

**Petition for**  
**In-Principle approval for capital expenditure for**  
**implementation of revised Emission Norms in the power**  
**plants of RVUN**

Submitted to

Rajasthan Electricity Regulatory Commission

Jaipur

by

Rajasthan Rajya Vidyut Utpadan Nigam Limited

Vidyut Bhavan, Janpath, Jaipur

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## A1: BACKGROUND

- 1.1 Rajasthan Rajya Vidyut Utpadan Nigam Ltd (RVUN) was incorporated under the Companies Act 1956, as one of the five successor companies of erstwhile Rajasthan State Electricity Board (RSEB) to take over the electricity generation business in the state of Rajasthan. The existing power stations and those under commissioning in the state sector were transferred to RVUN as per the Rajasthan Power Sector Reforms Transfer Scheme, 2000 notified by State Government provisionally on 19th July 2000 and finally on 18th January 2002.
- 1.2 RVUN has entered into Long Term Power supply-Purchase Agreements (PPA) in respect of existing and future power projects for 25 Years with the three Discoms on 28.09.06 and subsequently various supplementary PPA's with Discoms.
- 1.3 The Commissioning and Commercial Operation dates of KSTPS, STPS, CTPP, KaTPP, CSCTPP and SSCTPP are as under:

**Table-1 Details of COD of Units**

S.No.	Plant name	Capacity(MW)	Date of COD
1.	KSTPS Unit-1,2,3,4,5,6 &7	Unit-1&2 : 1x110 Unit-3,4&5 : 1x210 Unit-6 & 7 : 2x195	Unit-1 : 01.04.1983 Unit-2 : 01.04.1984 Unit-3 : 11.03.1989 Unit-4 : 16.01.1990 Unit-5 : 18.07.1995 Unit-6 : 01.08.2004 Unit-7 : 31.12.2009
2.	STPS Unit- 1to 6	6X250	Unit-1 : 01.02.1999 Unit-2 : 01.10.2000 Unit-3 : 15.01.2002 Unit-4 : 31.07.2002 Unit-5 : 19.08.2003 Unit-6 : 30.12.2009
3.	CTPP Unit – 1to 4	4X250	Unit-1 : 11.06.2010 Unit-2 : 15.10.2011 Unit-3 : 19.12.2013 Unit-3 : 30.12.2014
4.	KaTPP-Unit-1&2	2X600	Unit-1 : 07.05.2014 Unit-2 : 25.07.2015
5.	SSCTPP Unit- 7&8	2X660	Unit-7 : under construction Unit-8 : under construction
6.	CSCTPP Unit-5&6	2X660	Unit-5 : 09.08.2018 Unit-6 : under construction

## **A2: SALIENT FEATURES OF THE PETITION**

- 2.1 RVUN is filing this petition for In-Principle approval of the Hon'ble Commission for capital expenditure for implementation of revised Emission Norms in the power plants of RVUN under Regulation 17(2) (ii) of RERC Tariff Regulations, 2014 which is reproduced as under:

### **"17. Additional Capitalisation**

2. *The capital expenditure incurred on the following counts after the cut-off date may at its discretion, be admitted by the Commission, subject to prudence check:*

*(ii) Change in law."*

- 2.2 Further, Change in Law is defined in regulation 2(13)(i) of RERC Regulations, 2014, which is reproduced as under:

"Change in Law" means occurrence of any of the following events:

- (i) the enactment, bringing into effect, adoption, promulgation, amendment, modification or repeal of any Indian law.

## **A3: BRIEF HISTORY**

- 3.1 Ministry of Environment, Forest and Climate Change, Government of India issued Gazette notification on 7th December 2015 amending Environment (Protection) Rules, 1986. Amended rules will be called Environment (Protection) Amendment Rule, 2015. Gazette notification of Amendment on the water consumption limits and stack height was issued on dated 28th June 2018. The revised standards are mandatory in nature and are to be complied with within a stipulated time frame. (Copy of MOEF&CC Notification dated 07 Dec, 15 and 28 June,18 as **Annexure-A.**)
- 3.2 Ministry of Power (GoI), vide letter dated 30.05.2018 addressed to Central Electricity Regulatory Commission (CERC) has issued directions **for smooth implementation of the revised emission standards and mechanism.** The said letter is enclosed as **Annexure-B.**
- 3.3 The Central Electricity Authority (CEA), in compliance to Hon'ble Supreme Court's hearing, has made recommendations regarding incentives to thermal power plants for early installation of Pollution Control Equipments. The said letter is enclosed as **Annexure-C.**

3.4 The Emission standards for Thermal Power Plants as per Ministry of Environment, Forest and Climate Change are below:

**Table 2: Emission Standards as per MOEF & CC for TPPs (units) installed before 31<sup>st</sup> December, 2003**

Sr. No.	Industry	Parameter	Standards
1	<b>Thermal Power Plants</b>	Particulate Matter	100 mg/Nm <sup>3</sup>
2		Sulphur Dioxide (SO <sub>2</sub> )	600 mg/Nm <sup>3</sup> (Units Smaller than 500 MW capacity units) 200 mg/Nm <sup>3</sup> (for units having capacity of 500 MW and above)
3		Oxides of Nitrogen (NO <sub>x</sub> )	600 mg/Nm <sup>3</sup>
4		Mercury (Hg)	0.03 mg/Nm <sup>3</sup> (for units having capacity of 500 MW and above)
5		Water Consumption	Maximum 3.5 m <sup>3</sup> /MWh

**Table 3: Emission Standards as per MOEF & CC for TPPs (units) installed after 1<sup>st</sup> January, 2004 up to 31<sup>st</sup> December, 2016**

Sr. No.	Industry	Parameter	Standards
1	<b>Thermal Power Plants</b>	Particulate Matter	50 mg/Nm <sup>3</sup>
2		Sulphur Dioxide (SO <sub>2</sub> )	600 mg/Nm <sup>3</sup> (Units Smaller than 500 MW capacity units) 200 mg/Nm <sup>3</sup> (for units having capacity of 500 MW and above)
3		Oxides of Nitrogen (NO <sub>x</sub> )	300 mg/Nm <sup>3</sup>
4		Mercury (Hg)	0.03 mg/Nm <sup>3</sup>
5		Water Consumption	Maximum 3.5 m <sup>3</sup> /MWh

**Table 4: Emission Standards as per MOEF&CC TPPs (units) installed from 1<sup>st</sup> January, 2017**

Sr. No.	Industry	Parameter	Standards
1	<b>Thermal Power Plants</b>	Particulate	30 mg/Nm <sup>3</sup>
2		Sulphur Dioxide (SO <sub>2</sub> )	100 mg/Nm <sup>3</sup>
3		Oxides of Nitrogen (NO <sub>x</sub> )	100 mg/Nm <sup>3</sup>
4		Mercury (Hg)	0.03 mg/Nm <sup>3</sup>
5		Water Consumption	Maximum 3.0 m <sup>3</sup> /MWh
6		Zero Liquid Discharge	To be adopted.

3.14 Further, the BOD, RVUN in its 275<sup>th</sup> and 284<sup>th</sup> meeting held on dated 13.11.2017 and 26.12.2018 respectively (enclosed as **Annexure-D**) have approved the cost of implementation of revised emission norms at RVUN plants as under:

**Table 5: Details of Cost for implementation of emission norms as approved by the BoD for RVUN plants**

Rs in cr

Sr. No.	Description	KSTPS (5,6&7)	STPS (1to6)	CTPP (1to4)	KaTPP (1&2)	CSCTPP (5&6)	SSCTPS (7&8)	Estimated Total Cost including IDC
1.	FGD Installation				600.00			600.00
2.	De SOx (FGD) Installation	342.00	865.02	593.74		660.00	660.00	3120.76
3.	De NOX System (SCR System)	78.60	78.60	470.08	393.37	528.00	528.00	2076.65
5.	ESP upgradation	4.38	10.95	8.77		172.00	172.00	368.10
6.	ETP, waste water treatment plant	79.35	44.91					124.26
7.	<b>Total</b>	504.33	999.48	1072.59	993.37	1360.00	1360.00	6289.77



- 3.15 RRVUNL has appointed M/s Fichtner Consulting Engineers (India) Private Limited “hereafter called as M/s FCEIPL” to prepare Feasibility Report after carrying out the evaluation and assessment for implementation of the revised emission norms for existing/and under construction power plants of RRVUNL. M/s FCEIPL submitted their final Feasibility Report on dated 01.02.2018 .
- 3.16 M/s FCEIPL team visited the power plant sites to study the plant details. M/s FCEIPL team collected the plant design data, specifically with regard to coal analysis, Plant water consumption, designed/actual emissions levels of SO<sub>x</sub>, NO<sub>x</sub>. The data collected from RRVUNL during the site visit. The measurement for plant specific water consumption was carried out by M/s FCEIPL. (Copy of the final feasibility reports of thermal power plants are enclosed )–**Annexure-F**.
- 3.17 Impact of pollution control equipments on plant design is as under:
- (I) Impact of FGD, SNCR and FGD WWTP plant design for KSTPS (1X210 & 2X195 MW unit)
- (a) The total Auxiliary power requirement for unit 5 is around 5100 KW, for unit 6 to be 3250 KW and for unit 7 to be around 3344 kW for each unit. This will work out to around 2.43%, 1.67% & 1.71% of installed capacity respectively.
- (b) The flue gas temperature at FGD outlet after installation of wet limestone FGD is around 54.4°C. Hence, each unit is recommended to be provided with separate RCC wet stack of minimum 120m height, with steel flue with suitable corrosion and acid resistant lining. Hot flue gas during FGD bypass operation shall be dispersed through the existing stack.
- (c) The FGD make up water requirement for each unit shall be around 42 m<sup>3</sup>/hr, based on M/s FCEIPL report. Clarifier Raw water shall be used as FGD make up water.
- (d) The plant specific water consumption is above the MOEF & CC stipulated limit with and without considering FGD makeup. Hence, measures to reduce plant water consumption are recommended for implementation.
- (e) Limestone is the sorbent used in FGD. The estimated lime stone requirement for each unit is around 1.817 TPH. The quantity of Limestone is arrived based on minimum purity of 85%.
- (f) Gypsum generation in the process shall be 3.344 TPH.
- (g) The aqueous Reagent (aqueous Ammonia) consumption estimated is 0.515 TPH for unit 7 boiler to reduce NO<sub>x</sub> in SNCR.

(II) Impact of FGD, SNCR and FGD WWTP plant design for STPS (each 250 MW unit)

- (a) The total Auxiliary power requirement of FGD and Waste water treatment systems is estimated to be around 3254 kW for 1 to 5 units and 3330 kW for unit 6 including SNCR system. This will work out to around 1.3% & 1.33% of installed capacity.
- (b) The flue gas temperature at FGD outlet after installation of wet limestone FGD is around 54.5°C. Hence, each unit is recommended to be provided with separate RCC wet stack of minimum 120m height, with steel flue with suitable corrosion and acid resistant lining. Hot flue gas during FGD bypass operation shall be dispersed through the existing stack.
- (c) The FGD make up water requirement shall be around 56 m<sup>3</sup>/hr, based on M/s FCEIPL report. Clarifier Raw water shall be used as FGD make up water.
- (d) The plant specific water consumption is above the MOEF & CC stipulated limit with and without considering FGD makeup. Hence, measures to reduce plant water consumption are recommended for implementation.
- (e) Lime stone is the sorbent used in FGD. The estimated lime stone requirement for each unit is around 2.1 TPH. The quantity of Limestone is arrived based on minimum purity of 85%.
- (f) Gypsum generation in the process shall be 3.9 TPH.
- (g) The aqueous Reagent (aqueous Ammonia) consumption estimated is 0.7 TPH for unit 6 boiler to reduce NO<sub>x</sub> in SNCR.

(III) Impact of FGD, SNCR and FGD WWTP on plant design for CTPP (each 250 MW unit)

- (a) The total Auxiliary power consumption for FGD, SNCR and FGD WWTP is estimated as 2749 kW, which is about 1.07% of gross unit power output.
- (b) The flue gas temperature at FGD outlet after installation of wet limestone FGD is around 54.5°C. Hence, each unit is recommended to be provided with separate RCC wet stack of minimum 100m height, with steel flue with suitable corrosion and acid resistant lining. Hot flue gas during FGD bypass operation shall be dispersed through the existing stack.

- (c) The FGD make up water requirement shall be around 56 m<sup>3</sup>/hr, based on M/s FCEIPL report. Clarifier Raw water shall be used as FGD make up water.
- (d) FGD waste water treatment plant (UF-RO based) is proposed to treat the FGD waste water.
- (e) Lime stone is the sorbent used in FGD. The estimated lime stone requirement for each unit is around 2.1 TPH. The quantity of Limestone is arrived based on minimum purity of 85%.
- (f) Gypsum generation in the process shall be 3.9 TPH.
- (g) The aqueous Reagent (aqueous Ammonia) consumption shall be 0.6 TPH for each boiler.

(IV) Impact of FGD,SNCR and FGD WWTP on plant design for KATPP (each 600 MW unit)

- (a) The total Auxiliary power consumption is estimated as 7914 kW, which is about 1.32% of gross unit power output. Major power consumers are Booster Fan, Slurry recirculation pumps.
- (b) The flue gas temperature at wet stack inlet after installation of wet limestone FGD is around 54.5°C. Hence, each unit is recommended to be provided with separate RCC wet stack of minimum 100m height, with steel flue with suitable corrosion and acid resistant lining. Hot flue gas during FGD bypass operation shall be dispersed through the existing stack.
- (c) The FGD make up water requirement shall be around 135 m<sup>3</sup>/hr, based on M/s FCEIPL report. Clarifier Raw water shall be used as FGD make up water.
- (d) The design plant specific water consumption is within the MOEF & CC stipulated limit. Plant specific water consumption including the FGD makeup water requirement works out to around 3.04 m<sup>3</sup>/MWh, which is also within the stipulated MOEF&CC norms.

- (e) Lime stone is the sorbent used in FGD. The estimated lime stone requirement for each unit is around 6.568 TPH. The quantity of Limestone is arrived based on minimum purity of 85%.
- (f) Gypsum generation in the process shall be 11.77 TPH for each boiler.
- (g) The aqueous Reagent (aqueous Ammonia) consumption shall be 1.497 TPH for each boiler.

(V) Impact of FGD, SCR, ZLD on plant design for SSCTPS (each 660 MW unit)

- (a) The total Auxiliary power consumption for FGD, SCR, ZLD plant and PAC systems is estimated as 9777 kW, which is about 1.48% of gross unit power output.
- (b) The flue gas temperature at FGD outlet after installation of wet limestone FGD is around 53°C. Hence, each unit is recommended to be provided with separate RCC wet stack of minimum 100m height, with steel flue with suitable corrosion and acid resistant lining. Hot flue gas during FGD bypass operation shall be dispersed through the existing stack.
- (c) The FGD make up water requirement for each unit shall be around 154m<sup>3</sup>/hr, on continuous basis. The make-up water shall be sourced from clarified water/ CT blow down tank.
- (d) Plant specific water consumption including the FGD make up water requirement works out to around 3.66 m<sup>3</sup>/MW, which is exceeding the stipulated MOEF&CC norms. Measures to reduce the plant water consumption to meet the MOE stipulation is recommended.
- (e) Lime stone is the sorbent used in FGD. The estimated lime stone requirement for each unit is around 7.1 TPH. The quantity of Limestone is arrived based on minimum purity of 85%.
- (f) Gypsum generation in the process shall be 12.7 TPH.

(VI) Impact of FGD, SCR, ZLD on plant design for CSCTPP (each 660 MW unit)

- (a) The total Auxiliary power consumption for FGD, SCR, PAC, ZLD systems is estimated as 9138 kW, which is about 1.38% of gross unit power output.
- (b) The flue gas temperature at FGD outlet after installation of wet limestone FGD is around 54.5°C. Hence, each unit is recommended to be provided with separate RCC wet stack of minimum 100m height, with steel flue with suitable corrosion and acid resistant lining. Hot flue gas during FGD bypass operation shall be dispersed through the existing stack.
- (c) Make up water requirement for each Wet FGD system works out to 154 m<sup>3</sup>/hr. This water requirement will be tapped from clarified water source. With the additional water requirement for FGD, the consumptive water requirement increases by 308 m<sup>3</sup>/h and the specific water consumption to 3.2 m<sup>3</sup>/MWh and 2.82 m<sup>3</sup>/MWh without and with ash water recovery respectively.
- (d) Lime stone is the sorbent used in FGD. The estimated lime stone requirement for each unit is around 7 TPH. The quantity of Limestone is arrived based on minimum purity of 85%.
- (e) Gypsum generation in the process shall be 12.5 TPH.

Observation and Recommendation carried out by M/s FCEIPL

(I) For KSTPS (1X210 & 2X195 MW unit)

- (a) To restrict the SO<sub>2</sub> emission levels below the stipulated value of 600 mg/Nm<sup>3</sup>, wet lime stone based FGD with 68.5% efficiency is recommended.
- (b) The NO<sub>x</sub> emission levels measured are within the MOEF&CC stipulated limit in the unit 5 & 6. Hence no NO<sub>x</sub> emission control measures are required.

- (c) The M/s FCEIPL measured value of NO<sub>x</sub> emission for the unit 7 is 654.8 mg/Nm<sup>3</sup>. To restrict the NO<sub>x</sub> emission levels below the stipulated value of 300 mg/Nm<sup>3</sup>, A combustion control method along with Selective Non-Catalytic Reduction (SNCR) technology is recommended.
  - (d) PM emission for unit 5 is below the MOEF stipulated limit, however considering the historic emission data provided by RRVUNL, the maximum value 130.61mg/Nm<sup>3</sup> PM level is considered which is exceeding the MOEF&CC stipulated limit by around 3.32 times, hence modification of existing ESP is recommended to limit the Particulate Matter with in 100 mg/Nm<sup>3</sup>.
  - (e) PM level in Unit 6 flue gas is 332 mg/Nm<sup>3</sup>, which is exceeding the MOEF&CC stipulated limit by around 3.32 times, hence modification of existing ESP is recommended to limit the Particulate Matter with in 100 mg/Nm<sup>3</sup>. In Unit 7 the PM level in flue gas is 425 mg/Nm<sup>3</sup>, which is exceeding the MOEF&CC stipulated limit by around 8.5 times, hence modification of existing ESP is recommended to limit the Particulate Matter with in 50 mg/Nm<sup>3</sup>.
  - (f) The plant specific water consumption is above the MOEF & CC stipulated limit with and without considering FGD makeup. Hence, measures to reduce plant water consumption are recommended for implementation.
- (II) For STPS (each 250 MW unit)
- (a) To restrict the SO<sub>2</sub> emission levels below the stipulated value of 600 mg/Nm<sup>3</sup>, wet lime stone based FGD with 68.6% efficiency is recommended.
  - (b) The baseline NO<sub>x</sub> emission level is marginally above the MOEF&CC stipulated limit in the unit 1 to 5. Hence, RRVUNL is recommended to consult with Boiler OEM for adjusting the existing Low NO<sub>x</sub> burners, and OFA system to reduce the NO<sub>x</sub> emission in the Units 1 to 5, such as to meet the MOEF&CC stipulated limit.

- (c) The baseline NO<sub>x</sub> emission for the unit 6 is 619.05 mg/Nm<sup>3</sup>. To restrict the NO<sub>x</sub> emission levels below the MOEF&CC stipulated value of 300 mg/Nm<sup>3</sup>,
- (d) Implementation of Selective Non-Catalytic Reduction (SNCR) technology is recommended along with the adjustment in the existing combustion control.
- (e) In all the six units PM emission levels are exceeding the MOEF&CC stipulated limit, hence suitable ESP retrofit measures are suggested to meet the MOEF&CC stipulation.
- (f) The plant specific water consumption is above the MOEF & CC stipulated limit with and without considering FGD makeup. Hence, measures to reduce plant water consumption are recommended for implementation.

(III) For CTPP (each 250 MW unit)

- (a) To restrict the SO<sub>2</sub> emission levels below the stipulated value of 600 mg/Nm<sup>3</sup>, wet lime stone based FGD with efficiency of around 69% is recommended.
- (b) The M/s FCEIPL measured value of NO<sub>x</sub> emission is 615.29 mg/Nm<sup>3</sup>. To restrict the NO<sub>x</sub> emission levels below the stipulated value of 300 mg/Nm<sup>3</sup>, Combustion control methods along with Selective Non-Catalytic Reduction (SNCR) technology is recommended.
- (c) In Unit 1,2,3 & 4 the PM level in flue gas is exceeding the MOEF&CC stipulated limit, Hence, modification of existing ESP is recommended to limit the particulate matter within 50 mg/Nm<sup>3</sup>.
- (d) The design specific plant water consumption is within the MOEF&CC stipulated limit. The FGD make up water requirement shall be around 56 m<sup>3</sup>/hr, on continuous basis. The make-up water shall be clarified water.

- (e) With the additional water requirement for FGD from the clarified water system, the consumptive water requirement increases by 84 m<sup>3</sup>/h for each phase. The specific water consumption for Phase 1 will be 3.38 m<sup>3</sup>/MWh and for phase 2 will be 3.53 m<sup>3</sup>/MWh, when including FGD water requirement. When considering the actual historic plant water consumption of 3.18 m<sup>3</sup>/MWh, the specific water consumption including FGD requirement is around 3.35 m<sup>3</sup>/MWh, which is within MOEF&CC stipulation.
- (f) FGD waste water treatment plant (UF-RO based) is proposed to treat the FGD waste water.

(IV) For KATPP (each 600 MW unit)

- (a) To restrict the SO<sub>2</sub> emission levels below the stipulated value of 200 mg/Nm<sup>3</sup>, wet lime stone based FGD with 89.47% efficiency is recommended.
- (b) The NO<sub>x</sub> emission for the plant is 472.29 mg/Nm<sup>3</sup> which is exceeding the MOEF stipulated limit of 300 mg/Nm<sup>3</sup>. Selective Non-Catalytic Reduction (SNCR) technology is proposed to control NO<sub>x</sub> emission level to the MOEF&CC stipulation.
- (c) The measured PM emissions limits in flue gas of unit 1 is 124.62 mg/Nm<sup>3</sup>. Which is exceeding the MOEF&CC stipulated limit by around 2.5 times. Hence, suitable abatement methods are to be implemented considering the PM reduction due to WFGD.
- (d) The measured PM emissions limits in flue gas of unit 2 is 97 mg/Nm<sup>3</sup>. which is exceeding the MOEF&CC stipulated limit by around 1.94 times, Hence, suitable abatement methods are to be implemented considering the PM reduction due to WFGD.
- (e) The plant specific water consumption including FGD requirement is within the MOEF&CC stipulated limit.
- (f) FGD waste water is recommended to be treated in a separate UF-RO based waste water treatment plant.

(V) For SSCTPS (each 660 MW unit)

- (a) To restrict the SO<sub>2</sub> emission levels below the stipulated value of 100 mg/Nm<sup>3</sup>, wet lime stone based FGD with around 95% efficiency is recommended.
- (b) The design value of NO<sub>x</sub> emission for the plant is 743 mg/Nm<sup>3</sup>. This is as per the boiler design data.



- (c) For NO<sub>x</sub> control, Primary measures like Low NO<sub>x</sub> burners, Over fire air ports, O<sub>2</sub> Trimming are proposed along with SCR system to limit the NO<sub>x</sub> emission to the MOEF stipulated limit of 100 mg/Nm<sup>3</sup>.
- (d) The designed PM emissions limits in the Plant are exceeding the MOEF & CC Norms. Hence, suitable abatement methods in ESP are to be implemented considering the PM reduction due to WFGD.
- (e) The plant design specific water consumption without considering FGD requirement exceeds the MOEF&CC stipulated limit. Hence suitable measures to reduce plant water consumption are recommended with the additional water requirement for FGD, the consumptive water requirement increases by 308 m<sup>3</sup>/h and the specific water consumption to 3.66 m<sup>3</sup>/MWh when there is no ash water recovery, 3.53 m<sup>3</sup>/MWh when the ash water recovery is established. Ash water recovery is expected to be within first year of plant operation which would be the plant normal operational condition. The FGD implementation is expected to be after the first year of plant operation.
- (f) It is recommended to implement the UF-RO based Zero liquid discharge system in the ETP for the plant within the scope of the ongoing EPC contract of the power plant.

(VI) For CSCTPP (each 660 MW unit)

- (a) To restrict the SO<sub>2</sub> emission levels below the stipulated value of 100 mg/Nm<sup>3</sup>, wet lime stone based FGD with 94.8% efficiency is recommended.
- (b) The design value of NO<sub>x</sub> emission for the plant is 743 mg/Nm<sup>3</sup>. This is as per the boiler design data.
- (c) For NO<sub>x</sub> control, SCR system to limit the NO<sub>x</sub> emission to the MOEF stipulated limit of 100 mg/Nm<sup>3</sup>.
- (d) The designed PM emissions limits in the Plant are exceeding the MOEF & CC Norms. Hence, suitable abatement methods are to be implemented considering the PM reduction due to WFGD.

- (e) Make up water requirement for each Wet FGD system works out to 154 m<sup>3</sup>/hr. This water requirement will be tapped from CMB or Filtered water tank. With the additional water requirement for FGD, the consumptive water requirement increases by 308 m<sup>3</sup>/h and the specific water consumption to 3.2 m<sup>3</sup>/MWh and 2.82 m<sup>3</sup>/MWh without and with ash water recovery respectively. Hence suggestive optimisation measures for reducing water consumption in various consumptive areas are suggested to meet MOEF&CC norms in any condition.
- (f) It is recommended to implement the UF-RO based Zero liquid discharge system in the ETP for the plant within the scope of the ongoing EPC contract of the power plant.

#### A4: ESTIMATED COST, TIME SCHEDULE AND IMPACTS BY M/S FCEIPL

- 4.1 The cost of implementation of revised emission norms at RVUN plants as suggested by the above consultancy (M/s FCEIPL) is as under:

**Table 6: Details of Cost for implementation of emission norms as submitted by the Consultant (M/s FCEIPL) of RVUN plants**

(Rs. crore.)

Sr. No.	Description	KSTPS (5,6&7)	STPS (1to6)	CTPP (1to4)	KaTPP (1&2)	CSCTPP (5&6)	SSCTPS (7&8)	Estimated Total Cost including IDC
1.	FGD	342.00	865.02	592.84	689.25	678.92	690.44	3858.47
2.	SNCR	78.60	78.60	317.38				474.58
3.	SCR				393.37	480.56	471.28	1345.21
4.	Combustion modification			152.70				152.70
5.	PAC	2.86	5.39	20.36	17.96	17.96	17.96	82.49
6.	ESP retrofit	6.58	13.14	8.77	8.77	3.29	4.38	44.93
7.	Raw water treatment plant	14.97						14.97
8.	CW(IDCT/CW/ACW Pumps)	52.10						52.10
9.	WWTP	12.28	44.91	0.90	2.40			60.49
10.	ZLD					23.65	25.45	49.10
11.	Total (in Rs.)	509.39	1007.06	1092.95	1111.75	1204.38	1209.51	6135.04

- 4.2 The estimated cost approved by BoD of RVUN is Rs. 6289.77 cr and the cost suggested by M/s FCEIPL is Rs. 6135.04 cr.
- 4.3 Further, it is submitted that implementation of FGD of KTPS Unit # 1-4 is also under process and estimated project cost shall be as under (as per **Annexure-E**):

**Table 7: Details of estimated Cost for implementation of emission norms of KTPS Unit# 1-4 of RVUN.**

Rs in Cr.

Particulars	Unit#1	Unit#2	Unit#3	Unit#4	Total
FGD Cost	54.70	54.70	83.85	83.85	277.10
Combustion Modification	16.47	16.47	31.44	31.44	95.82
ESP Retrofit	29.21	29.21	55.84	55.84	170.10
Raw Water Treatment					13.70
Common Waste Water Treatment					13.92
Total	100.38	100.38	171.13	171.13	570.64

- 4.4 It is pertinent to mention that the total estimated cost for implementation of norms for RVUN plants is likely to be Rs 6860.41 cr.
- 4.5 The time schedule for implementation of revised emission norms at RVUN plants as suggested by the above consultancy (M/s FCEIPL) is as under:

**Table 8: Details of time schedule for implementation of emission norms as submitted by the Consultant (M/S FCEIPL) of RVUN Plants**

(in months)

Sr. No.	Description	KSTPS (5,6&7)	STPS (1to6)	CTPP (1to4)	KaTPP (1&2)	CSCTPP (5&6)	SSCTPS (7&8)
1.	FGD	24	24	24	24	24	24
2.	SNCR	15	06		15		
3.	SCR			15		15	15
4.	Combustion modification						
5.	PAC	06	06	06	06	06	06
6.	ESP retrofit	06	06	06	06	06	06
7.	Raw water treatment plant	24	06				
8.	CW(IDCT/CW/ACW Pumps)						
9.	WWTP			06	06		
10.	ZLD					06	06

4.6 Impact on Generation Cost due to implementation of revised Emission Norms in the power plants of RVUN.

**Table 9: Details of impact on tariff by implementation of emission norms as submitted by the Consultant (M/S FCEIPL) of RVUN Plants**

(Rs./kWh)

Sr. No.	Description	KSTPS			STPS		CTPP	KaTPP	CSCTPP	SSCTPS
		U#5	U#6	U#7	U#1to5	U#6	U#1to4	U#1&2	U#5&6	U# 7&8
1.	Impact on Fixed Cost (1st Year)	0.252	0.20	0.50	0.253	0.386	0.410	0.334	0.263	0.285
2.	Impact on Variable Cost (1st Year)	0.04	0.043	0.278	0.025	0.255	0.258	0.26	0.194	0.152
3.	Impact on Total Cost (1st Year)	0.292	0.244	0.78	0.277	0.641	0.668	0.589	0.457	0.437
4.	Levelised impact on Cost	0.27	0.24	0.66	0.19	0.43	0.53	0.59	0.48	0.41
5.	Levelised Period (Year)	12	12	12	12	12	18	22	25	25

**A5: ESTIMATED AUXILIARY CONSUMPTION IMPACT BY M/S FCEIPL**

5.1 Impact on Auxiliary Consumption due to implementation of revised Emission Norms in the power plants of RVUN.

**Table 10: Details of Auxiliary Consumption for implementation of emission norms as submitted by the Consultant (M/S FCEIPL) of RVUN Plants**

(Rs./kWh)

Sr. No.	Description	KSTPS			STPS		CTPP	KaTPP	CSCTPP	SSCTPS
		U#5	U#6	U#7	U#1to5	U#6	U#1to4	U#1&2	U#5&6	U# 7&8
1	MW	210	195	195	1250	250	1000	1200	1320	1320
2.	Auxiliary power Consumption in KW for implementation New Norms	5100	3250	3344	16270	3330	10996	15828	18276	19554
3.	Auxiliary power Consumption in % increase due to implementation of new norms	2.43	1.67	1.71	1.30	1.33	1.10	1.32	1.38	1.48
4.	RVUN Claim for increase in APC %	2.43	1.67	1.71	1.30	1.33	1.10	1.32	1.38	1.48

5.2 Station wise details of Auxiliary Power Consumption of RVUN plants before and after implementation of the revised emission norms are as under:

**Table 11: Details of Auxiliary Consumption claimed by RVUN for its plants.**

Sr. No.	Description	KSTPS (1-7))	STPS (1to6)	CTPP (1to4)	KaTPP (1&2)	CSCTPP (5&6)	SSCTPS (7&8)
1	MW	1240	1500	1000	1200	1320	1320
	Auxiliary power Consumption in % Allowed as per Regulation, 2014	9.27	9.00	9.00	5.25	5.25	5.25
2.	Auxiliary power Consumption in MW Allowed as per Regulation, 2014	114.948	135.00	90.00	63.00	69.30	69.30
3.	Auxiliary power Consumption in MW for implementation of new norms	11.694	19.600	10.996	15.828	18.276	19.554
4.	Total Auxiliary power Consumption in MW for implementation of new norms	126.642	154.600	100.996	78.828	87.576	88.854
5	RVUN Claim % APC after %	10.213	10.306	10.0996	6.569	6.635	6.731

5.3 Therefore, RVUN request the Hon'ble Commission to kindly allow Auxiliary power Consumption as per above table to compensate the auxiliary power against the implementation of revised emission norms.

5.4 Further, these equipments will be maintained after commissioning by RVUN and annual expenditures shall incur as O&M. Therefore, RVUN request the Hon'ble Commission to allow Rs 2.08 lac/ MW suggested by M/s FCEIPL with usual escalation@ as other plant O&M.

5.5 Also, there shall be utilisation lime stone, Ammonia, activated carbon and other ingredients for effective control of emission as per revised norms of MOEF & CC. Therefore, RVUN request the Hon'ble Commission to allow this expenditure on actual basis as fuel.

5.6 Therefore, RVUN request the Hon'ble Commission to kindly accord "In-Principle" approval for capital expenditure of Rs. 6289.77 cr for implementation of revised Emission Norms in the power plants of RVUN under Regulation 17(2) (ii) of RERC Tariff Regulations, 2014 in which GoR has been requested by RVUN for equity support of Rs 1257.95 cr and Rs 5031.82 cr shall be arranged through loans from financing institutes. Further, it is requested to the Hon'ble Commission to kindly accord "In-Principle" approval for capital expenditure of Rs. 570.64 cr for implementation of revised Emission Norms for KTPS Power Station Unit 1-4 of RVUN under Regulation 17(2) (ii) of RERC Tariff Regulations, 2014 in which GoR shall be requested by RVUN for equity support of Rs 114.13 cr and Rs 456.51 cr shall be arranged through loans from financing institutes.

**A6: RESPONDENTS:-**

6.1 All the three Discom's (i.e. JVVNL/AVVNL/ JdVVNL) Jaipur/ Ajmer/ Jodhpur are respondents for the above petition.

**A7: PRAYER**

7.1 RVUN humbly request the Hon'ble Commission:

**(a)** To accord "In-principle" approval for additional capitalization amounting to Rs. 6860.41 cr excluding taxes/levies & duty etc under Regulation, 17 (2) (ii) of RERC Tariff Regulations, 2014.

**(b)** To condone any inadvertent omissions/errors/rounding off differences/shortcomings and permit the Petitioner to add/alter this filing and make further submissions as may be required by the Hon'ble Commission; and

**(c)** Pass such other further orders as are deemed fit and proper in the facts and circumstances of the case.

(Y.K.Upadhyay)  
Chief Accounts Officer (Comml)  
RVUN, Jaipur.

(Ajay Kumar Saxena)  
Addl. Chief Engineer (PPMC &IT)  
RVUN, Jaipur.

