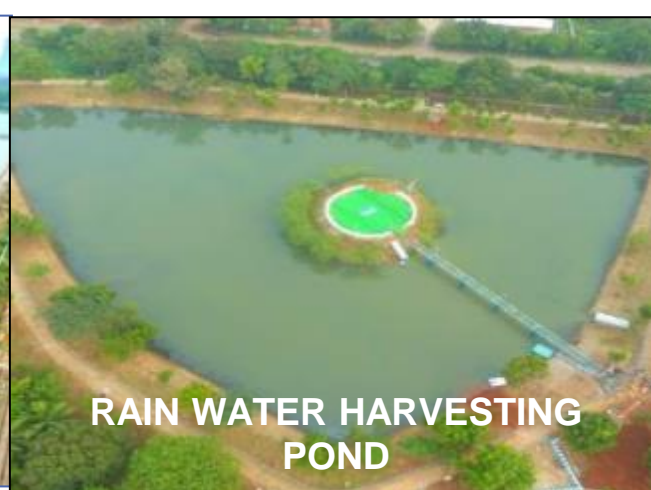




PLANT



FLOATING SOLAR



RAIN WATER HARVESTING POND



SOLAR TREE

22ND National Award for Excellence in Energy Management - 2021



A Maharatna Company

SIMHADRI

SIMHADRI SUPER THERMAL POWER STATION

Presented By

GS Phanikiran, DGM (MTP), Dr. V. Jayan, AGM (EMG) & Y.M.Muralikrishna, HOD (EEMG &MTP)



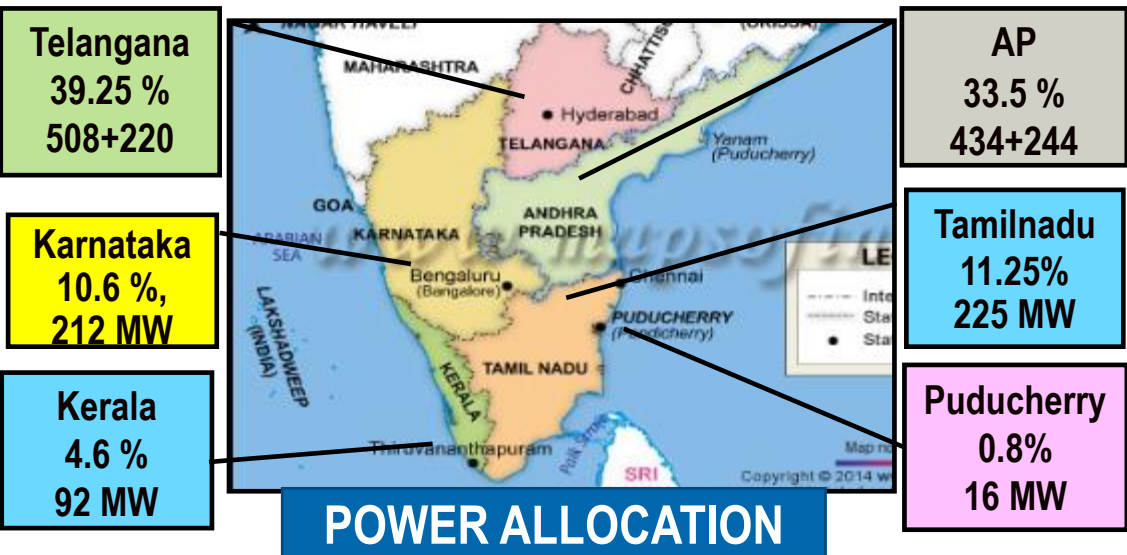
Presentation Outline

- 1 Introduction
- 2 Station Performance - Challenges
- 3 Energy Consumption
- 4 EnCons & Innovative Projects
- 5 Renewable Energy & Water Conservation
- 6 Environment & Ash Utilisation
- 7 Best Practices
- 8 Team work
- 9 Learning
- 10 Awards

“SIMHADRI – Salient features”



- Capacity : 4 X 500 MW + 10 MW FLOATING SOLAR
- First Coastal, Coal Fired Station of NTPC
- Sea Water for Condenser Cooling with NDCTs
- Sea Water for Ash Disposal
- Rail Fed Station
- Fuel Linkage : 98.2 LMT
 - MCL/ECL : 83.2/15.0 LMT
- Water Source (Consent)
 - Sweet Water : 900 CUM / Hr , Yeleru Canal
 - Sea Water : 17885 CUM / Hr, Bay of Bengal



Station Performance

Parameter	UOM	2019-20	2020-21	2021-22 (JUL)
Generation	MU	10650	8680	3023
PLF	%	60.62	49.54	51.61
Availability	%	87.86	70.14	69.22
DC	%	90.17	94.65	81.95
Gross Heat Rate	Kcal/kwhr	2413	2409	2392
APC	%	6.45	6.68	6.85
Boiler Efficiency	%	86.60	86.74	87.05
GTC HR	Kcal/kwhr	1995	1991	1989
DM water Consumption	% MCR	0.81	0.86	0.63
Raw Water Consumption	MLD	22.4	19.4	22.03
Sp. Oil Consumption	ml/kwh	0.52	0.5	0.60

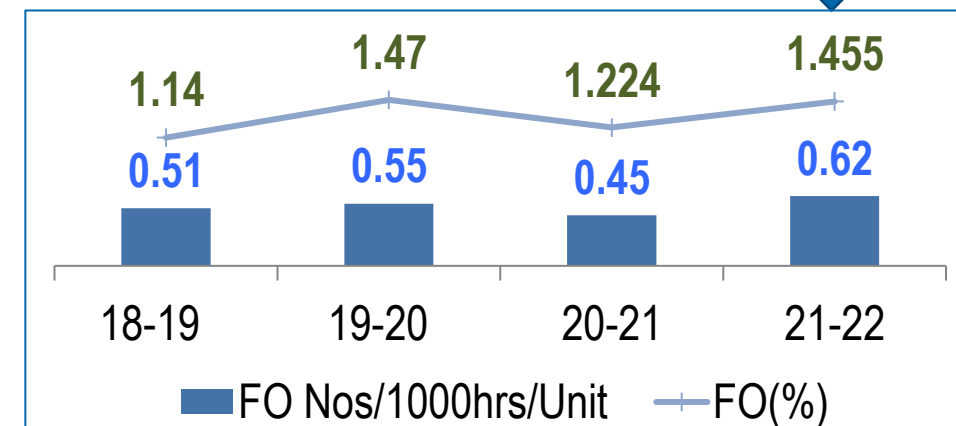
- Station continuous running without BTL : 585 Days (from 16.02.15 to 23.09.16)
- Unit-3 BTL free running since 03.10.17 1395 Days (till 01.08.21)
- “ZERO” Process trips in 2008-09

Longest Running of Units After Station Complete COD

	Period	No of Days
U#1	19.12.15 to 07.08.16	232
U#2	24.02.17 to 09.03.19	378
U#3	23.04.16 to 13.12.16	235
U#4	27.12.15 to 19.12.16	358 (within 5 years of COD)

Units running > 100 Days:
11 times in Last 3 FYs

Forced Outage (%) Trend



Improvements In Recent O/Hs

	Year	Heat Rate (Kcal/kwhr)	Draft Power (kW)
U#2	Jan'21	90	350
U#3	Jul'21	39	103

- ECR improved by 11% (327 to 291 Ps/kwh)
- Net efficiency improvement by 3.85%
- Test Heat Rate improved by 3.28%
- Stage 1 & 2 AGC in service
- RGMO performance -100%
- Ramp Rates > 1%
- Participating in RTM
- Ash Utilisation > 100% since 2017-18
- Participation in Green Visakha Program
- Complete Conversion from HFO to LDO

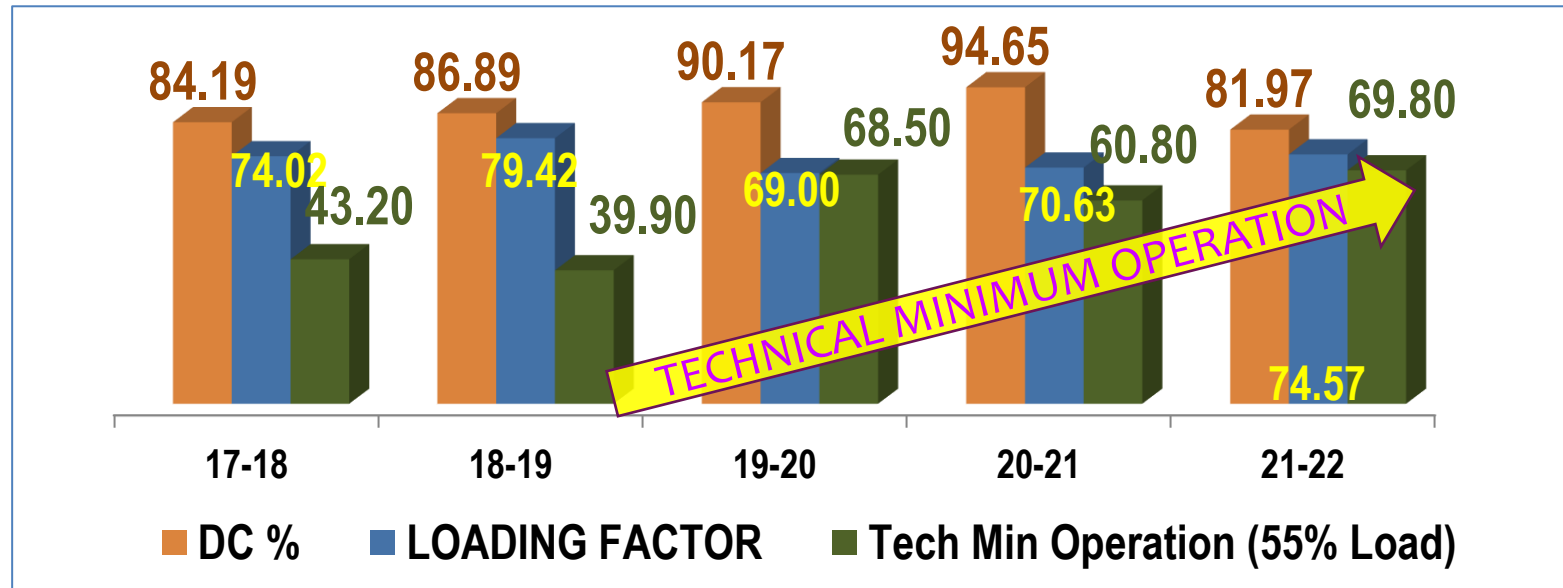
Challenges & Impact On Station Performance

Changes

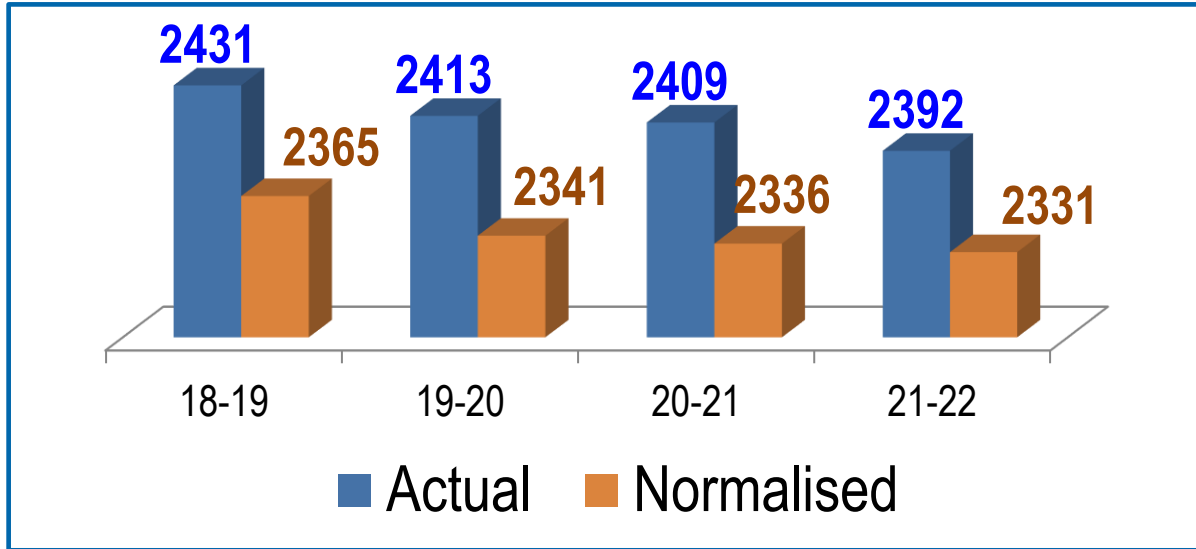
- Flexible Operation, SCED, AGC & RTM
- Higher Ramp rates
- Loads < 55%

Challenges

- Life cycle consumption - Reliability of Units
- More RSDs - Preservation Issues
- Limited scope for optimisation of Efficiency



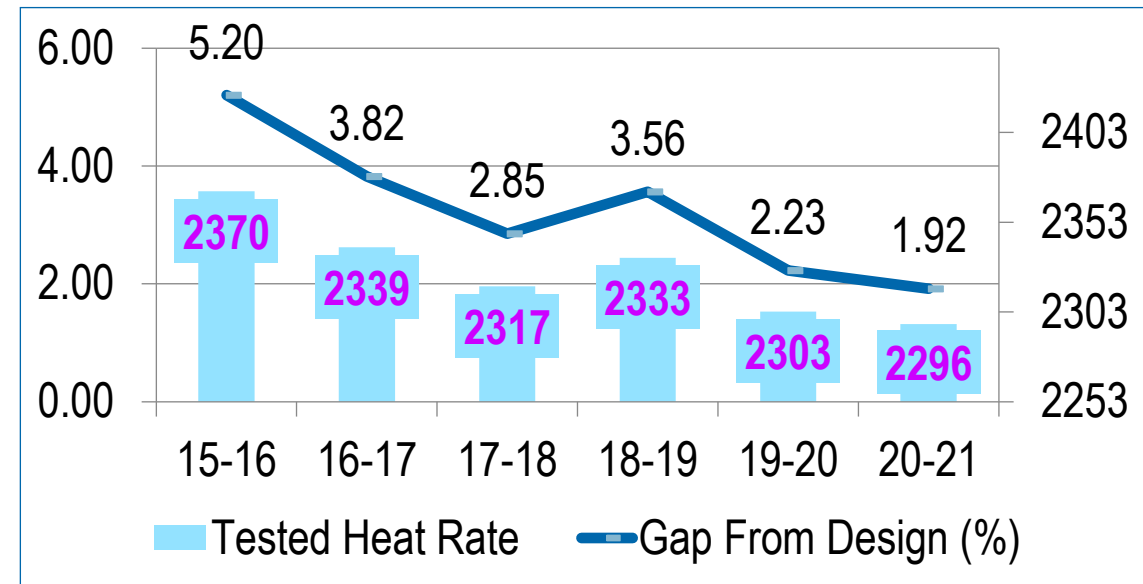
Gross Heat Rate (Kcal/kwh)



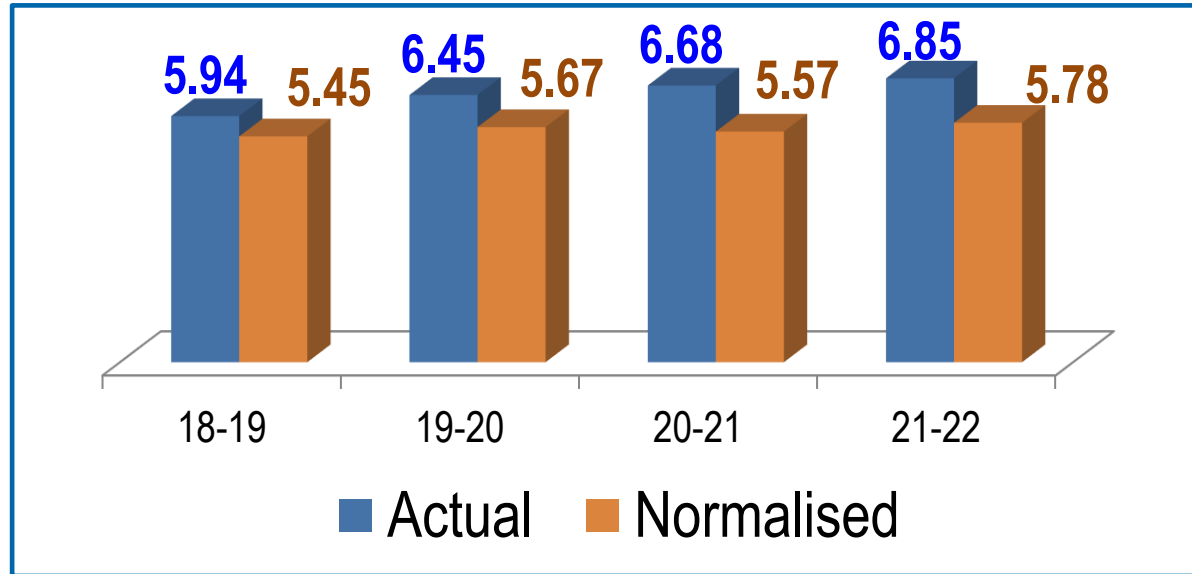
Design/Tariff: 2253/2375

Fleet Bench Mark
(Test Heat Rate Gap From Design)
Sipat & Kahalgaon – 1.92 %
Target: 1.16%

- ### Justification
- More Tech min opern & Frequent SG revisions
 - Low Loading factor
 - Normalised Value indicates a positive trend
 - Tested heat rate improved by 3.28%



Auxiliary Power Consumption (%)



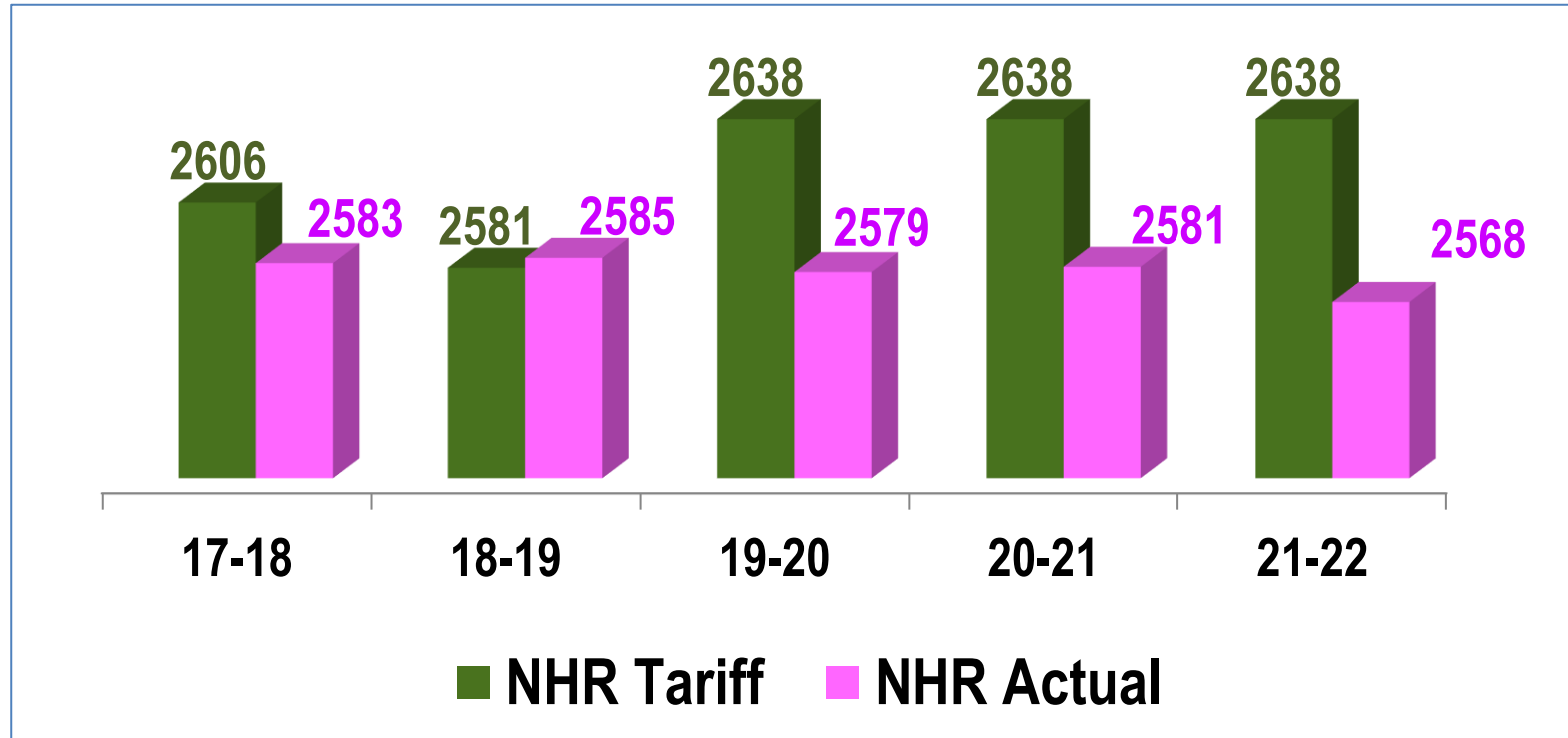
Design/Tariff: 5.68/5.75 %

Target/Bench Mark
Station Best Performance

- Justification/Difficulties**
- More Tech min opern & Frequent SG revisions
 - Reserve s/d – Preservation & Cold start ups
 - Normalised Value indicates a positive trend

Capacity (MW)	FY	APC (%)	LF (%)	APC % (corctd)
2 X 500	'08-09	5.27	103.4	5.32
4 X 500	16-17	5.49	85.12	5.34

Trend of Net Heat Rate (Kcal/kwh)



- Sustaining Efficiency levels with continual improvement measures
- Under compensatory regime benefits are passed to customers

Road Map for achieving targets

HEAT RATE

Action	Exp Improvement Kcal/kwh	Target Date
NDCT 3 & 4 Modification	2.0	May '21/ Nov'21
Unit-2 HPT/IPT replacement	10	Completed (Jan'21)
Advanced Process Control (APC)	10	U-4 Done U-3 Dec'21

Tested Heat Rate : 2281 Kcal/kwh
Gap from Design : 1.16%
Current: 1.92%

AUX POWER

Action	Improvement MU/APC	Target Date
St-1: AHP Instrument Air - screw compressors & VAM in Stage 1 HVAC	Completed	
Digital mapping of Turbines (CRO & Catenary Adjustment)	To reduce s/d power. (Nov'21)	
Draft Power Improvement with APC	7.00 (0.06)	U-4 Done U-3 Dec'21
VFDs for CEPs – Stage-1	10.72 (0.09)	Mar'22
Optimising Auxiliaries	6.00 (0.05)	Regular

APC Expected: 5.29

Commitment to Nature

FY	Budget Utilised (Rs Lacs)	SAVINGS Achieved			
		Energy (MU/)	Energy (MT of Coal)	Rs Lacs	App. Emission (Tons of CO2)
2017-18	195	45.59		1163	30694
2018-19	355	7.53	10248	654	14082
2019-20	377	7.24	45394	2368	47447
2020-21	186	14.67	63671	3004	69706
2021-22	1.59	1.88	26728	1124	26092



**A Tree Absorbs
1 Ton of CO₂
In its Life
Of 50 years**

Continual Improvement in Efficiency

**1 KG of Coal with 25% fixed carbon
produces 0.916 KGs CO₂**

Energy Savings Achieved & Pay back Period: FY 2018-19

S.N	Area	Activity	Energy savings (MU/MT)	Investment (Rs Lacs)	Pay back period (Yrs)
1	Single CEP Operation	At technical minimum load(55%). Savings 440/110 KW	1.171	Nil
2	Single ARCWP Opern		0.29	Nil
3	LED lights	Total 52.8% replaced (12400 in FY)	1.904	376	7.05
4	U- 3 HPT / IPT Efficiency	Heat Rate improved by 3.97 / 6.78 Kcal/kwhr	8290 MT	492	1.28
5	Optimisng PA Hdr pr at part loads	For safe & efficient operation (53 KW savings per Unit)	0.09	Nil
6	St-2 CWP/P -2 O/H	Efficiency improvement	1.903	65	0.33
7	U 4 HPT/ IPT Efficiency	Heat Rate improved by 2.37 / 1.24 Kcal/kwhr	1958 MT	721	7.91
8	Unit-4 ESP inlet duct	Unit-4 ESP inlet duct modification (By CFD Modeling - 330 KW savings)	1.537	55	1.28
9	VFDs in St-2 FAHP P/Ps	Installed in March 2018 (33 KW per pump)	0.361	30.7	3.04

Energy Savings Achieved & Pay back Period : FY 2019-20

S.N	AREA	ACTIVITIES	Savings achieved		Investment	Payback
			Energy (MU)	Coal (MT)	Rs Lacs	Yrs
1	Single CEP & Single ARCW p/p Operation	At technical minimum load(55%). Savings 440/110 KW	2.972		NIL	
2	LED lights	Total 85.8% Replaced (10960 in FY)	3.275		37.3	3
3	PA Header pressure Optmization (part loads)	For safe & efficient operation (53 KW savings per Unit)	0.051		NIL	
4	Unit #3 Cooling tower	Distribution header scales cleaning, pipe replacement etc		4734	50	0.29
5	Unit #3 ESP Duct	Duct Modification – CFD Modelling (298 KW saving)	0.938		10.3	1.6
6	Unit 1 HPT/IPT efficiency	Efficiency improvement after overhaul		21312	1774	1.54
7	Unit 1 Boiler Modification	RH Spray, FGET reduction		19348	500	0.51

Energy Savings Achieved & Pay back Period : FY 2020-21

S.N.	AREA	ACTIVITIES	Savings Due to		Investment (Rs Lacs)	Payback
			Energy (MU)	Coal (MT)		
1	Single CEP & Single ARCW p/p Operation	At technical minimum load(55%).	4.713		NIL	
2	LED Lights	Total 86.4% Replaced (200 in FY)	2.844			Covered in Prev FYs
4	PA Hdr pressure Optmization	For safe & efficient operation at Part loads	0.025			
5	Unit #3 Cooling tower	Distribution header scales cleaning & Nozzle Modification		10067	50	
6	Ut #3 ESP Duct Modifications	As per NETRA Recommendations	1.844		10.3	
7	Unit 1 HPT & IPT	Efficiency improvement after overhaul		23231	1774	
8	Unit 1 Boiler Modification	Efficiency improvement after overhaul		23410	500	
9	Stopping All CW pumps in St-2 during RSD	STG2 CW duct inter connection with Sea water make up Line	1.719		6.71	3.2 Days
10	Water Conservation	Reduction in pump running hours & Power Consumption	3.522		62	7.29 Months
11	Unit 2 HPT & IPT	Capability & Efficiency improvement after overhaul		6964	1103	4.5 Months

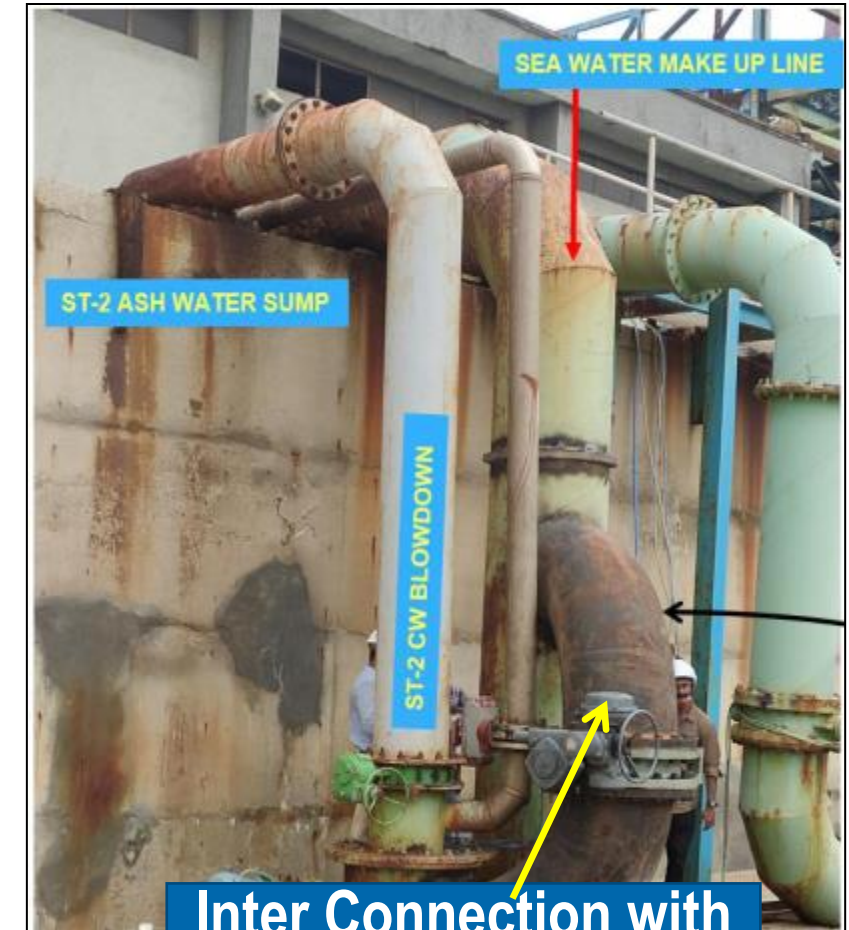
- ❖ Stage2 CW make up from Stage-1 – Aux power savings during RSD
- ❖ Unit-2 : Refurbishment of HPT & IPT – Capacity regained (38 MW). Net Eff – 3.85%
- ❖ Floating Solar on RAW water reservoir. (10 MW/ 25 MW COD wef 30.06.21)
- ❖ Advanced process Control – Unit-4 Completed. Unit-3 tuning in progress
- ❖ Comprehensive Water Dash Boards & PI Vision Process Books
- ❖ ZERO LIQUID DISCHARGE (ZLD) schemes implemented

On Going:

- ❖ Units 1,2 & 3 : Advanced process control
- ❖ Stage-2 NDCT – Design modification
- ❖ FGD Erection & Boiler DE-Nox Modification In Stage 2

Encon 1: Stage 2 CW Interconnection from Stage1

- Issue: During Complete RSD of Stage-2 Power to be drawn from Grid under DSM. (Approximate Rs 2.25 Lacs per day)
- Solution Implemented:
 - Interconnection to CW system from Stage-1 Ash water makeup line. An in house idea
- Cost of Implementation: Rs 6.71 Lacs
- Benefits Derived:
 - In FY 20-21 Stage-2 was under RSD for 25 Days.
 - APC Savings of 1.79 Mus
 - DSM Savings of Rs 52 lacs
- Pay Back Period: 3.225 Days



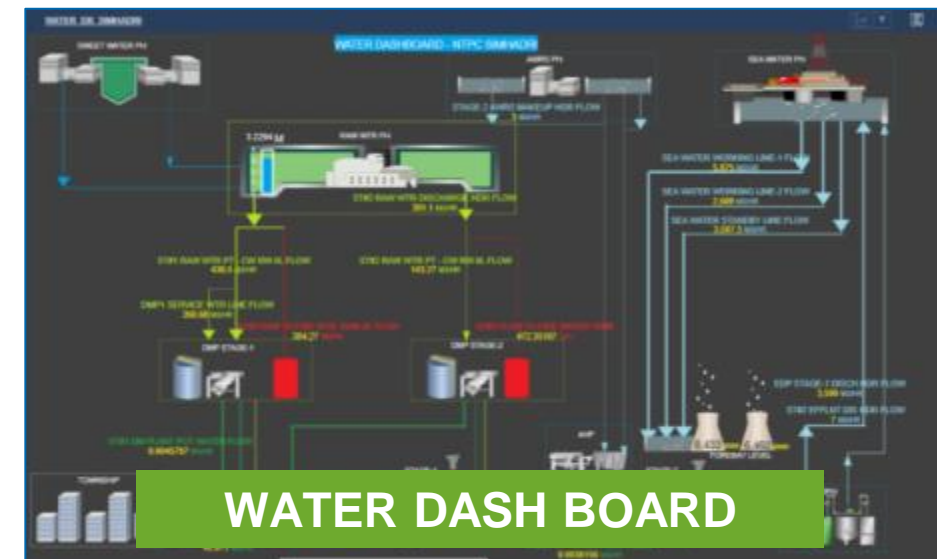
Encon 2: Unit 2 HPT/IPT Refurbishment

- Issue: Capability Shortfall (45 MW)
High TG Heat Rate (2016 Kcal/kwh)
- Measures Taken:
 - Offline assessment done
 - Pre-poning the Unit COH
 - HPT – Cleaning deposits & seals adjustment
 - IPT Rotor & casing Replaced
- Cost: Material & Job Cost – Rs 11.03 Crs
- Benefits: Capability Increased by 38 MW
GTCHR improved by 63 Kcal/kwh
- Savings (100% Load): Addl. Generation - 0.528 MU
 - Coal: 222 MT;
 - Cost Savings: Rs 8.2 Lacs
- Pay Back: 4.5 months



Encon 3: Sweet WATER Conservation

- ❖ Issue: Consumption higher than Consent Limit (21.6 MLD)
FY water bill is around Rs 14 Crs
- ❖ Impact: Additional burden on Consumers.
- ❖ Measures Taken:
 - Solenoid based filling of Service water tanks
 - Centralised Monitoring of Township water consumption
 - Cross functional team for water conservation
 - Awareness campaigns & Whats App based information
 - Rain Water harvesting pond renovated
 - STP water for Horticulture
 - Floating Solar Project – reduced Evaporation loss
- ❖ Benefits :
 - Rs 2.98 Crs in water charges. Pass on to Beneficiaries
 - Aux Power reduction & Conservation of Natural Resources



Utilization of Renewable Energy

- ❖ 25 MW Floating Solar Plant on Sweet water Reservoir (Thermal Flexibility Scheme)
 - 10 MW COD wef 30.06.21
 - Balance by 31.08.21
 - Contribution in RE power: 3.186 Mus
- ❖ **Solar Tree** In front of Plant Main Gate – In house Design (3.3 Kw Peak DC)
- ❖ 25 KW Roof top Solar installed in guest house and EDC
- ❖ Solar water heating system installed on all guest houses and ET hostels



SOLAR TREE



Environment Management- Water

Particulars	UOM	17-18	18-19	19-20	20-21	21-22
DM Water Consumption	MCR %	0.78	0.80*	0.81*	0.86*	0.63
Raw Water Consumption	MLD	24.1	22.8	22.4	19.38	22.03

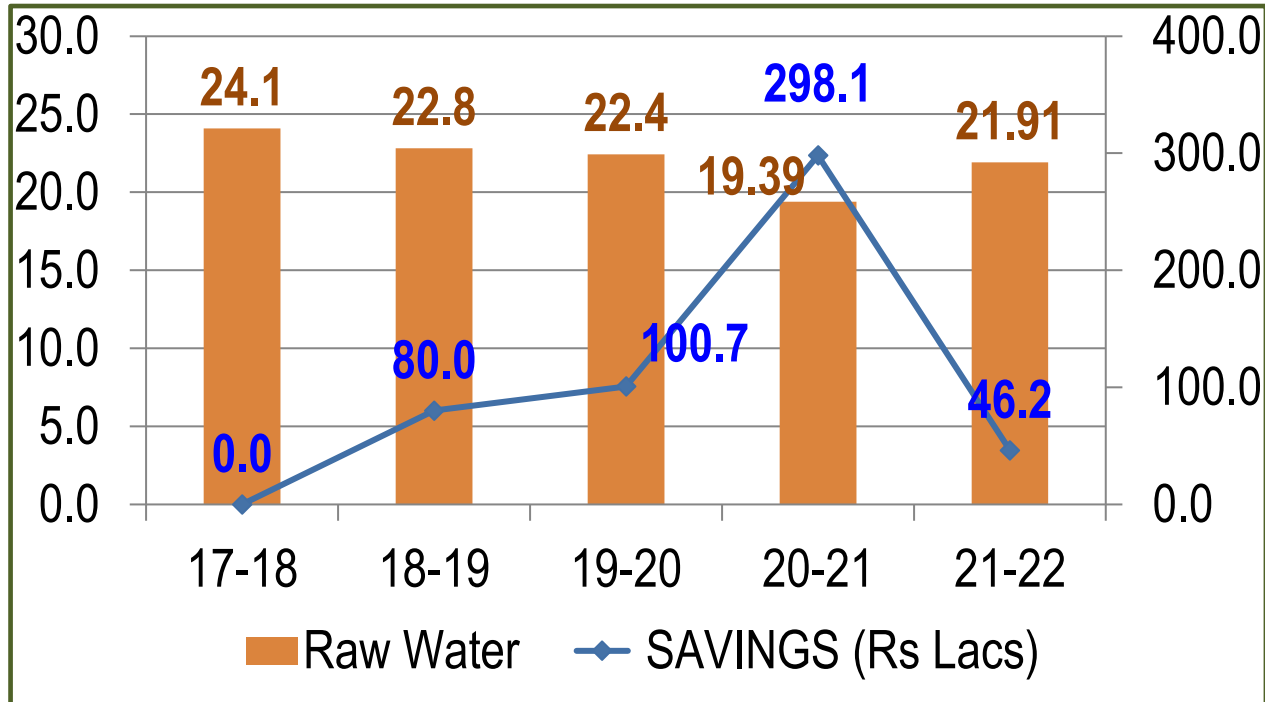
Best Practices:

- Rain Water Harvesting Pond renovated
- STP water for Horticulture
- Maintaining cycle makeup below 0.8% MCR
 - CBD tanks kept in service & 100% usage of CPUs including start ups.
- 100% measurement of water consumption & Comprehensive Dash Boards
- What's App for Information
- Level transmitters for Overhead tanks & Sumps in township – Centralised monitoring
- Solenoid based filling of service water tanks
- Water Audit by External Agency & Re drawing Water Balance Diagrams



RAW Water Consumption, Target & Road Map

Consent: 21.6 MLD



- Water savings are pass through to Beneficiaries
- Conservation of Natural Resources & Ecological balance

Road Map

Action	Improvement (MLD)	Target Date
Solenoid Based Filling of Service Water tanks	Completed	
Centralized monitoring of Township Consumption	Completed	
Re cycling of ESP Vacuum P/Ps seal water	Completed	
Floating Solar on Reservoir (intake Reduction)	1.2	15.08.21

Annual Savings in water bill: Rs 3.8 Crs

Environment Management- Ash Utilization

Particulars	UOM	17-18	18-19	19-20	20-21
Ash Stock in Plant (Yard + Pond)	Lac MT	179.5	179.5	165.5	155.50
Ash generated	TONS	3010763	2975585	2641122	2448817
Ash Utilized	%	101.57	100.15	167.74	123.87
Ash utilized in manufacturing of cement/concrete-other similar products	%	15.60	17.60	11.53	12.74
Ash utilized in Fly Ash Bricks	%	16.88	17.76	16.62	19.90
Ash Utilized in Mine Filling	%	0.00	0.00	0.00	0.00
Ash Utilized for Road works	%	57.01	53.96	139.56	88.33
Clay Brick Manufacturing	%	8.43	9.52	0.00	0.00
Cenosphere	%	0.01	0.00	0.02	0.005
NTPC Land Development	%	3.23	0.53	0.00	0.00
BA Cover	%	0.42	0.79	0.00	0.00

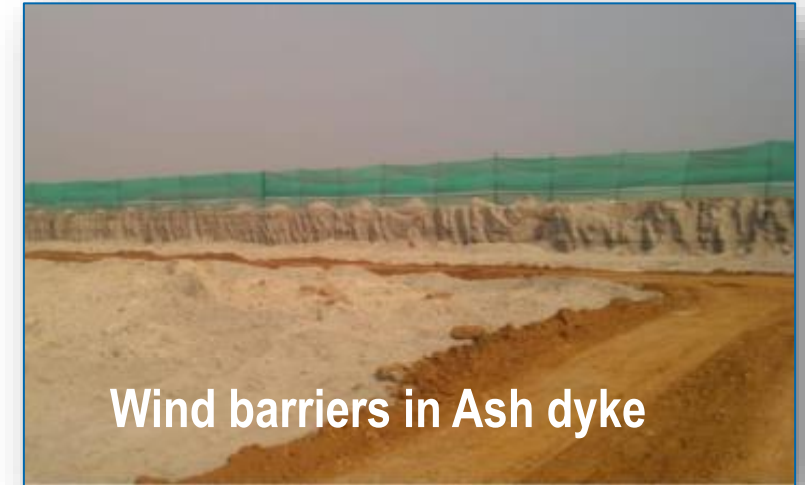
Particulars	UOM	17-18	18-19	19-20	20-21
Total CO2 emission per KW of generation	Ton/KW	0.00092	0.00095	0.00104	0.00090
Current Sox emission in full load	mg/Nm3	1140	1067	1045	1135
Current Nox emission in full load	mg/Nm3	275	396	365	253
Particulate matter	mg/Nm3	49.62	38	39.63	41.58
Mercury	mg/Nm3	Nil	Nil	Nil	Nil

Emission Reduction Program:

- ❖ All 4 Units FGD erection is in advanced stage – Completion by Dec'2021
- ❖ Unit-3 De-Nox Commissioned in Jun'21. Unit-4 by Nov'21

Environment - Best Practices

- The Up-linking of Online parameters of AAQMS, EQMS and CEMS to CPCB thro' Central cloud server.
- MoU with M/s. ITC Ltd -recycling of plastic & paper waste
- Digital gate pass system - Movement of ash laden trucks
- Fugitive dust Control: Water sprinkling, spraying of chemical solvents reduces PM10 concentration and emission levels well within stipulated norms.
- Installation of wind barriers in Ash dyke (Reduction in PM10 concentration to the tune of 23%)
- Issue of Ash thro Railway wagons and Exporting dry ash thro' Barge vessels by sea route to Bangladesh
- Usage of treated STP water for horticulture through sprinkler network



- ❖ System wise Sp. Energy Consumption (SEC) monitoring using SEED & EMS
- ❖ Performance Optimisation Groups (POGs) for Efficiency & ESP
- ❖ LMIs and SOPs Implementation
- ❖ Reliability Centred Maintenance (RCM) & Extensive usage of PdM techniques
- ❖ Blade Vibration Monitoring System (BVMS) – LP Turbine of Unit 4
- ❖ Unit Capability (105%) testing & 100% Equipment testing

- ❖ Flexible Operation:
 - ❖ Single CEP & ARCW operation at 55% load
 - ❖ PA header pressure optimisation
 - ❖ CBD tanks re commissioned Comprehensive water dash board
- ❖ Maintaining COC of CW system with chemical treatment – Less Make up
- ❖ Maintaining Ecological balance
- ❖ ISO 50001 Surveillance Certification in Jan'21
- ❖ Co-firing of Bio mass pellets

Team Work: Engaging minds to innovate

- In house Design & Installation of SOLAR TREE
- PA Fan vibration protection logic modified (2/3) – in house
- Performance Improvement Projects – First Position in SR – NTPC
(In house modification of CW butterfly valve Logics)
- QC National Award (Second) : URJA JYOTHI –CHP
- Prof Circle – 2nd in SR workshop
- PI Vision – Process books for Optimisation
- Cross Functional Team for Water Management & Conservation
- Efficiency deviations Daily monitoring by Senior Management
- 12 QC and 17 PC Teams. Ideas emerged have been implemented for improving energy efficiency




Team Work: Engaging minds to innovate



- ENERGY CONSERVATION WEEK Celebrations
 - Auditors 25 available. Every year 5 executives sponsored
- Training/Workshops:
 - **EEMG HODs Meet 26th to 28th Feb'20**
 - **Water Balance & Auditing – PAN NTPC**
 - **Energy Efficiency Projects in Power plants – PAN NTPC**
 - **Solar Power – Modalities & Commercial Aspects**



Vexil Business Process Services Pvt. Ltd.					
Management System Audit Report					
Client : NTPC Limited Simhadri Super Thermal Power Station					
AUDIT CONDUCTED AGAINST					
<input type="checkbox"/>	ISO 9001:2015	<input type="checkbox"/>	ISO 14001:2015	<input type="checkbox"/>	ISO 45001:2018
<input type="checkbox"/>	ISO 22000:2018	<input type="checkbox"/>	ISO 27001:2005	<input checked="" type="checkbox"/>	ISO 50001: 2018
				<input type="checkbox"/>	Other (Pl. Specify)
Client Documents Ref: EnMS Manual : EnMS/AM/NTPC/SIMHADRI/EMG Issue No. 01 Date of Issue 14.05.2019 and associated procedures					

AUDIT CONCLUSION	
<input type="checkbox"/>	We are pleased to recommend Certification/Recertification/Restoration of Certification (See Certification details below)
<input type="checkbox"/>	Recommend Certification/Recertification with condition (subject to effective resolution/closure of identified non conformities – see corrective action box above)
<input type="checkbox"/>	Recommend Limited Follow up audit of ___ manday(s) to verify effectiveness of corrective actions. (Dates for audit shall be mutually agreed subject to conditions stated above)
<input type="checkbox"/>	Recommend Complete re-audit.
<input checked="" type="checkbox"/>	Recommend Continuation /Revocation of suspension and continuation of certification

October 2019. First STPS in NTPC & First DC of BEE to be certified

January 2021 : Surveillance Audit

WORKSHOP 2019

- Boiler Penthouse sealing with AIRSEAL component. – On requirement basis (Ramagundam)
- Screw Compressor in lieu of Reciprocating Compressor: – AHP Stage-1 (90 KW savings) (CESC)
- ESP Hopper heaters temperature - RTDs in lieu of Thermostats. (CESC)
- HP Heaters parting plane seal welding on requirement basis (Adani Power)

WORKSHOP 2020

- Magnetic Grills in un loading lines – Being studied (Nabha Power)
- Digitisation in Power plants: On line training, E-Guru, Knowledge sharing (DB power)
- Wire Framed – Anti clog trickle fill material for CT fill pack. – Being Studied
- EEMG meet Feb'20 :
- “Zero Loss” Drain traps & Demand Side Controller in Instrument Air System (CESC)
- Scale Ban in water systems
- Co-firing of Bio mass pellets

Awards



PRSI Award 2020
(Best PSU Implementing CSR)

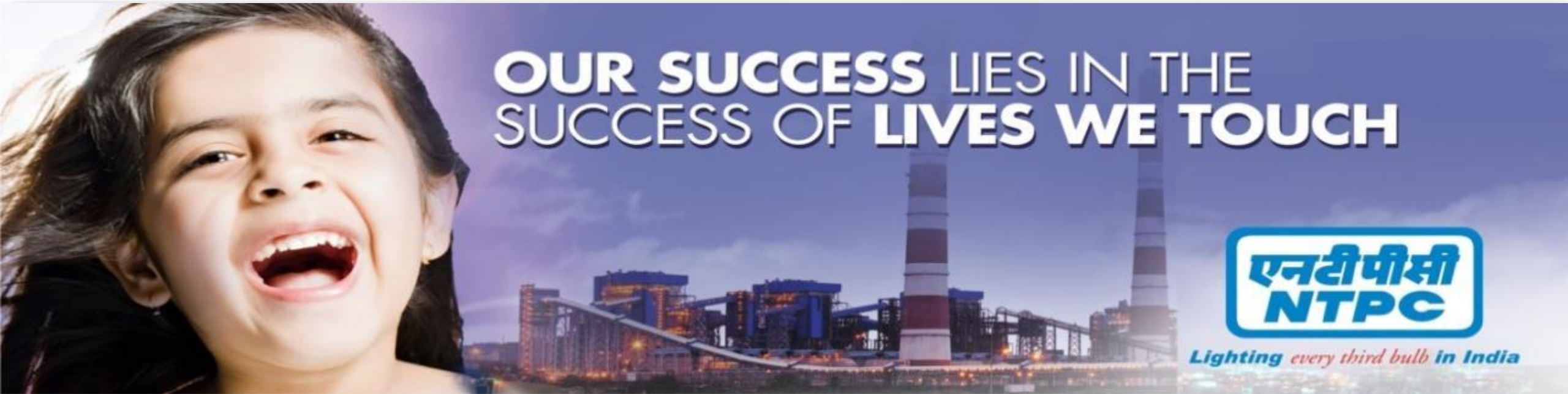


Swarna Shakti
(Protection & Improvement of
Environment)



GOLD MEDAL
(Energy Conservation from
APSECM)

THANK YOU



**OUR SUCCESS LIES IN THE
SUCCESS OF LIVES WE TOUCH**



Lighting every third bulb in India

Contact Details:

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