditions inductive compensation may be required to control overvoltages.
- In general to meet dynamic voltage support requirement in a transmission systems, FACTS devices like SVCs may also be required over and above generator AVR control, OLTCs and switchable shunt compensation.

References

[1] P. Kundur, *Power System Stability and Control.* New York: McGraw-Hill, Inc., 1993.

[2] T. Miller, *Reactive Power Control in Electric Systems.* New York: John Wiley and Sons, Inc., 1982.

Appendix A

The following members were present in the committee meeting held on 19/07/2013. The convener was Mr. S. A. Soman, IIT Bombay. MERC to revise the list based on full names of the participants, designations and organizational affiliations.

- Mr. Kelkar, STU
- Mr. P. Pentayya, WRLDC
- Mr. Sonkavday, STU
- Dr. Sanjay Kulkarni, SLDC
- Mr. Vivek Panday, WRLDC
- Mr. Jayant Kulkarni, SLDC
- Mr. Pande, SLDC
- Mr. Kishore Chavan, MERC
- Mr. Prafulla Varhade, MERC
- Mr. Krishna Rao, AMPL
- Mr. Dhantole, MSEDCL
- Mr. Pardhi, MSETCL
- Mr. Sundary, AMPL
- Mr. Phatak, AMPL
- Mr. S. A. Soman, IIT Bombay (Convener)
- Mr. P. V. Navalkar, IIT Bombay

C. C. Chokshi & Co.

C. C. Chokshi & Co.
Chartered Accountants
'Heritage', 3rd Floor,
Near Gujarat Vidhyapith,
Off Ashram Road,
Ahmedabad - 380 014.
Tel +91 (79) 27582542
+91 (79) 27582543
+91 (79) 66073100
Fax . +91 (79) 27582551

REF: GJS/APML/2013-14/16

CERTIFICATE

Adani Power Maharashtra Limited (Registered office at "Adani House", Near Mithakhali Six Roads, Navrangpura, Ahmedabad – 380 009) ('the Company"), vide its letter dated 27th November, 2013 has requested us to verify the financial information contained in the **Annexure** attached hereto showing the details of total cost incurred by the Company for 2 numbers of 80 MVAR Bus Reactors and for 2 numbers of 80 MVAR Bus Reactor Bays, at Tiroda, Maharashtra as at 31st March, 2013, have been properly extracted from the books of account and other records of the Company for the year ended 31st March, 2013.

The preparation of the attached **Annexure** and the maintenance of the related books of account and other records is the responsibility of the management of the Company. Our responsibility is to state whether the financial information contained in the **Annexure** has been properly extracted from the books of account and other records of the Company.

We have verified the information in the **Annexure** (i) with the books of account and other relevant records maintained by the Company and (ii) with a certificate of R.K.Patel & Co., Chartered Engineers, dated December 3, 2013 having Ref. Number : Ch Engg/APML/Dec/01/2013-14, regarding details of various materials used and costs incurred for construction of 2 numbers of (a) 80 MVAR Reactors and (b) 80 MVAR Reactor Bays, as furnished to us by the Company.

Based on such verification and the information, explanations and representations provided to us by the Company, we state that the information contained in the **Annexure** have been properly extracted from the books of account and other relevant records of the Company and above mentioned certificate of the Chartered Engineers. The **Annexure** has been stamped and initialed by us for the purpose of identification.

This certificate is being issued by us, at the request of the Company for the purpose of submitting the same to the Maharashtra Electricity Regulatory Commission and should not be used /submitted to any other person/party for any other purpose without our prior written consent.

For C. C. Chokshi & Co.
Chartered Accountants
(ICAI Reg. No. 101876W)

Partner

Gaurav J. Shah - M. No. 35701

AHMEDABAD, 4th December, 2013

Annexure

(As referred to in Certificate REF: GJS/APML/2013-14/16 issued by C.C.Chokshi & Co., Ahmedabad, the Statutory Auditors of the Company)

Adani Power Maharashtra Limited

Total cost incurred for 2 numbers of 80 MVAR Bus Reactors and 2 numbers of 80 MVAR Bus Reactor Bays, at Tiroda, Maharashtra as at 31st March, 2013

(Amount - Rs. In Crores)

Particulars of Company's Bus Reactors and Bus Reactor Bays	Quantity	Amount
Capital Cost of 80 MVAR Bus Reactors	2	10.82
Capital Cost of 80 MVAR Bus Reactor Bays	2	12.42
Total		**23.24**

For, Adani Power Maharashtra Limited

Authorised Signatory

4th Dec 2013

Adani Power Maharashtra Limited
Notice of Amendment of Transmission License

Adani Power Maharashtra Limited has made an application before Maharashtra Electricity Regulatory Commission for the amendment of "Transmission License for Adani Power Maharashtra Limited (License No. 2 of 2009)" granted u/s 14 of the Electricity Act, 2003 (36 of 2003) and Maharashtra Electricity Regulatory Commission (Transmission License Conditions) Regulations, 2004, as amended in 2006. The particulars in respect of the application are as following:

Nature of Transmission Licensee: Adani Power Maharashtra Limited

Address of main office in the area of Transmission:
Adani Power Maharashtra Limited
B 401, 4th Floor, Thapar Enclave-II
Ramdaspeth
Nagpur – 440 010
Maharashtra

Description of alteration or amendment for which application has been made to the Hon'ble Commission:

Existing Area of Transmission	Amended Area of Transmission Proposed
a. 400 KV Double Circuit Transmission Line with quad conductor from Tiroda (Gondia) to 400 KV Warora Switching Station b. 2 Nos., 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Tiroda Project Switchyard c. 2 Nos. 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Warora switching station	a. 400 KV Double Circuit Transmission Line with quad conductor from Tiroda (Gondia) to 400 KV Warora Switching Station b. 2 Nos., 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Tiroda Project Switchyard c. 2 Nos. 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Warora switching station d. **2 x 80 MVAR Bus Reactors along with associated bays at Tiroda Substation**

The license after amendment would authorize the Transmission Licensee to operate the following Transmission lines inclusive of related infrastructure:

e. 400 KV Double Circuit Transmission Line with quad conductor from Tiroda (Gondia) to 400 KV Warora Switching Station
f. 2 Nos., 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Tiroda Project Switchyard

g. 2 Nos. 400 KV bays for Tiroda-Warora Double Circuit Transmission lines at Warora switching station
h. 2 x 80 MVAR Bus Reactors along with associated bays at Tiroda Substation

Rationale for the proposed alteration or amendment: The 400 kV D/C Tiroda-Warora Transmission system planned by STU was included in the STU Transmission plan for FY 2010-11 to FY 2014-15. Adani Power Maharashtra Limited was granted the Transmission License No. 2 of 2009 on July 06, 2009 (amended on March 30, 2011) for executing the said system. The said License did not include Bus Reactors at Tiroda Substation. Due to High voltage prevailing in Wardha and Warora areas coupled with the line capacitance at the time of commissioning of Tiroda-Warora line, it became imperative to compensate the impact by way of installation of Bus Reactor. The same has been highlighted in various Technical Reports, correspondences from WRLDC/SLDC and has also been stipulated in the Commission's Order in Case No. 51 of 2013 and Case No. 190 of 2013. Accordingly, Bus Reactors need to be considered as an integral part of APML's Licensed Transmission System.

The application and other documents can be inspected in the office of the following persons during the working hours between 10 am to 5 pm on any working day:

1. **Mr. Jignesh Langalia**, Adani Power Maharashtra Limited, 3rd Floor, Achalraj Building, Opposite Mayor's Bungalow, Law Garden, Ahmedabad – 380006

2. **Mr. Ajit Barodia**, 601, Hallmark Business Plaza, Sant Dnyaneshwar Marg, Near Kalamandir Talkies, Opposite Gurunanak Hospital, Bandra (East), Mumbai - 400051

Application and other documents can also be purchased in person from the above persons by paying Rs 10/- (Rs. Ten only) for the application and Rs 100/- (Rs Hundred only) for the application together with other documents.

Application and other documents can also be purchased by post by sending a request to Mr. Jignesh Langalia, 3rd Floor, Achalraj Building, Opposite Mayor's Bungalow, Law Garden, Ahmedabad – 380006 along with Demand Draft in favor of "Adani Power Maharashtra Limited" payable at Ahmedabad for an amount of Rs 30/- (Rs. Thirty only) for the application and Rs. 130/- (Rs One Hundred and Thirty only) for the application together with other documents.

Inspection and sale of application and other documents would remain open up to thirty days from publication of this notice.

Website of applicant: The application/documents can be downloaded free of cost from our website **www.adanipower.com**

NOTICE:

Any person desirous of making any objection with reference to application to Commission, may do so by way of a written intimation (six copies) addressed to the Principal Secretary, Maharashtra Electricity Regulatory Commission, World Trade Centre, Center No. 1, 13th Floor, Cuffe Parade, Colaba, Mumbai – 400005 with a copy to the applicant, so as to be received before the expiration of thirty days from the date of publication of this Notice.