



**RAJASTHAN RAJYA VIDYUT UTPADAN NIGAM LTD.**  
**CHHABRA SUPERCRITICAL THERMAL POWER PLANT**  
**MOTIPURA CHOWKI, TEHSIL - CHHABRA, DISTT. - BARAN (RAJ.)**

*Presentation for:*  
**23<sup>rd</sup> National Award for Excellence in Energy Management 2022**  
**23<sup>rd</sup> - 25<sup>th</sup> August, 2022**

***Presented by:***

***Lead Presenter: Mr. Pradip Sah, Executive Engineer (9413349842)***  
***Team Members: Mr. R. P. Yadav, Assistant Engineer***  
***Mr. D. K. Jangid, Assistant Engineer***

# **PRESENTATION CONTENT**



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# 1 (A) BRIEF INTRODUCTION ABOUT COMPANY



*Formerly, Rajasthan State Electricity Board (RSEB) was formed in Power Sector on 1st July 1957. Later on, RSEB was unbundled into five Government Companies - 01 Generation Company-Rajasthan Rajya Vidyut Utpadan Nigam Ltd., 01 Transmission Company-Rajasthan Rajya Vidyut Prasaran Nigam Ltd. and 03 Distribution Companies-Jaipur Discom (JVVNL), Jodhpur Discom (JdVVNL) & Ajmer Discom (AVVNL) in July 2000 under new Power Reforms Undertaken by State Government. The Head Office of RVUNL is at Vidyut Bhawan, Jaipur (Raj.).*

*The installed capacity of RVUNL is 8594.35 MW. In addition to this, RVUNL is also managing and operating Inter-State Hydro Projects (271 MW).*

*CMD of RVUNL: Sh. R. K. Sharma*

*Director (Projects/Technical): Sh. R. K. Soral*

# 1 (B) BRIEF INTRODUCTION ABOUT PLANT



<b>Name of Plant</b>	<b>CHHABRA SUPERCRITICAL THERMAL POWER PLANT</b> <b>(1<sup>ST</sup> Supercritical Plant of Govt. of Rajasthan)</b>
<b>Latitude &amp; Longitude</b>	<b>North Latitudes 24<sup>0</sup> 24" &amp; East Longitude 77<sup>0</sup> 03"</b>
<b>Location</b>	<b>Village – Motipura Chowki, Tehsil – Chhabra, Distt. – Baran (Raj.)</b> <b>(150 KM away from Kota City)</b>
<b>Installed Capacity</b>	<b>2X660 MW (Stage – II, Phase – III)</b>
<b>Type of Unit</b>	<b>Supercritical Pressure, Once-through, Sliding Pressure Operation Boiler</b>
<b>Ht. of Chimney &amp; CT</b>	<b>275 Meters (Twin Flue); 185 Meters (NDCT)</b>
<b>Design Fuel (Coal)</b>	<b>30% Imported and 70% Indian</b>
<b>Date of COD</b>	<b>U#5: 09.08.2018 and U#6: 02.04.2019</b>
<b>Head of Plant</b>	<b>Sh. Mohammed Mohsin, Chief Engineer</b>

## 2. ENERGY CONSUMPTION OVERVIEW (2021-22)



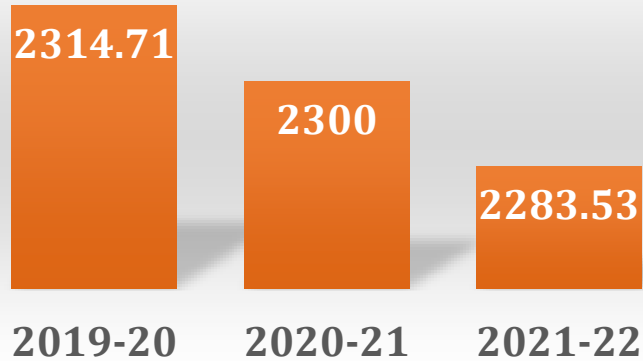
<b><i>Annual Generation</i></b>	<b><i>MU</i></b>	<b><i>5633.23</i></b>
<b><i>PLF</i></b>	<b><i>%</i></b>	<b><i>48.72</i></b>
<b><i>Availability</i></b>	<b><i>%</i></b>	<b><i>51.96</i></b>
<b><i>Gross Heat Rate</i></b>	<b><i>Kcal/Kwh</i></b>	<b><i>2283.523</i></b>
<b><i>Auxiliary Power Consumption</i></b>	<b><i>%</i></b>	<b><i>6.468</i></b>
<b><i>Boiler Efficiency (Station-wise)</i></b>	<b><i>%</i></b>	<b><i>87.023</i></b>
<b><i>Turbine Heat Rate (Station-wise)</i></b>	<b><i>Kcal/Kwh</i></b>	<b><i>2155.288</i></b>
<b><i>DM Water Consumption</i></b>	<b><i>%</i></b>	<b><i>1.571</i></b>
<b><i>Raw Water Consumption</i></b>	<b><i>%</i></b>	<b><i>2.950</i></b>
<b><i>Sp. Oil Consumption</i></b>	<b><i>ml/Kwh</i></b>	<b><i>0.685</i></b>

**Note: MDBFP in unit#6 was in service upto 19.01.2022 and in unit#5 upto 29.01.2022 due to outages of TDBFPs in both the units.**

### 3. SP. ENERGY CONSUMPTION IN LAST 03 YEARS



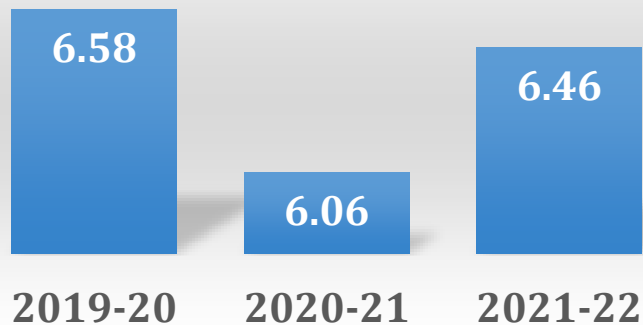
Gross Heat Rate (Kcal/Kwh)



Note: “-” means Improvement

FY	% Improvement in SHR
2019-20	-3.925
2020-21	-0.636
2021-22	-0.716

APC (%)

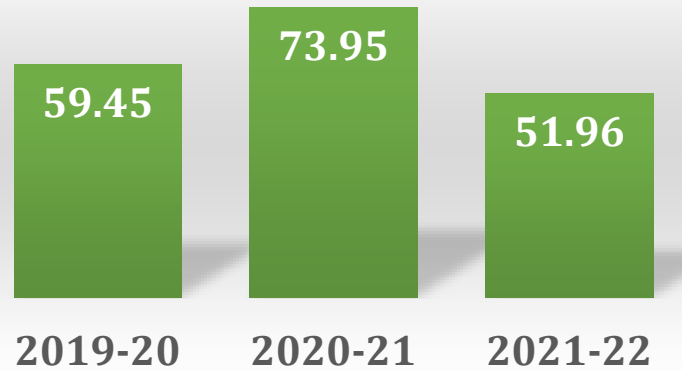


FY	% Improvement in APC
2019-20	-4.175
2020-21	-7.917
2021-22	6.733

### 3. SP. ENERGY CONSUMPTION IN LAST 03 YEARS



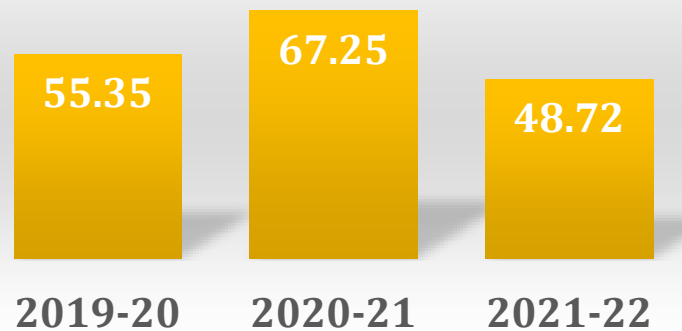
Availability (%)



Note: “+” means Improvement

FY	% Improvement in Availability
2019-20	-20.21
2020-21	24.39
2021-22	-29.74

PLF (%)



FY	% Improvement in PLF
2019-20	-24.08
2020-21	21.49
2021-22	-27.55

### 3. SP. ENERGY CONSUMPTION IN LAST 03 YEARS



#### **REASONS FOR VARIATIONS**

- **Gross Heat Rate:** *The overhauling of Turbine in both units was done in the FY 21-22 by Sand Blasting. The overhauling of Boiler and its Auxiliaries, etc. were conducted also.*
- **APC:** *It increased due to outages of TDBFP-5B & 6B due to high vibrations and defects in cartilages. So, MDBFP were in service upto Nov-21/Dec-21.*
- **Availability & PLF:** *DC Availability and PLF were 51.96% and 48.76% resp. due to spreading of COVID-19 during the period of shutdown for overhauling so shutdown period extended due to non-availability of labour and M/s L&T Engineers (got infected COVID-19). Shutdown period of unit#5: 121 days and of unit#6: 92 days.*



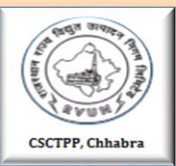
## 4. INFORMATION ON COMPETITORS, NATIONAL & GLOBAL BENCHMARK



### INTERNAL BENCHMARKING:

<i>Year</i>	<i>Parameter</i>	<i>FY 2019-20</i>	<i>FY 2020-21</i>	<i>FY 2021-22</i>
<b><i>CSCTPP, Chhabra (2x660 MW)</i></b>	<b><i>APC (%)</i></b>	<b><i>6.581</i></b>	<b><i>6.06</i></b>	<b><i>6.467</i></b>
	<b><i>SHR (Kcal/Kwh)</i></b>	<b><i>2314.71</i></b>	<b><i>2300.00</i></b>	<b><i>2283.528</i></b>
<b><i>KaTPP, Jhalawar (2x600 MW)</i></b>	<b><i>APC (%)</i></b>	<b><i>6.82</i></b>	<b><i>6.20</i></b>	<b><i>6.47</i></b>
	<b><i>SHR (Kcal/Kwh)</i></b>	<b><i>2377.02</i></b>	<b><i>2366.37</i></b>	<b><i>2463.03</i></b>
<b><i>STPS-SC, Suratgarh (2x660 MW)</i></b>	<b><i>APC (%)</i></b>	<b><i>-</i></b>	<b><i>COD: U#7-01.12.20 and U#8-07.10.21</i></b>	<b><i>7.103</i></b>
	<b><i>SHR (Kcal/Kwh)</i></b>	<b><i>-</i></b>		<b><i>2328.796</i></b>

## 4. INFORMATION ON COMPETITORS, NATIONAL & GLOBAL BENCHMARK



### NATIONAL BENCHMARKING:

Plant	Capacity (MW)	APC (%)			SHR (Kcal/Kwh)		
		2019-20	2020-21	2021-22	2019-20	2020-21	2021-22
<b>CSCTPP, Chhabra</b>	<b>2x660</b>	<b>6.581</b>	<b>6.060</b>	<b>6.467</b>	<b>2314.71</b>	<b>2300.00</b>	<b>2283.528</b>
<b>Jindal (I) TPP, Angul</b>	<b>2x660</b>	<b>5.97</b>	<b>5.64</b>	<b>5.65</b>	<b>2367.00</b>	<b>2328.00</b>	<b>2318.00</b>
<b>NTPC, Sipat</b>	<b>3x660 2x500</b>	<b>5.56</b>	<b>5.52</b>	<b>-</b>	<b>2318.00</b>	<b>2336.00</b>	<b>-</b>

## 5A. ENCON PROJECTS IMPLEMENTED IN LAST 03 YEARS



<i>Year</i>	<i>No. of Energy Saving Projects</i>	<i>Investment (INR Million)</i>	<i>Electrical Savings (Million Kwh)</i>	<i>Thermal Savings (Million Kcal/MTOE)</i>	<i>Savings (INR Million)</i>
<i>FY 2019-20</i>	<i>1</i>	<i>0</i>	<i>8.339</i>	<i>0</i>	<i>348.57</i>
<i>FY 2020-21</i>	<i>2</i>	<i>0</i>	<i>10.8599</i>	<i>0</i>	<i>45.091</i>
<i>FY 2021-22</i>	<i>2</i>	<i>0</i>	<i>39.1226</i>	<i>0</i>	<i>156.4904</i>

## 5B. ENCON PROJECTS FOR FY 2022-23



S. No.	Energy Saving Measures	Invest. (INR Million)	Life Cycle (Years)	Annual Energy Savings		
				Coal (TPA)	Electricity (Kwh/Year)	Others (Crore)
1	Improvement in Condenser Vacuum of Unit#5 after Annual Shutdown	0.20	0.33	13610	---	7.18
2	Improvement in MS Pressure of Unit#5 after Overhauling	0.00	0.00	6590	---	3.40
3	Performance Improvement in HPT of Unit#5 after Overhauling	0.50	0.40	28151	---	14.85
4	Performance Improvement in IPT of Unit#5 after Overhauling	1.00	1.29	17608	---	9.29
5	Improvement in Feed Water Temperature after installing HPH in Unit#5 during Annual Shutdown	10.25	18.70	12827	---	6.77
6	Replacement of Sodium/Mercury Lights to LEDs Light	2.00	2.05	0	3250000	0.97



# 5B. ENERGY SAVING PROJECTS 2022-23

S. No.	Energy Saving Measures	Invest. (INR Million)	Life Cycle (Years)	Annual Energy Savings		
				Coal (TPA)	Electricity (Kwh/Year)	Others (Crore)
7	Improvement in Condenser Vacuum of Unit#6 after Annual Shutdown	0.20	0.08	58307	---	30.76
8	Improvement in MS Pressure of Unit#6 after Overhauling	0.00	0	4820	---	2.50
9	Performance Improvement in HPT of Unit#6 after Overhauling	0.50	0.40	27658	---	14.59
10	Performance Improvement in IPT of Unit#6 after Overhauling	1.00	0.75	30490	---	16.09
11	Improvement in Feed Water Temperature after installing HPH in Unit#6 during Annual Shutdown	10.25	19.64	11869	---	6.26
12	Replacement of Motor Roof Extractor Fans to Green Turbo Ventilators	0.02	0.11	0	607068	0.18

**Note: The Energy Audit, as per BEE Guidelines, has been conducted in the Month of Apr-22 and Twelve ENCON Projects is to be implemented in FY 2022-23. After implementation of above ENCON Projects, there will be saving of Rs. 112.84 Crore.**

## 6. INNOVATIVE PROJECTS IMPLEMENTED



### **ESP MODIFICATION FOR PROPER ASH CONVEYING**

*Earlier, approx. 95% of ash was conveying through 1<sup>st</sup> and 2<sup>nd</sup> ESP field. Due to this, Ash Hoppers frequently choked. So, modification done in Fluidizing System of 1<sup>st</sup> and 2<sup>nd</sup> paths of ESP, ESP Hoppers & Receivers as under:-*

*a) Receiver Fluidizing Pad: Stone-type Pad changed into Air-boosting Flow Pad (NRV-type) which gives proper flow of material (dry fly ash).*

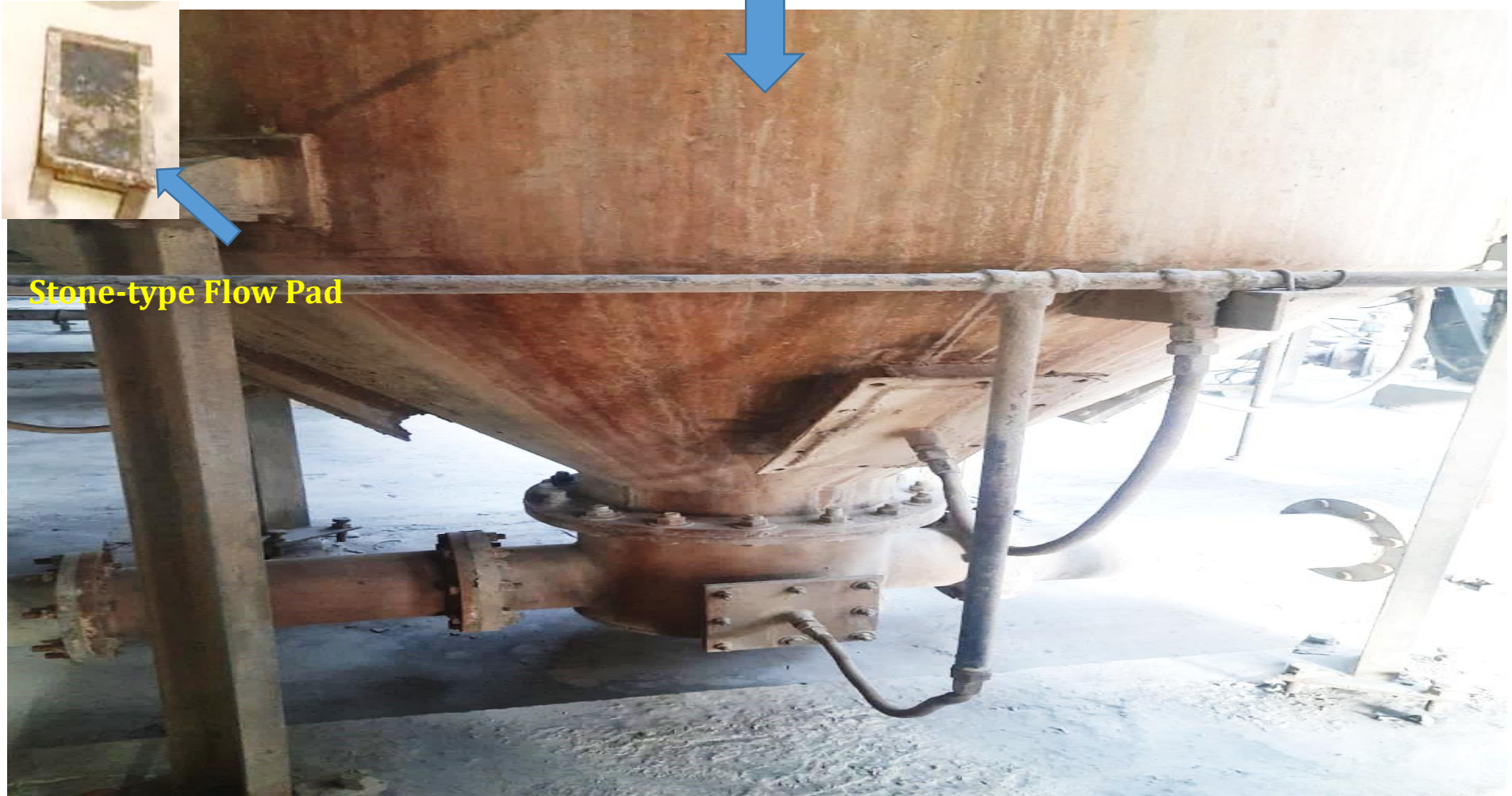
*Note: Stone Pad choked frequently and can't be replaced during running system whereas flow pad (made of Rubber NRV) can be repaired/replaced during running system.*

*b) Near each receiver of 1<sup>st</sup> to 3<sup>rd</sup> field a separate venting is provided to avoid choking and easy flow of ash.*

*c) Conveying lines/pipes from ESP to ISH (Intermediate Surge Hoppers) have changed in PIP( Pipe-in-Pipe System) which gives turbulence effect to proper flow of ash without choking.*

## 6. INNOVATIVE PROJECTS IMPLEMENTED

Before Modification

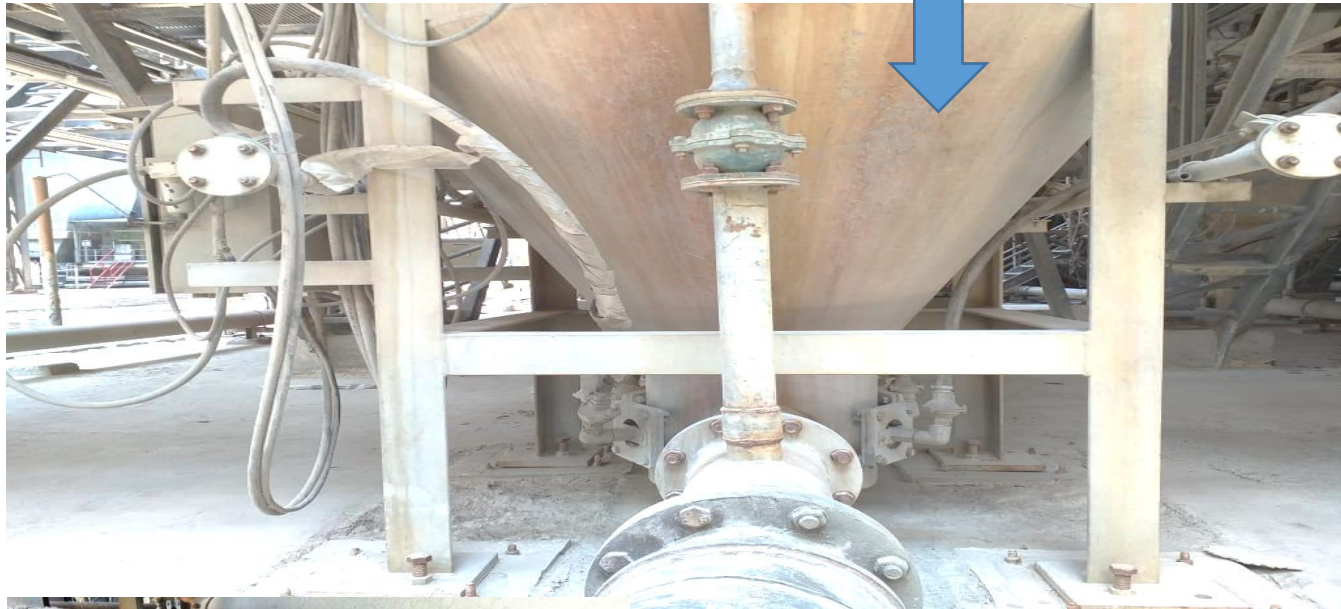


Stone-type Flow Pad

*Stone-type fluidizing system were frequently chocking*

# 6. INNOVATIVE PROJECTS IMPLEMENTED

After Modification



Air-boosting Fluidizing System with Rubber Pad NRV

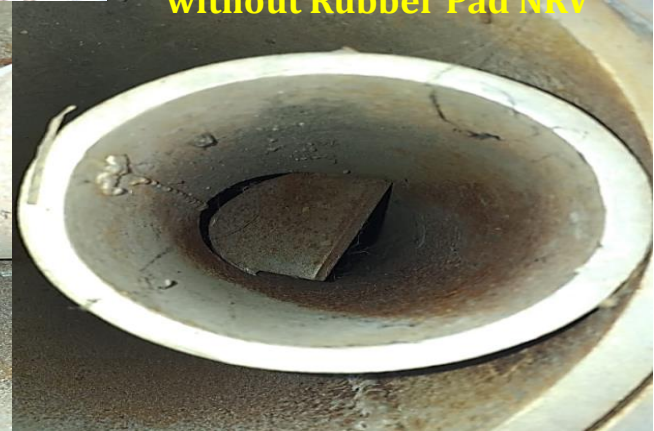
Air-boosting Fluidizing System without Rubber Pad NRV



Chocking before Modification



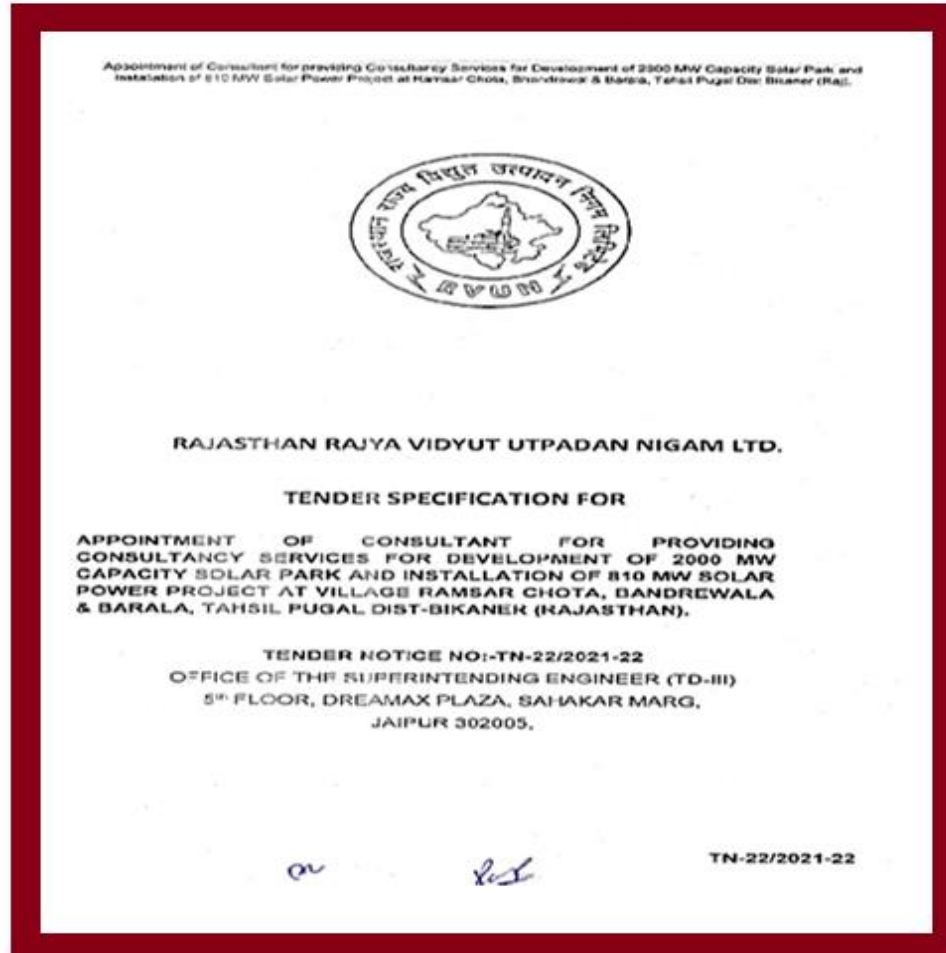
PIP Inner Air System



Air Diverter



# 7. UTILIZATION OF RENEWABLE ENERGY SOURCES



***LOI No. - D. 283 dt. 20.05.2022 has issued to M/s TUV SUD South Asia Pvt. Ltd., Mumbai.***

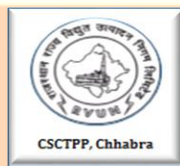
## 8A. ENVIRONMENT MANAGEMENT – ASH UTILIZATION



<i>Year</i>	<i>Ash Utilization (Tons)</i>	<i>Mode of Ash Conveying (Dry/Wet/Semi-Dry)</i>	<i>Distribution of Areas of Ash Utilization (Ex-Cement, Mine Filling/Road Pavement/Others)</i>
<i>FY 2019-20</i>	<i>410961.585</i>	<i>Dry</i>	<i>Utilized in Manufacturing of Cement/Concrete/Fly Ash Bricks/Mine Filling/Filling of low lying areas within plant premises</i>
	<i>815786.000</i>	<i>Wet</i>	
<i>FY 2020-21</i>	<i>741562.956</i>	<i>Dry</i>	<i>Utilized in Manufacturing of Cement/Concrete/Fly Ash Bricks/Mine Filling/Filling of low lying areas within plant premises</i>
	<i>1559442.000</i>	<i>Wet</i>	
<i>FY 2021-22</i>	<i>817996.091</i>	<i>Dry</i>	<i>Utilized in Manufacturing of Cement/Concrete/Fly Ash Bricks/Mine Filling/Filling of low lying areas within plant premises</i>
	<i>1736325.000</i>	<i>Wet</i>	

**Reasons for Less Ash Utilization:** Due to far distance and high transportation cost, less applications received from Ash Users. Cement Industries are in Chhittorgarh district which is near to KTPS-Kota, KaTPP-Jhalawar & Adani TPP-Kawai power plant whereas CSCTPP, Chhabra is approx. 400 Km away from the cement plants.

## 8B. ENVIRONMENT MANAGEMENT – ASH UTILIZATION



<i>Particulars</i>	<i>UOM</i>	<i>2019-20</i>	<i>2020-21</i>	<i>2021-22</i>
<i>Ash Stock in Plant (Yard+Pond)</i>	<i>Tons</i>	815786	1559442	1736325
<i>Ash Generated</i>	<i>Tons</i>	1226751	1485205.20	994887
<i>Ash Utilization</i>	<i>%</i>	33.50	49.93	82.22
<i>Ash Utilized in Manufacturing of Cement/Concrete- Other similar products</i>	<i>%</i>	33.50	48.78	39.82
<i>Ash Utilized in Fly Ash Bricks</i>	<i>%</i>	----	1.15	10.13
<i>Ash Utilized in Mine Filling</i>	<i>%</i>	----	----	----
<i>Ash Utilized in for Roads Pavements</i>	<i>%</i>	----	----	----
<i>Ash Utilization in Other Areas, if any</i>	<i>%</i>			
<i>1. Filling of low lying areas within plant premises</i>	<i>%</i>	----	----	32.27
<i>Expenditure on Ash Utilization (Annual)</i>	<i>INR (Lakhs)</i>	----	0.177	24.91

### *Ash Handling Done Through Various Methods:*

<i>Ash Handled (Wet Method)</i>	<i>%</i>	25
<i>Ash Handled (Dry Method)</i>	<i>%</i>	75
<i>Ash Handled (Semi-Dry Method)</i>	<i>%</i>	0

## 8C. ENVIRONMENT MANAGEMENT – EMISSION



### EMISSION DATA OF LAST 03 YEARS

<i>Particulars</i>	<i>UOM</i>	<i>2019-20</i>	<i>2020-21</i>	<i>2021-22</i>
<i>Total CO<sub>2</sub> Emissions per KW of Generation</i>	<i>Ton/KW</i>	<i>0.000932</i>	<i>0.000871</i>	<i>0.000859</i>
<i>Current SO<sub>x</sub> Emissions at Full Load</i>	<i>Mg/Nm<sup>3</sup></i>	<i>1473</i>	<i>1302</i>	<i>707.7</i>
<i>Current NO<sub>x</sub> Emissions at Full Load</i>	<i>Mg/Nm<sup>3</sup></i>	<i>348</i>	<i>171</i>	<i>158.4</i>
<i>Particulate Matter</i>	<i>Mg/Nm<sup>3</sup></i>	<i>40</i>	<i>24</i>	<i>26.1</i>
<i>Mercury</i>	<i>Mg/Nm<sup>3</sup></i>	<i>6.4</i>	<i>0.0054</i>	<i>2.2</i>

## 8D. ENVIRONMENT MANAGEMENT – EMISSION



### **Infrastructure available at CSCTPP for Emission Management & Control:**

- *Continuous Emission Monitoring System (CEMS).*
- *Ambient Air Quality Monitoring System (AAQMS).*

### **Best Practices adopted for Emission Monitoring and Control:**

- *For Controlling SPM Emission, ESP is installed.*
- *Continuous Emission is Monitored to control Emission Parameters.*

### **Future Plan for Achieving Emission Target:**

- *For Controlling SO<sub>x</sub> Emission, Work Order No. 397 & 398 dt. 08.06.22 has placed to M/s JSP Projects (P) Ltd., Ghaziabad (U.P.) for Supply, Installation and O&M of Wet FGD at CSCTPP, Chhabra.*
- *For Controlling NO<sub>x</sub> Emission, De-No<sub>x</sub> Technology (SCR/SNCR/Combustion Optimization) to be adopted after verification of Pilot Plan Study by NTPC & CEA.*
- *For PM Reduction, ESP Retrofit Technology to be adopted after finalization PM Reduction due to installation of Wet FGD.*

## 8E. ENVIRONMENT MANAGEMENT – WATER



<i>FY</i>	<i>DM Water Consumption (%)</i>	<i>Raw Water Consumption (m<sup>3</sup>/MW)</i>	<i>Whether Plant is Zero Liquid Discharge</i>
<i>2019-20</i>	<i>1.616</i>	<i>3.86</i>	<i>Yes</i>
<i>2020-21</i>	<i>1.408</i>	<i>3.190</i>	<i>Yes</i>
<i>2021-22</i>	<i>1.570</i>	<i>2.950</i>	<i>Yes</i>

### **Best Practices in Water Management:**

- *Rain Water Harvesting System is installed and the rain water is fed directly to AHP Recovery sump pumps. It is being used for plantation work.*
- *STP treated water is also being used for plantation.*
- *Water recovered from Ash-Pond and discharge from ETP is utilized in ash water sump for wet discharge of ash/bottom de-ashing.*

## 9. BEST PRACTICES IN THE PLANT



- 1. Maintenance and Reliability:** Daily defects is being checked and attended. List of defects more than 15 days is being monitored and material required is being processed to attend as soon as possible. For reliability, repetition of same defects is being monitored.
- 2. Digitization:** In the field of digitization, ABT Software for DSM monitoring is installed. AAQMS, CEMS, CEQMS data's are connected and integrated with CPCB. **Netmation Software** has installed for DCS system which is user friendly and most advanced technology.
- 3. Asset Management:** In the field of assets management, a separate committee has constituted.
- 4. Biodiversity:** In the field of biodiversity, different kind of plants and animals naturally available in the area has been saved and security has provided. Dams, ponds and rivers are protected and zero discharge policy is being adopted.
- 5. Afforestation:** In the field of afforestation, the density of trees more than 2500 per Hectare is being maintained and for its survival watering is being done.
- 6. Research:** In the field of Research, the BIO mass pallets use is going to be implemented.
- 7. New Initiatives – Flexibility:** Solar system on the roof of plant is being proposed.
- 8. Beyond the fence best practices for community and others:** The Kendriya Vidyalaya , Play School, Gym, Community Center, Play-ground, Medical Dispensary, etc. facilities are open for villagers also. Under CSR Policy Rs 19.23 Crore used to develop various facility like roads, drainages, 105 schools with e-learning, etc.

## 9. BEST PRACTICES IN THE PLANT



### **REDUCTION IN APC**

- *01 No. CW Pump in each unit not run during winter and monsoon season.*
- *01 No. ACW Pump for station not run during winter and monsoon season.*
- *01 No. Instrument Air Compressor not run by maintaining 07 Kg instrument air pressure by attending leakages on daily basis.*
- *Conveying-air Compressors are taken in service in 04 Hrs frequency for disposal of ash after collecting ash in ESP/APH and APH Duct Hoppers. Earlier, 04 Compressors were running 24 Hrs. This energy saving has been possible after modification in Ash Handling System.*

### **REDUCTION IN SYNCHRONIZATION TIME**

- *Synchronization Time of units has been reduced by taking one mill in service just after Turbine-rolling started as per OEM Standards.*



# 10. TEAMWORK, EMPLOYEE INVOLVEMENT & MONITORING



## **DAILY MONITORING SYSTEM**

- *Daily Monitoring Meeting of all circles is being organized by Commercial Wing headed by the Chief Engineer for discussion on deviations of parameters, plant performance data and APC. Energy consumption of all areas including draft powers are being reviewed in the meeting and high energy consuming area is taken on priority to analyze the reason and its remedial action immediately.*
- *Daily Defects, defects existing more than 15 days are being analyzed and related procurement status is also being reviewed.*
- *Emission, Ambient & Effluent Parameters are being monitored on daily basis.*

## **PROJECTS IMPLEMENTED THROUGH KAIZEN (AT WORKMEN & SUPERVISOR LEVEL)**

- *Modification in Ash Handling System at Supervisor Level.*
- *Modification at Compressor Cooling System Pump Area as per suggestion of Workmen.*

# 10. TEAMWORK, EMPLOYEE INVOLVEMENT & MONITORING

## Before Improvement



*The pump tripping was frequent due to ASH ingress inside the coupling, bearing, impeller etc. so complete air compressor system used to trip affecting ash conveying system.*

## 10. TEAMWORK, EMPLOYEE INVOLVEMENT & MONITORING

### After Improvement



*The Tin shed erected above the canopy of cooling motor due to which the falling ash to pump remains on the roof of shed resulting no tripping due to overloading of motor. The compressor cooling water system remains uninterrupted so ash conveying system remains continuous.*

# 11. IMPLEMENTATION OF ISO 9001:2015



**% Investment of Energy Saving Projects on Total Turn-over of the Company (FY 2021-22): 0.12**

## 12. LEARNING FROM CII ENERGY AWARD OR ANY OTHER AWARD PROGRAM



- *To know about the best practices which are not being implemented in our plant.*
- *An opportunity to know about the best achieved data's by other plants, which can be a benchmarking for us.*
- *An opportunity to contact with individuals/companies to know about the best vendors for implementing proposed ENCON projects economically.*
- *To know about new technology, ENCON Projects, area's of innovation and remedy of same problems.*
- *Motivation for performing the best by knowing the ideas about how the participating companies is spreading awareness about "Energy Efficiency" to reduce the variable cost and maintaining the Environmental data in the field of **Going Green**.*

# 13. AWARDS AND ACCOLADES



2014



2015



2018



**THANK YOU**