Powering India through

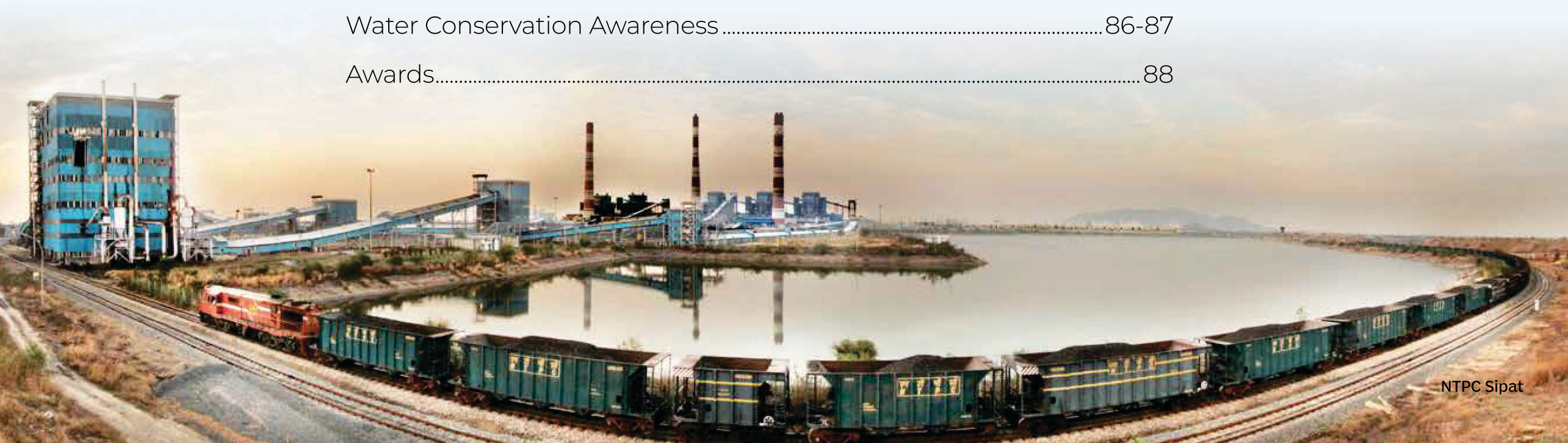
More Power per Drop

NTPC Water Conservation Compendium

22nd March, 2022

Compiled by
Corporate Environment Management Group

Content



NTPC Sipat

MESSAGE FROM CMD

Water is an integral part of economic and social development. It is a lifeline for all the living beings on this planet, which makes it a necessity and access to water a fundamental right. Echoing this sentiment, water has been recognized as one of the most important components of United Nations Sustainable Development Goals (UN-SDGs) as well as India's National Action Plan on Climate Change (NAPCC).

NTPC, in line with India's National Water Mission, is fully committed towards optimization of our Water footprint through sustainable usage including its re-use through efficient O&M of our plants and by conservation techniques like Rainwater harvesting at all our establishments.

Reinforcing its unwavering commitment, NTPC has signed the CEO water mandate, which is a highly collaborative partnership between UNGC and specialized organizations dealing with the problem of water scarcity. In this regard, our conscious efforts to reduce water consumption have started showing results.

It gives me immense pleasure and a deep sense of satisfaction that we are publishing "Water Compendium" on World Water Day-2022, recognizing best practices and initiatives taken up by our Business Units in line with our commitment towards Water Sustainability. This will further motivate all our establishments to take up newer initiatives.

With Best Wishes,

Gurdeep Singh

Chairman & Managing Director

एनटीपीसी
NTPC
A Maharatna Company

रमेश बाबू वी.
निदेशक (प्रचालन)
Ramesh Babu V.
Director (Operations)

एनटीपीसी लिमिटेड
(भारत सरकार का उपक्रम)
NTPC Limited
(A Govt. of India Enterprise)

केन्द्रीय कार्यालय / CORPORATE CENTRE

Message from Director (Operations)

NTPC Ltd being India's leading integrated energy major is conscious of the fact that Water, which is the most important natural resource, needs to be conserved with optimum usage.

We are not oblivious to the fact that Power generation is a water intensive business, therefore it is our duty to optimize usage of every drop of water and make determined efforts towards water conservation.

NTPC has signed the CEO water Mandate and is taking conscious efforts to minimize fresh water uses and making all stations Water efficient through technology upgradation, regular monitoring and better O&M. All NTPC are taking structured and systemic steps to reduce water footprints through implementation of Zero Liquid Discharge (ZLD) , Higher Cycles of Concentration (COC) operation, Saving of water through installation of floating solar PV plants, Adoption of Air Cooled Condensers at upcoming stations, High concentration ash slurry disposal systems (HCSD), use of treated sewage water etc.

On Water conservation front, NTPC has taken up series of steps to realize the full potential of Rainwater harvesting at all its stations. Presently, Studies are being undertaken through reputed institutes and all out efforts will be made to achieve our targets.

I am happy to note that Corporate EMG team in collaboration with all our stations is coming out with **"1st NTPC Water Compendium"** on World Water Day'2022 covering consolidated list of the initiatives taken towards Water sustainability. The intent is to showcase the efforts, sharing of peer initiatives and spread awareness for optimal water consumption. Further, from this year onwards we have also commenced giving Water awards to the best performing station and township to further promote efforts for water conservation.

I sincerely hope this initiative will further help in our endeavor for sensible use of water in all our plant operations activities and in our daily lifestyles at all our establishments.

(Ramesh Babu V)

Corprate Identification Number L40101DL1975GO1007966
एनटीपीसी भवन, स्कोप कॉम्प्लेक्स, 7 इंस्टीट्यूशनल एरिया, लोधी रोड, नई दिल्ली-110 003, टेल./Tel. (O): +91-11- 24360232, 24360251, फैक्स/ Fax : +91-11-24363478
NTPC BHAWAN, SCOPE Complex, 7 Institutional Area, Lodhi Road, New Delhi-110 003, E-mail : rameshbabu@ntpc.co.in, वेबसाइट/Website : www.ntpc.co.in

एनटीपीसी NTPC एन टी पी सी लिमिटेड NTPC Limited

CC-OS, EOC-Raipur

We in NTPC are committed to optimize our water footprint for every unit of energy generation & are achieving and setting new benchmark for industry. Operating in a water intensive sector we consider it our moral responsibility to undertake water efficiency measures at war scale and set tougher targets. I am delighted to share that; our company has become signatory of UN CEO Water mandate to better its water stewardship programs as part of long-term Sustainable Development goals.

Metering, Monitoring (24*7) & Optimization is the key to optimize water consumption. All our Closed Cycle stations have installed water meters & as of now total 569 water meters have been installed across stations & hooked up to PI where water consumption on 24*7 is monitored through Pan NTPC Water dashboard from remote.

NTPC for the first time has adopted new technology like Air Cooled Condenser (ACC) System at North Karanpura & Patratu super thermal power plant. Further, hybrid cooling system (combination of dry and wet cooling system) will be adopted.

Other Initiatives like floating solar at reservoirs, Dry Bottom Ash Handling System instead of conventional Wet Bottom Ash Handling System will reduce our freshwater requirement. All NTPC stations having closed cycle condenser cooling water systems are operating with higher Cycle of Concentration (COC). Further, adoption of high concentration slurry disposal (HCSD) system, rainwater harvesting system, reuse of treated effluent in ash slurry disposal and reuse of treated sewage effluent for horticulture purposes are few measures implemented in all stations.

Reduce, Reuse and Recycle is the mantra for water optimization and our "Water Policy-2021" is a step towards minimizing the water footprint to the extent possible.

It gives me immense satisfaction that CC-EMG has prepared this water compendium covering all details like Water Norms, allocation, annual water consumption, Specific water consumption, ZLD Status, Rainwater Harvesting, New initiatives (Air cooled condenser), water meters & dashboard along with water audits. I am sure that the compilation will be useful to our power engineers.

I convey my warm wishes to CC-EMG team for their commendable efforts & hope that this Water Compendium shall go a long way in generating awareness on water optimization for making our plants & townships water efficient.

With Best Wishes

Ashwini Kumar Tripathi
Executive Director (Operation Services)

पश्चिमी क्षेत्र – II मुख्यालय, एनटीपीसी लिमिटेड / Western Region – II Headquarter, NTPC Limited
प्लॉट नंबर-87, सेक्टर-24, नवा रायपुर, अटल नगर – 492018, छत्तीसगढ़, टेलीफोन 0771 2515201, फैक्स – 0771 2960101
Plot No. 87, Sector – 24, Nava Raipur, Atal Nagar – 492018,Chhattisgarh; Phone: 0771 2515201, Fax: 0771 2960101
पंजीकृत कार्यालय: एनटीपीसी भवन, स्कोप कॉम्प्लेक्स, इंस्टीट्यूशनल एरिया, लोधी रोड, नई दिल्ली – 110003.
Regd. Office: NTPC Bhawan, Scope Complex, 7 Institutional Area, Lodhi Road, New Delhi – 110003.
Visit : /ntpc1 /ntpcfdl1 /ntpclimited /companyintpc /ntpclimited

एनटीपीसी NTPC

एन टी पी सी लिमिटेड
भारत सरकार का उपक्रम
NTPC Limited
A Govt. of India Enterprise
(Formerly National Thermal Power Corporation Ltd.)
केन्द्रीय कार्यालय / Corporate Centre

सी. शिवकुमार
कार्यकारी निदेशक (सुरक्षा, सतत विकास, पर्यावरण एवं राख प्रबंधन)
C. SIVAKUMAR
EXECUTIVE DIRECTOR (SAFETY, SUS DEV., ENVIRONMENT & ASH MANAGEMENT)

Water is one of the most essential needs for life. About 0.3% of the water resources in the world are usable. Water shortages already exist in many regions, with more than one billion people without adequate drinking water. This situation is one of the most important indicators of why we should be very sensitive and conscious towards our water resources.

As a responsible corporate, NTPC understands the importance of Water and commits itself to the cause of water conservation and usage optimization by becoming one of the Energy Majors to sign CEO Water Mandate.

In fact, NTPC has a dedicated Water Policy released in 2021, which commits NTPC to proactively conserve the most precious natural resource and address water sustainability issues through its implementation and serves as a directive for establishing water management strategies, systems, processes, practices, and research initiatives.

Accordingly, all NTPC stations have taken up many initiatives to generate **"More Power per drop"**

Following the principle of 3 Rs (Reduce, Recycle & Reuse), NTPC has undertaken various steps to optimize the present water footprint along with many initiatives to enhance conservation.

Considering the strategic importance of ESG for NTPC and water being an important component of the Environment portfolio, it becomes imperative to not only meet the statutory norms but to exceed the stakeholder's expectations by achieving better results.

Accordingly, NTPC has included Water Consumption and Optimization as an important KPA in its Brighter Plan 2032.

Further, I would like to congratulate my Team at Corporate Environment Management, for taking up this initiative in collaboration with stations, to consolidate the various initiatives and bringing out a useful and informative document- **"Water Compendium" on World Water Day.** This document will help in sharing knowledge and will also benefit in building awareness in public domain.

With Best Wishes.

(C Sivakumar)

कमरा न. 168, ई ओ सी बिल्डिंग, ए-८ ए , इस्कॉन मंदिर के सामने, सेक्टर- २४, नोएडा-२०१३०१ (उत्तर प्रदेश)
R.No.168, EOC Building, A-8A, Opp. Iskcon Temple, Sector-24, Noida-201301 (U.P.)
Tel. Off: 0120-2410466, Fax: 0120-2410621, E-mail: csivakumar@ntpc.co.in
पंजीकृत कार्यालय एन टी पी सी भवन, स्कोप कॉम्प्लेक्स, ७, इंस्टीट्यूशनल एरिया, लोधी रोड, न्यू दिल्ली – ११०००३
REGD.OFFICE: NTPC BHAVAN, SCOPE COMPLEX, 7, INSTITUTIONAL AREA, LODHI ROAD, NEW DELHI-110003

Water Policy 2021

NTPC as a responsible corporate entity for environment has proactively initiated steps towards water stewardship in power generation sector. NTPC released its Water Policy to set its own benchmark in water consumption in power generation by setting its aim and objectives for various water conservation and management measures by using 3Rs (Reduce, Recycle & Reuse) as guiding principle.

NTPC Jhanor

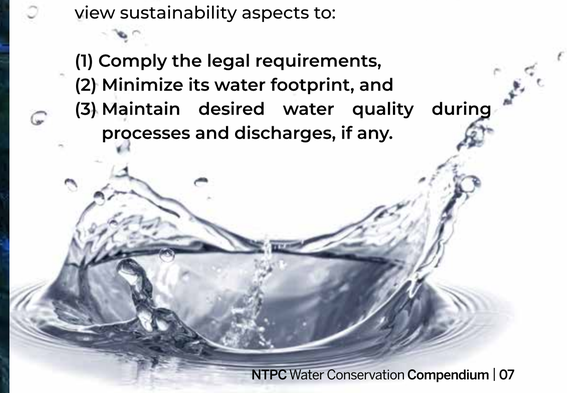
PURPOSE

Water is the basic amenity for domestic, agricultural and industrial use. As a responsible corporate citizen, NTPC commits to be a flag-bearer by optimizing its processes & practices to increase fresh water availability for other uses.

At the same time, the quality of water/steam is a no-compromise zone for NTPC's processes to ensure un-interrupted power supply and to increase equipment's efficiency & reliability.

NTPC hereby commits to proactively conserve the most precious natural resource and address water sustainability issues through implementation of this Water Policy, which will serve as a directive for establishing water management strategies, systems, processes, practices and research initiatives keeping in view sustainability aspects to:

(1) Comply the legal requirements,
(2) Minimize its water footprint, and
(3) Maintain desired water quality during processes and discharges, if any.



NTPC Vindhyachal

PHILOSOPHY

NTPC shall follow 3 R's for water conservation and management by adopting the best Practices, while carrying out its core business activity of Power Generation.

APPLICABILITY

This policy shall apply to all establishments of NTPC and its JV companies.

OBJECTIVE

- To be amongst the least water intensive power generator globally.
- To ensure right quality of water all the time at every point.
- Endeavor to achieve positive water footprints in NTPC Townships.

POLICY

NTPC shall achieve these objectives by:

Stakeholder Management

NTPC shall:

a. Identify internal and external stakeholders (such as employees, Opinion makers, media, community, District administration, and respective State Governments etc) and list their water-related expectations.

b. Prioritize and identify the areas which need action based on (a) and establish phase wise goals and targets.

c. Take required technological support that promote water sustainability, by collaborating with:
   - International and national research institutes.
   - Equipment manufacturers and suppliers.
   - Peer group/internal expertise.

d. Play key role for undertaking study and policy advocacy for water-related issues.

e. Communicate key "water messages" to all the stakeholders to promote awareness on water sustainability issues and enforce informed decisions timely.

Water Stewardship

NTPC commits to:

- Become a Zero Liquid Discharge company for all closed cycle operating stations.
- Identify and implement Water conservation initiatives to reduce specific water consumption in NTPC.
- Cascade water quality at all points of use, from best to worst water quality depending on the requirement of systems/ processes.
- Establish water footprints of NTPC business across its entire value chain, and strive to reduce it.
- Ensure right quality of water (or steam) at every point, without deviation.
- Break down water consumption in all processes individually and benchmark the same internally with other stations and outside NTPC.
- Regularly review the quality and availability of water – from conventional and non-conventional water resources – to ensure that NTPC's water supply requirements are met in the short, medium and long term.
- Constitute focused Working Groups at Corporate, Regions and Stations, responsible for entire water systems in research and adopt edge cutting technologies in all areas wherein company is having business ventures to improve water efficiency & reducing impact on natural water resources
- Measure and track domestic water consumption vis-à-vis global standards, for optimization. Adoption of latest technologies to achieve the desired results shall be encouraged and promoted.
- Ensure that potential of rain water harvesting is fully garnered at all locations in plant, township and green belt areas.
- Rehabilitate all the water bodies located in establishment/ project affected areas/villages in phased and time bound manner and re-visit them for further activities in a cycle of 2/3 years.

Compliance and Assurance

NTPC shall continue to:

- Ensure that Stations are complying with water-related regulations, like:
  - Compliance beyond Environmental norms on Specific Water Consumption,
  - Discharges, if any, shall be consistently as per stipulated norms and efforts are to be made to achieve quality beyond norms.
- Identify water-related risks and its mitigation strategies.
- Develop water management information systems, to update actual water balance three times a year (seasonal factors), to initiate timely and appropriate actions.
- Undertake regular water audits, deliberate and act on recommendations.


NTPC Dadri


NTPC Singrauli

Human Resource Development

NTPC shall:

- Provide specialized training to focused groups at Corporate and Station levels to meet policy objectives.
- Organize training on water related aspects for all employees and allied groups (Townships/Schools/CISF/Bank/Post Office etc.).
- Subscribe and disseminate water related study reports, researches, findings, innovations through different media to all employees.
- Encourage discussion platforms such as Professional and Quality Circles focused on water conservation and sustainability issues.

STRUCTURE & RESPONSIBILITIES

Overall responsibility is vested with NTPC management, however, the implementation of this policy is primarily that of the factory occupiers under the guidance of Regional Headquarters.

FOCUSED GROUP STRUCTURE

Corporate Centre

A dedicated cross-functional group to be formed and responsible for:

- Strategy formulation, review and follow-up of all water management activities.
- Design, prepare and support in formulating water budget and its implementation.
- Provide inputs to Sustainable Development group on water related schemes, projects, and planning.
- Issue necessary OGN as required from time to time.

RHQs/Stations/Projects

- REDs to form appropriate dedicated teams in RHQs/ Stations/Projects.
- BUH shall be responsible for implementation of all policy points at their respective stations.
- Station will prepare LMI based on site specific conditions.

AWARD FOR EXCELLENCE IN WATER MANAGEMENT

For the contribution in reducing water footprints, two awards shall be given annually on occasion of Water day celebration i.e. 22nd March. Details of award is as follows:


NTPC Sipat

Most Water Efficient Plant

One Station shall be awarded for most significant contribution in reducing its water footprint in process/operations.

Best Water-efficient Township of Year

For Station's township which is most efficient in water consumption and per capita water consumption is better than national consumption levels.

COMMITMENT & REVIEW

NTPC commits to support and implement this Water Policy. This policy shall be reviewed at opportune time, but not later than once in three years.

CEO Water Mandate

NTPC has became signatory of CEO water mandate on 23.03.2021, which is a highly collaborative partnership between the United Nations Global Compact, the Government of Sweden and a group of committed companies and specialized organizations dealing with the problems of water scarcity and sanitation. CEO Water mandate is designed as a private-public initiative with a focus on developing strategies and solutions to contribute positively to the emerging global water crisis.

The CEO Water Mandate is a UN Global Compact initiative that mobilizes business leaders on water, sanitation, and the Sustainable Development Goals. Endorsers of the CEO Water Mandate commit to continuous progress against six commitment areas of stewardship and in so doing understand and manage their own water risks.

- DIRECT OPERATIONS
- COLLECTIVE ACTION
- COMMUNITY ENGAGEMENT
- PUBLIC POLICY
- SUPPLY CHAIN & WATERSHED MANAGEMENT
- TRANSPARENCY

NTPC Bongaigaon

UN WATER

22 MARCH

WORLD WATER DAY

2022 Groundwater

The Importance of Water

World Water Day, held on 22nd March every year since 1993, focuses on the importance of freshwater.

World Water Day is being celebrated around the world to raise awareness of the 2.2 billion people living without access to safe water. It is about taking action to tackle the global water crisis. A core focus of World Water Day is to support the achievement of Sustainable Development Goal 6: water and sanitation for all by 2030.

Groundwater – making the invisible visible

Groundwater is invisible, but its impact is visible everywhere.

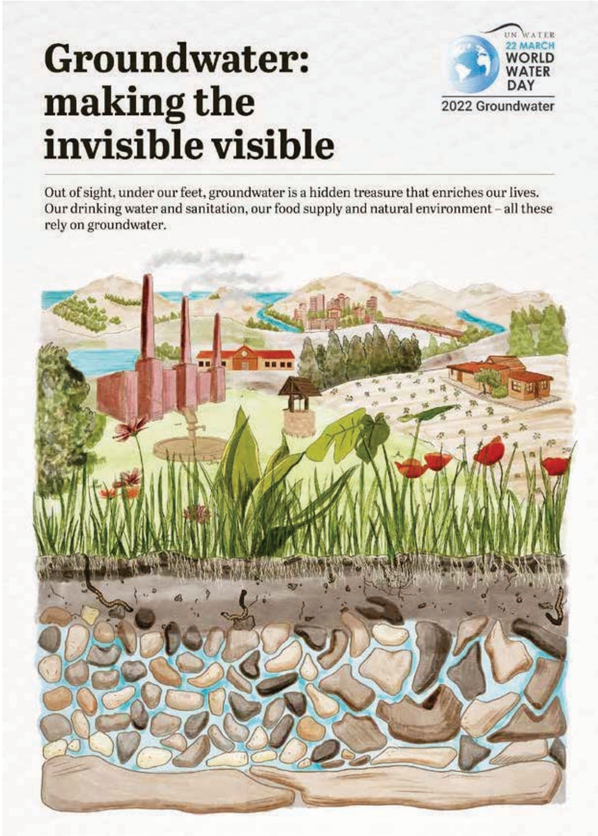
Almost all of the liquid freshwater in the world is groundwater, which is used for drinking water supplies, sanitation systems, farming, industry and ecosystems.

What we do on the surface matters underground. We must only put harmless, biodegradable products on the soil and use water as efficiently as possible.

Groundwater crosses borders. We must work together to manage transboundary groundwater resources.

We cannot manage what we do not measure. Groundwater must be thoroughly explored, analysed and monitored.

Groundwater will play a critical role in adapting to climate change. We must protect and explore groundwater, balancing the needs of people and the planet.



Research & Development Initiatives

By NTPC Energy Technology Research Alliance (NETRA)

COOLING WATER TREATMENT FORMULATION DEVELOPMENT FOR COC ENHANCEMENT

Introduction

Thermal Power Plant's Condenser Cooling Water System is highest water consuming utility. By operation of CW System at higher COC reduce the specific water consumption of a plant. NTPC stations are in different location are having a variation in water quality. Some stations of particular region are inherited with some particular cooling water chemistry, which provide some operational challenges.

Challenges for Thermal Power Station

- Need of operation of Cooling Water System of Power Plant at high COC, while raw water quality is degrading as comparison to previous years.
- Increasing Silica and Chloride in make-up water to CW System.
- High Turbidity in CW Basin with increase in COC.
- Readiness of Power plants for STP water usage for CW System.
- Need of Side Stream Filtration System on increase of COC and in the plants where STP water reuse having high TDS load is proposed for Power stations like Solapur, Mauda, etc. Side Stream Filtration System will not only be useful for minimising the CW system problems like scaling, Corrosion, Fouling and Bio fouling but also reduces the CW system Chemical dosing cost.

Methodology

- Testing of Make-up and circulating water of site to know the water characteristics regarding its nature of scaling or corrosive tendency.
- Thorough investigation of water characteristic nature by analyzing the all season water of last 2 years.
- Collection of water balance diagram and analyzing the site request for current high COC.
- Testing of scale inhibitors performance/efficiency for high COC water.

Data analysis and interpretation

- NETRA is providing Advanced Scientific support to NTPC stations by developing Chemical Formulation based on specific cooling water chemistry of each station. In 2020 NETRA developed Chemical Formulation for NTPC Solapur, Meja, BRBCL Nabinagar, Mouda Stage-I & II, Barh Stage-II, NSPCL Durgapur, Darlipalli and VSTPS Stage I, II, III, IV, V.
- **Total Projected Annual water saving (above eight stations) after implementing the chemical treatment will be 496.4 Lakh M^3.**

Application

After implementing NETRA's Chemical Treatment Formulation NTPC Stations like Talcher-K, Rihand Stage-III, Sipat Stage-I & II and Korba Stage-III achieved 269.2 Lakh M^3 Water saving annually by increasing their **COC upto 6**.

RECYCLING OF WASTEWATER BY PT PLANT SLUDGE THICKENING PROCESS

Introduction

Sludge handling and disposal is considered as most troublesome phase of industrial water treatment. Sludge may be defined as a semi-liquid waste having a total solids concentration of at least 2500 ppm. In NTPC Processes Sludge may be Primary Sludge coming from the settling process, Biological sludge coming from the biological treatment of the wastewater and Digested Sludge coming from a biological stabilizing step in the wastewater treatment.

NTPC Faridabad is facing sludge thickening issue of CW PT Plant Clarifier. Site intake water is drawn from Gurgaon Canal through Rampur distributary. Since inception of the plant, raw water quality is getting deteriorated with passage of time.

Methodology

Detailed analysis of Raw water, Clarified water and sludge was carried out to know its dewatering capacity. Several parameters which affect the dewatering capacity of sludge are Concentration (g/l), The organic matter content (%), colloidal nature of the sludge etc.

Data analysis and interpretation

- The organic matter content of sludge sample is high which leads to difficulty in the dewatering. In such cases, the dryness achieved will be low, the mechanical properties will be low, and the flocculant consumption will be high. BOD and COD of clarified water and sludge slurry sample is high, indicating that disinfectant dosage is insufficient.
- When the organic matter and volatile solids of the sludge is high, thickening step in the process is to be added in order to achieve a better dewatering. But challenge was selection of type of dewatering aid. These can be Mineral chemicals such as iron salts, lime and another type of organic chemicals such as coagulants and flocculants. The most common type of flocculants are cationic in nature

Sludge as received – No Flocculant

Sludge – 50 ppm Flocculant

Sludge Thickening experiments at NETRA

NETRA used different cationic coagulant to settle the sludge slurry sample from Faridabad. Finally, trial experiment with Polyacrylamide based Cationic Flocculant Chemical was successful in settling the sludge with optimum dose of 50 ppm.

Application

Based on lab studies, NETRA proposed:

- Optimization of disinfectant dosage of chlorine/ClO_2 so that BOD level can be reduced to minimum in sludge, which will enhance the dewatering capacity of sludge.
- Centrifuge system should be in operation to thicken the sludge and if required maintenance can be carried out by OEM/supplier.
- Use of Polyacrylamide based cationic Polymer with optimum dosage to settle the sludge. A Field trial is scheduled at site to optimize the dosage and time.

NON-THERMAL FORWARD OSMOSIS PROCESS OF TERTIARY WATER TREATMENT

Introduction

For most of thermal plants, large volumes of water is a crucial part of the process and as the demand for energy rises, the power sector's water usage is expected to increase even further, straining scarce water resources.

Tertiary treatment of STP water is primarily thru Reverse Osmosis (RO) System. Although RO is well proven technology but it has certain limitation viz: (i) limited water recovery (upto 70%), (ii) high power consumption (5.5-6 kWh/Ton), (iii) limited membrane life (4-6 years). Keeping in this mind NETRA is developing a bouquet of water treatment technologies which can be deployed for conversion of 'any kind of waste water' into 'any kind of process water'. Forward Osmosis (FO) is a one of such technology having very high recovery rate (up to 95%). Configuration of FO system can be designed to handle 2nd group compounds. Further, FO technology can be harnessed in both thermal and non-thermal means.

Technology

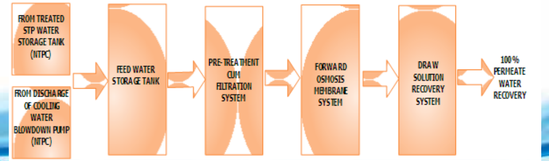
In FO technology, input water is first passed through FO membrane system where water is separated using osmotic pressure gradient arising across input water and concentrated 'draw solution'. This process occurs without application of external pressure i.e without usage of pumps. Thereafter, the diluted 'draw solution' is passed through 'membrane recovery system' where high quality permeate is obtained. Hence diluted 'draw solution' is converted to concentrated 'draw solution' which flows in the closed loop.

Salient Details

- In FO process water recovery rate is up to 95%. Therefore, this technology is better suited for water efficient operations.
- The FO membrane can handle high TDS level up to 2,00,000 ppm while RO membrane have limited capacity to handle TDS UPTO 70,000 ppm only
- FO system has lower bio-fouling tendency of membrane compare to RO. Therefore FO membrane have high life (8-10 years) compared to RO (4-6 years)
- Operating pressure in FO system is substantially less (< 8 bar) compared to traditional RO (60-70 bar). Substantially low auxiliary power consumption in FO due to low operating pressure

Application/Demonstration

In light of above, NETRA is going to demonstrate this technology at NTPC Mouda by designing and setting up 240 TPD Non-thermal FO (NT-FO) System with high recovery and capable of handling both in-house STP water and CW effluent.



ELECTRO COAGULATION TECHNOLOGY BASED SILICA REDUCTION IN RAW WATER AT NTPC SOLAPUR

Introduction

Silica can accumulate on surfaces as hard mineral deposits and can cause failure in boiler water wall tubes. Hence removal of silica from process water is required to prevent deposition and premature damage to boiler and turbine. High level of silica (more than design limits) in raw water was observed, at NTPC Solapur which is creating problem in DM streams. Electro Coagulation (EC) Technology was found suitable after technology scan. Further trials of EC technology were carried out at laboratory scale and pilot scale.

Technology

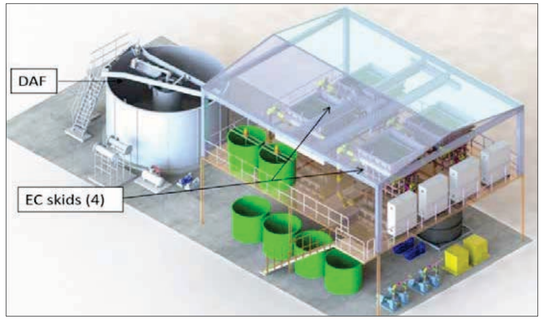
EC is offered as technical solution which is being used for novel application of Silica reduction in raw water. EC is an electrochemical method of treating water whereby sacrificial anodes corrode to release active coagulant precursors (usually aluminium or iron cations) into solution. This enhances effectiveness of coagulation and flocculation activity in water hence results in better silica removal. It is planned to put up a full scale plant of EC technology at NTPC Solapur with production capacity of 3600 TPD.

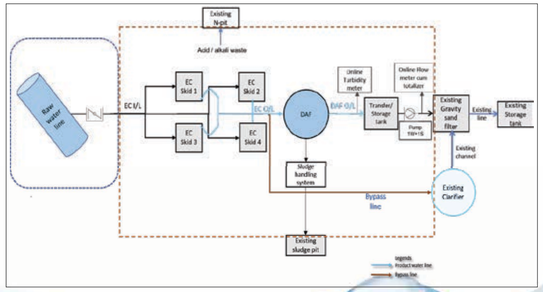
Advantage

Silica reduction to < 10 ppm from 25-30 ppm in raw water, hence trouble free operation of DM plant and maintaining boiler steam parameters.

Application/Demonstration

In light of above, Netra is going to demonstrate this technology at NTPC Solapur by designing and setting up 3600 TPD EC System.





NANO SILVER HYDROGEN PEROXIDE FOR DISINFECTION OF COOLING WATER

Introduction

- Cooling towers provide ideal conditions for micro organism growth. Currently used disinfection methods involve the use of chlorine, chlorine dioxide, UV, or ozone. Although these disinfectants are effective, but they have many constraints also.
- Nano-Silver particles can be used in view of their effective antimicrobial properties and low toxicity to mammalian cells, easy to handle & biodegradable nature. The purpose of our study was to determine the effectiveness of a biocide containing Nano-silver.

Methodology

- Site: NTPC Tanda Bearing Cooling Water System
- BCW of Tanda Thermal Power Station was chosen to study the performance of Nano silver hydrogen peroxide. The BCW system is used for cooling of auxiliary equipment's viz: compressor cooling pump, bearings etc. The BCW system had algae deposited on the walls/ columns of cooling tower.
- Biocide employed: Nano-Ag-H_2O_2 (colourless liquid, specific gravity: 1.2, Ag content: 500 ppm, H_2O_2: 50%)

Data Analysis and Interpretation

Variation in COD, BOD & ORP

- Monitoring of ATP

Observation

- Shock dosing (25 ppm, Nano-Ag-H_2O_2): Shock dosing was effective, as ATP count decreases from 269 pg/ml to 56pg/ml and remained well below 100 pg/ml for 22 hours.
- Maintenance dosing (07 ppm, Nano-Ag-H_2O_2): Initial Maintenance dose was not found to be effective as it increased the ATP count from 115 pg/ml to 405 pg/ml.
- Maintenance dosing (14 ppm, Nano-Ag-H2O2): Maintenance dose (14 ppm) had been found effective as it reduced the ATP count to 80 pg/ml and was maintained near 100 pg/ml up to 20 hours

Application

- The Nano-Ag-H_2O_2 has found to be effective biocide after trial carried out at Banda BCW System. It is very effective against SRB and algae removal and Cooling Tower pillers was cleaned. The ATP content has reduced from 405 pg/ml to 80 pg/ml when regular dose of Nano-Ag-H_2O_2 was increased from 07 ppm to 14 ppm on holdup volume basis.
- This study has proved that Nano silver peroxide dosing in CW is an alternate and eco-friendly approach and will give good results in biofilm removal efficacy.

ACTIVATED FILTER MEDIA (AFM) BASED TERTIARY TREATMENT OF EXISTING STP AT NTPC DADRI

Introduction

NTPC Dadri is having sewage treatment plant of installed capacity 3.8 MLD for treatment of sewage generated from township and plant with design output parameters of BOD - 20 ppm and TSS- 30 ppm. AFM TT Plant, which can treat existing STP treated water into high quality process water having BOD <10 ppm and TSS < 10 ppm.

Technology Activated Filter Media (AFM)

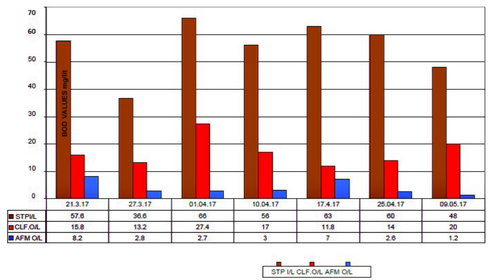
- Activated glass beads have meso-porous (Φ2-50 nm) structure with large catalytic surface area (~1million m2)
- High zeta potential (> -70 mV) of media attracts heavy metals & organics.
- In presence of oxygen and other oxidizing agent like chlorine etc., this catalytic surface generates free radicals that oxidize the pollutants and microbes.
- The media acts as a good substrate for controlled bacterial growth.

Advantages of AFM

AFM can be recovered and up cycled and reuse for water filtration, or can be directed into high value uses:

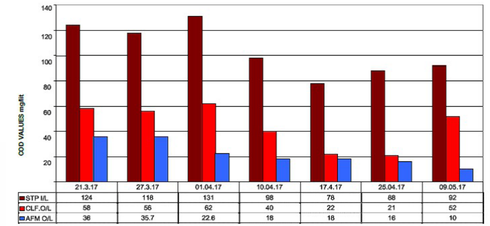
- Backwash water requirement reduces by up to 50%.
- Increased run phase and reduced back wash could give 15% energy savings.
- Reduced chemical consumption, chlorine & flocculants
- Expected life expectancy is 5 to 10 yrs.
- It also rejects bacteria growing and warm-hole channeling, removes heavy metals, Iron, Manganese & Arsenic from water. It reduces BOD & COD from water, removes organic impurities.

BOD VALUES OF AFM PILOT TRIAL AT TALCHER KANIHA STP



	21.3.17	27.3.17	01.04.17	10.04.17	17.4.17	25.04.17	09.05.17
STP/L	57.6	36.6	66	56	63	60	48
CLF.O/L	15.8	13.2	27.4	17	11.8	14	20
AFM O/L	8.2	2.8	2.7	3	7	2.6	1.2

COD VALUES OF AFM PILOT TRIAL AT TALCHER KANIHA STP



	21.3.17	27.3.17	01.04.17	10.04.17	17.4.17	25.04.17	09.05.17
STP I/L	124	118	131	98	78	88	92
CLF.O/L	58	56	62	40	22	21	52
AFM O/L	36	35.7	22.6	18	18	16	10

Adoption of New Technologies

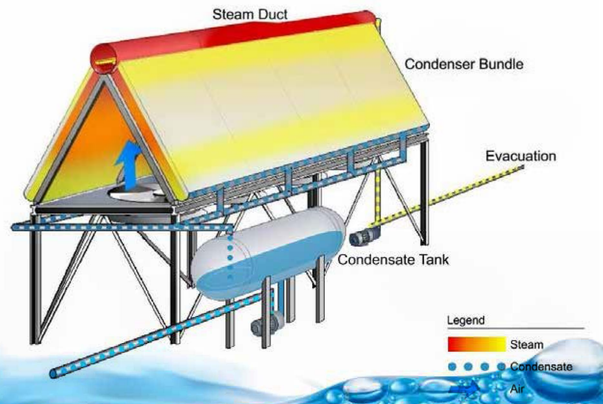
AIR COOLED CONDENSER

In water scarce and water stressed areas, Air Cooled condenser (ACC) is a good option to improve feasibility of setting up a power plant. NTPC has been path finder in this regard by adopting ACC based super critical units in North Karanpura (3x660 MW) and Patratu (3x800 MW).

Exhaust steam from the Turbine is led through Steam Duct to the Air-Cooled Condenser where it is distributed into finned tubes configured in A-frames for condensation.

Air is circulated by the cooling fans over the finned tubes. For higher size units' single row, flat carbon steel tubes with Aluminum fins are used. ACC for a typical 660 MW unit consists of about 80-100 nos of Fan Modules. Footprint of ACC is about "125m x 100m" with height of Fan deck and Top Steam duct as 40m and 70m respectively.

Saving of water in Air cooled condenser is approx. 63% in comparison to water cooled condenser.



HIGH CONCENTRATION SLURRY DISPOSAL SYSTEM

In conventional Lean Concentration Slurry Disposal (LCSD) System ash is disposed in ash dykes as lean slurry. This system have limitations/disadvantages on account of higher amount of water requirement, vast land requirement etc.

High Concentration Slurry Disposal (HCSD) Systems is a modern technique of disposing fly ash from thermal power plants to ash pond. In HCSD, Ash slurry is produced at a concentration of 60% to 75% of ash by weight and pumped through piston diaphragm slurry pumps to disposal area. The mixture behaves like semi solid and a non-newtonian fluid. The disposal of this highly viscous and nonnewtonian fluid requires special type pumps.

In HCSD system, water consumption is reduced. Water requirement is about 1/10 as compared to LCSD. HCSD system requires less land for disposal of fly ash. Specific energy consumption is also reduced.

NTPC Gadarwara

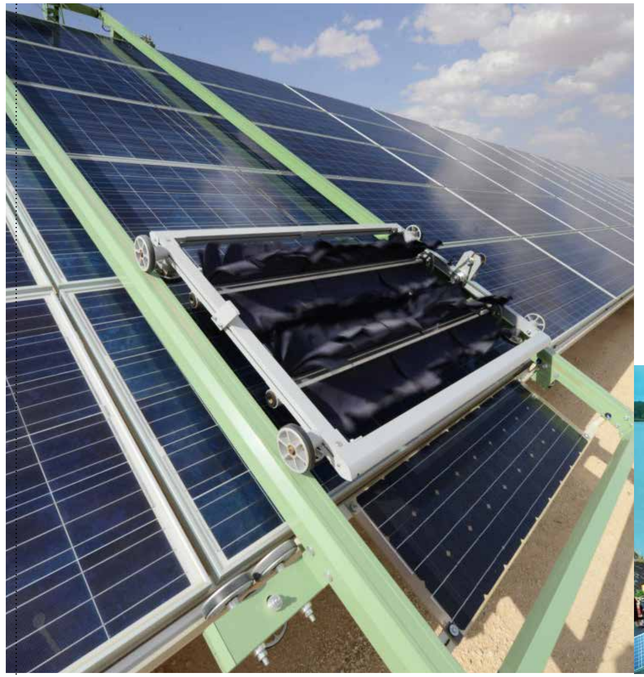
ADOPTION OF DRY BOTTOM ASH HANDLING SYSTEM

There are two fraction of ash i.e. Fly ash and Bottom ash in ratio of 80:20%. NTPC has already adopted Dry Ash Extraction System (DAES) to make the dry fly ash available to other end users. The traditional method of disposal of the bottom ash is to make a slurry of ash by mixing with water and pumping the same to distant located “ash ponds” through long distance pipes. This process requires considerable amount of water and is known as Conventional Lean Concentration Slurry Disposal (CLSD) System. One method to reduce water consumption is the adoption of dry ash handling system in which ash is extracted and disposed in dry form using pneumatic vacuum system.

Dry Bottom ash handling system is being installed in our new units at NTPC Unit Patratu and North Karanpura.

DRY SOLAR PANEL CLEANING

In solar panel cleaning, advance technologies having either no water usage or minimum water usage are available. In Dadri solar PV plant, 64 number of robots have been installed for dry cleaning of 4MWp solar PV panels. These robots are self-powered by dedicated separate solar panels. We are saving approx. 4,000 KL water annually after installation of dry robotic cleaning.



REDUCTION OF EVAPORATION LOSS THROUGH FLOATING SOLAR PV PLANTS

Floating Solar PV is an emerging renewable energy technology in which solar PV panels are installed on top of a floating platform, usually made of plastic type of material. Although the primary importance of such system is energy generation without using precious land areas, it can serve as a major means to conserve another precious resource, water, by reducing its natural evaporation rate. NTPC has already installed Floating Solar Plants in Raw Water reservoirs of NTPC Power stations at Kayamkulam, Simhadri & Ramagundam.

Ramagundam Floating Solar Plant (100MW)

Floating Solar Plant at NTPC Kayamkulam

Simhadri Floating Solar Plant (25MW)

Drinking Water from Sea Water

SOLAR POTABLE WATER PRODUCTION UNIT AT NTECL VALLUR

A unique pilot research project by NETRA of Solar Potable Water Production Unit of capacity 120 Tons/day was commissioned at NTECL in December 2020.

This unit utilizes solar energy to convert sea water from Cooling water blow down into high pure distillate at a rate of 5 TPH having TDS of 5-10 ppm which will be converted into potable water after Remineralization. High efficiency Solar Panels-Evacuated Tube Collectors with Compound Parabolic Concentrators are used. Multi effect distillation Unit, Remineralization set up, Ozoniser for disinfection and bottling plant are erected and commissioned. Connection from Auxiliary steam line to this Unit for operating during non Solar periods is made.

Introduction

120 TPD (tons per day) Pilot Solar Desalination Pilot plant was designed to produce potable water from sea water. This pilot plant utilizes solar thermal energy to run thermally driven machine called Multi Effect Distillation (MED) to produce distillate from seawater that will be converted to potable water after re-mineralization.

System Description

The Solar Desalination plant is divided into two parts namely LP steam Generator Block and Desalination block.

LP steam Generator Block

The hot water will be generated using solar thermal technology i.e. Evacuated Tube collectors with Compound Parabolic Collector (CPC). The hot water output from solar field (2200 M^2 Area, 600 KWth at GHI 600 W/M^2) is flashed in a chamber, which is maintained under vacuum to generate low-pressure steam. During non-solar/ low solar period, heat of auxiliary steam will be utilized for MED. LP steam heat exchanger is used for this purpose.

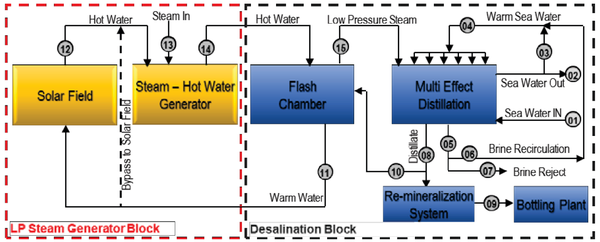
Distillation Block

The flash steam generated above will be utilized as a heat source in the 1st effect of Multi Effect Distillation (MED) plant, where sea water is sprayed over LP steam piping. Due to the combined effect of high skin temperature of the LP steam piping and vacuum in the distillation chamber, part of the sprayed sea water will be evaporated. This phenomenon is similar to a 'falling film reactor'. The evaporated vapor will go to the next chamber of MED where it acts as working steam. The process is repeated in the subsequent stages of MED. Last stage of MED is a condenser where vapor generated from preceding stages is condensed. The number of effect will primarily depend on the input steam parameters and the CW inlet temperature to MED condenser. The desalinated water produced from MED will be sent to the re-mineralization plant to add necessary minerals for producing drinking water. The process flow diagram of the proposed solar desalination plant is given below.

SALIENT FEATURES & PROCESS PARAMETERS

• Capacity of Plant	: 120 TPD
• Thermal Rating of Plant	: 500 kWth (approx.)
• Input Sea water	: 60 TPH, 33°C
• Make up Sea Water in MED	: 27 TPH, 38°C
• Sea Water Reject	: 47 TPH 42°C
• Hot Water to Flash chamber	: 30 TPH, 90°C
• LP steam input	: 0.7 TPH, 72°C
• Distillate generation	: 5 TPH, 49°C
• Distillate Quality	: TDS @ 5 ppm
• Gain Output Ratio (GOR=Distillate/Steam Input)	: 6
• Output Drinking Water	: 4.17 TPH, 49°C
• Brine Reject	: 7.5 TPH
• Brine Recirculation	: 15 TPH

Note: The Reject water is taken back to Sea Water Desalination Effluent Tank and in-turn send to CMB.



FLUE GAS BASED SEA WATER DESALINATION SYSTEM AT NTPC SIMHADRI

Introduction

Flue Gas based Sea Water Desalination (FG SW Desal) pilot plant is an innovative, low carbon intensive desalination system. This plant is first of its kind in our country. In this facility, the waste heat from exiting flue gas in a fossil fired power plant is utilized for distillation of sea water instead of steam or electricity as used in conventional desalination system.


Multi Effect Distillation (MED)

System Description

The plant is divided into 2 blocks:

LP Steam Generator Block

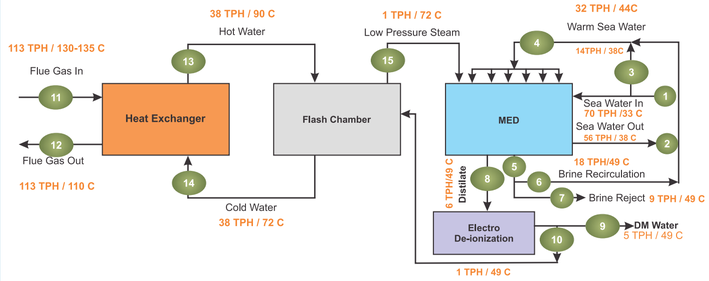
In LP Steam Generator Block, the thermal energy from exhaust flue gas exiting ID Fan is utilized to generate hot water at desired temperature thru a heat exchanger. This hot water is flashed in a flash chamber which is maintained under vacuum to generate low pressure steam.

Desalination Block

The flash steam so generated is fed to the Desalination block i.e. the 1st effect of Multi Effect Distillation (MED) Unit. In this chamber, sea water is sprayed over LP steam piping. Due to the combined effect of high skin temperature of the LP steam piping and vacuum in the distillation chamber, part of the sprayed sea water is evaporated. This phenomenon is akin to a 'falling film reactor'. This evaporated vapour is fed to the next distillation chamber of MED where it acts as working steam and the above mentioned process is repeated. Last stage of MED is condenser where vapour generated from preceding stage is condensed. The desalinated vapours produced in various effects are condensed and send to the electrode-deionization system where it is converted to DM water.

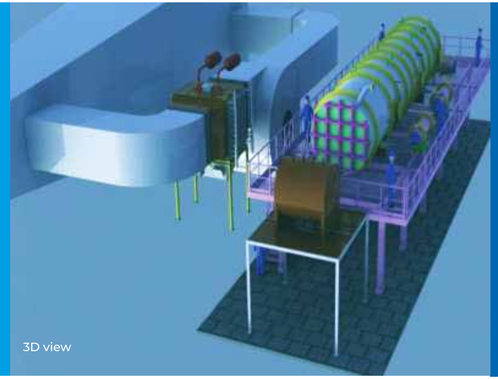
The number of effects will primarily depends on three factors: (i) Input steam parameter, (ii) Cooling Water Inlet temperature of MED condenser, (iii) Calcium Content in Sea Water.

PROCESS FLOW DIAGRAM



SALIENT FEATURES

- Capacity of Plant: 120 TPD
- Thermal Rating of Plant: 800 kW-Th
- Technology: (i) Desalination: Multi Effect Distillation; (ii) LP Steam: Flash Steam Generator in conjunction with Flue Gas Heat Exchanger
- Plant Input: (i) Waste Flue Gas from ID Fan outlet; (ii) Sea water; (iii) Auxiliary power for drives
- Plant Output: (i) DM water; (ii) Potable water
- Gain Output Ratio (GOR): more than 6
- Foot Print: 300 sq. mtr.


3D view

ADVANTAGE

- Utilization of waste heat.
- Cost effective desalination technology.
- Sustainable & Environment Friendly.
- Minimal chemical consumption: FG-MED design temperature (65^{0}C) considered below the solubility temperature of carbonates (70^{0}C) and sulphates (67^{0}C).
- Continuous operation system: No intermittency in operation, therefore high yield & plant availability.
- Modular & Scalable design.

Water Conservation Measures in NTPC

OUR STRATEGY

- R&D Efforts
- Air Cooled Condenser (AAC)
- Treatment & Reuse of Sewage Treated Water
- Liquid Waste Treatment Plant (LWTP)
- Ash Water Recirculation System (AWRS)
- Rainwater Harvesting
- Zero Liquid Discharge
- Increasing Cycles of Concentration

NTPC Simhadri

ZERO LIQUID DISCHARGE

As per MoEF&CC Notification dated 7th December 2015 and it's amendment dated 28th June 2018, Thermal Power plants installed after 1st January 2017 shall have to achieve zero wastewater discharge. Zero wastewater discharge Shall not be applicable to the Thermal Power Plants using sea water.

NTPC has taken proactive approach to become a Zero Liquid Discharge company for all its power stations.

Drain separation scheme has been implemented to segregate all type of plant effluents from storm water drain to ensure that plant effluents does not mixed with storm water & will not be released outside plant boundary in all seasons including monsoon. Plant effluents is being recycled, treated & reused to reduce water consumption.

In general, the following philosophy has been adopted for separation of plant drain from the storm water drain:

- Area wash water, Oil/Coal/Ash/Chemical contaminated water are considered as Plant Water.
- Plant water is completely isolated from the Storm/Rainwater and only Plant water needs to be treated & recycled/reused for various plant use. Storm water drains is separated out for free discharge or for harvesting.
- Area Pit/sump(s) are created broadly in the following areas to facilitate collection of plant drains:
  - TG Area
  - Condenser pits & CW Valve pits area
  - Boiler Area
  - CHP transfer point in the main plant area
  - Mill & Bunker area
  - ESP area
  - FOH area
  - Other Clusters in the plant area

- Submersible Pumps (Capacity-2x100%) interlocked with Level control devices are installed in the Area Pit/sump(s) to transfer the Plant Water to Waste Service Water Sump (WSWS) located in main powerhouse area or WTP area, Ash slurry sump/tank, Coal Slurry Settling Pond(CSSP), Central monitoring basin(CMB) depending on the proximity.
- The rainwater down comers shall be led to storm water drains without entry of Wash water drains into such down comers.

In new stations ZLD scheme has been included in EPC package. For older stations , A concept paper has been developed by our Project Engineering group for implementation of the ZLD scheme. Area wise scheme shall be as below:

TURBINE AREA

A-TG Ground Floor Area

- TG area pit/sump(s) shall be provided in turbine hall ground floor preferably in the B-C bay to collect the wash water having traces of oil & grease. Each pit/sump shall be provided with submersible pumps (Capacity-2x100%) to evacuate the pit/sump within 15-20 minutes.
- The operation of the pumps shall be interlocked through level measurement devices to be installed in the pit/sump so that the pumps shall start automatically and empty the pit on achieving certain level. Pumps are to stop on emptying the sump/pit
- The effluent from the proposed sump shall be pumped to Waste Service Water Sump (WSWS) or WTP area. Portable type oil skimmer(s) & Portable oil centrifuge shall be provided in the Waste Service Water Sump and purified oil shall be used either in non-critical units for lubrication purpose or the same shall be disposed of as per waste management rules.
- A drain header with the funnels shall be provided along the columns in TG Building at various floor areas to which various vents, drains, other sources of water etc. shall be connected which shall finally be led to TG area pit/sump(s).
- The rainwater down comers to be routed directly into storm water drain which finally goes out of the facility without any treatment or sent for harvesting.

Condenser Pits and CW Valve Pits Area

Condenser pits and CW valve pits shall be provided with raised dyke walls to avoid any oil spillage/wash water into the Condenser pit for ensuring oil free water. Submersible pumps (Capacity-2x100%) shall be provided to pump the water collected in Condenser pit to CW channel.

Other Oil Drainage in TG Area

All oil drainage shall be routed individually to a common collection tank for collecting oil or any such obnoxious material. Reusable part of oil from this tanks shall be transferred to dirty oil tank or drum for further processing.

ACW Self-cleaning Strainer Flushing Water

- ACW self-cleaning strainer flushing water shall be diverted to CW channel or fore bay suitably.
- Atmospheric flash tank drains & hot water drains of equipment shall be led to TG area pit/sump(s) after cooling.

BOILER GROUND FLOOR

- A Boiler area pit/sump(s) shall be provided preferably below the APH area in boiler ground floor to collect the wash water along with ash and oil particles. Each pit/sump shall be provided with submersible pumps (Capacity-2x100%) to evacuate the pit/sump within 15-20 minutes.
- The operation of the pumps shall be interlocked through level measurement devices to be installed in the pit/sump so that the pumps shall start automatically and empty the pit. The water shall preferably be pumped to Ash Slurry Sump or Waste Service Water Sump (WSWS) depending on the layout.
- Overflow from the bottom ash overflow tank to be led to Ash slurry sump either by gravity or by pumping as the case may be.

- All hot water blow downs from boiler shall be led to above Boiler area pit/sump(s).
- The rainwater down comers to be routed directly into storm water drain which finally goes out of the facility without any treatment or for harvesting.

CHP TRANSFER POINTS IN MAIN PLANT AREA

- The wash water down comers leading into a drain, starting from first transfer point near to mill to the last transfer point in main plant area, shall be collected in a Transfer Point Pit/sump(s) near last transfer point in main plant area.
- The wash water from transfer points in main plant area laden with coal particles shall be treated in coal slurry settling pond (CSSP) near the coal stock yard area.
- For wash water, separate down-comers other than rainwater downcomers shall be provided.
- The wash water from Transfer Point Pit/sump(s) shall be led to Coal Slurry Settling Pond (CSSP) either by gravity or pumping (capacity 2x100%) based on the plant layout.
- In case of gravity flow through channels, suitable flushing arrangement shall be provided to avoid settling of coal particles.

MILL AND BUNKER BUILDING

- The wash water from mill floor area shall be collected in the mill floor area pit/sumps located at the end of Mill reject system trench.
- The wash water from various floors like tripper floor, feeder floor etc. shall be led through down-comers pipes to the pits/sumps.
- For wash water, Separate down-comers other than rain water down-comers shall be provided.
- This water shall be led to coal slurry settling pond (CSSP) either by gravity or pumping (capacity-2x100%) based on the plant layout.
- In case of gravity flow through channels, suitable flushing arrangement shall be provided to avoid settling of coal particles.
- Separate pit/sump(s) for the mill bays shall be provided. The pit/sump(s) shall be resized to cater the washing of mill area floor, tripper floor and feeder floor etc.
- The rainwater down comers to be routed directly into storm water drain which finally goes out of the facility without any treatment.

ESP AREA

- The trench around the ESP area shall be suitably blocked to isolate it from storm water drain.
- The ash laden wash water from ESP area shall be collected in ESP Area Pit/sump(s) which shall preferably be located on the rear side of ESP. This water shall led to Ash slurry sump/tank either by gravity or pumping (Capacity-2x100%) based on the plant layout.
- Where ash slurry trenches are available, the wash water can be removed via the trenches to ash slurry sump.
- Seal water from vacuum pumps shall be collected in above ESP Area Pit/sump(s).

- The rainwater down comers to be routed directly into storm water drain which finally goes out of the facility without any treatment.

FUEL OIL HANDLING AREA

The wash water from the FOPH area containing traces of oil requires to be pumped to oil water separator pit in the fuel oil unloading area as per present practice. The decanted water shall be reused/recycled for the washing of fuel oil handling areas or collected in FOH Area Pit/sump(s) & pumped (Capacity-2x100%) to Waste Service Water Sump (WSWS) located in main powerhouse area or WTP area.

Effluent Treatment Systems

COAL SLURRY SETTLING PITS

Storm water drain in CHP area to be separated to reduce load in Coal Slurry Settling Pits. All the drain water and wash water from Crusher house, Track hopper, wagon tippler, Conveyor transfer points, conveyor gallery etc are diverted to CSSP and treated water is being used for dust suppression and as service water in CHP area.

Coal Slurry Settling Pits

LIQUID WASTE TREATMENT PLANTS

The effluent generated from various sources in the main plant area are treated in LWTP and treated water is reused in the plant as service water/ ash slurry make up.

Liquid Waste Treatment Plant

ASH WATER RECIRCULATION SYSTEM

NTPC stations have installed AWRS for optimization of water consumption in a closed cycle and achieving the zero liquid discharge from ash ponds. The effluent from ash pond is recirculated back to the plant for further ash slurry makeup.

Toe Drain Recirculation System is provided to recirculate Seepage water from the ash Dyke and the water is being reused in ash handling system and Dust suppression.

Ash Water Pump House

Ash Water Treatment Plant

Seepage Water Pump House

Reuse of water for Dust Suppression in Ash pond

SEWAGE TREATMENT PLANT

Sewage treatment Plants have been installed at all NTPC stations having new technologies like MBBR (Moving Bed Bio film Reactor) and Soil Biotechnology etc for treatment. Portable STPs are also being installed for remote locations as well as where same is required as per plant layout.

The effluent quality is monitored regularly and treated effluent is used further in horticulture purposes in the NTPC premises.

MBBR based Sewage Treatment Plant

Soil Biotechnology Based STP at NTPC Kahalgaon

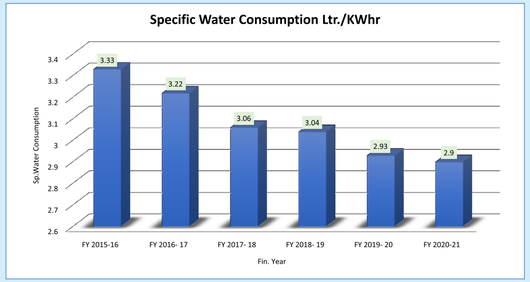
Packaged STP

Use of Treated sewage water for horticulture

Specific Water Consumption & Monitoring

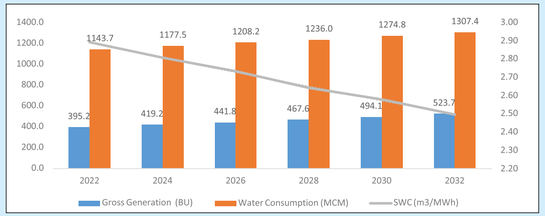
With various water conservation measures, Sp. Water consumption of NTPC is being continuously monitored and brought down to less than 3 litre / kWh.

SPECIFIC WATER CONSUMPTION TREND OF NTPC



ROAD MAP TO ACHIEVE SPECIFIC WATER CONSUMPTION 2.5 LITRE / KWH UPTO FY : 2032

Year	2022	2024	2026	2028	2030	2032
Gross Generation (BU)	395.2	419.2	441.8	467.6	494.1	523.7
Water Consumption (MCM)	1143.7	1177.5	1208.2	1236.0	1274.8	1307.4
SWC (Litre / kWh)	2.89	2.81	2.73	2.64	2.58	2.50



WATER DASH BOARD

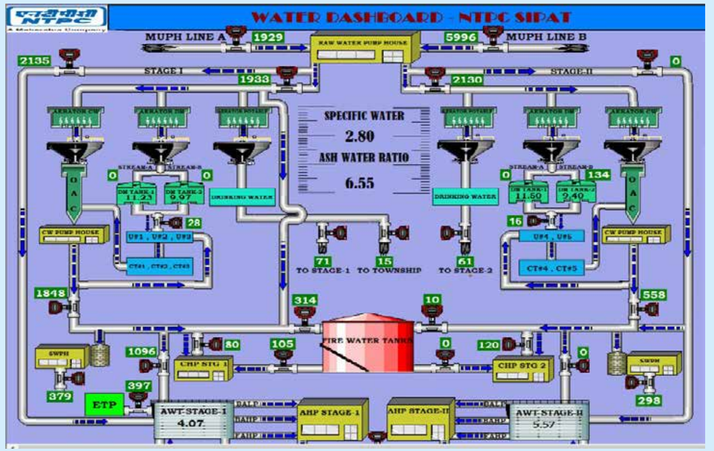
- To reduce our freshwater footprint, water consumption needs to be monitored and controlled. 24x7 Monitoring through dashboard is a step towards water optimization. Pan NTPC water dashboard is being developed in phase manner.
- Water consumption across all end users as per Water Balance Diagram(WBD) will be available for all concerned on continuous basis as well as for daily/ yesterday & monthly trend basis for corrective action for optimization.
- Even though Engineering WBD have quite a reasonable margin for all end users, but continuous monitoring will guide us to set new benchmarks for further optimization.

WATER AUDIT & WATER BALANCE STUDY

Water Audit and water Balance Study through internal and external agencies is being done on regular basis at all NTPC Stations and recommendations are being implemented to reduce specific water consumption.

WATER STORAGE RESERVOIR

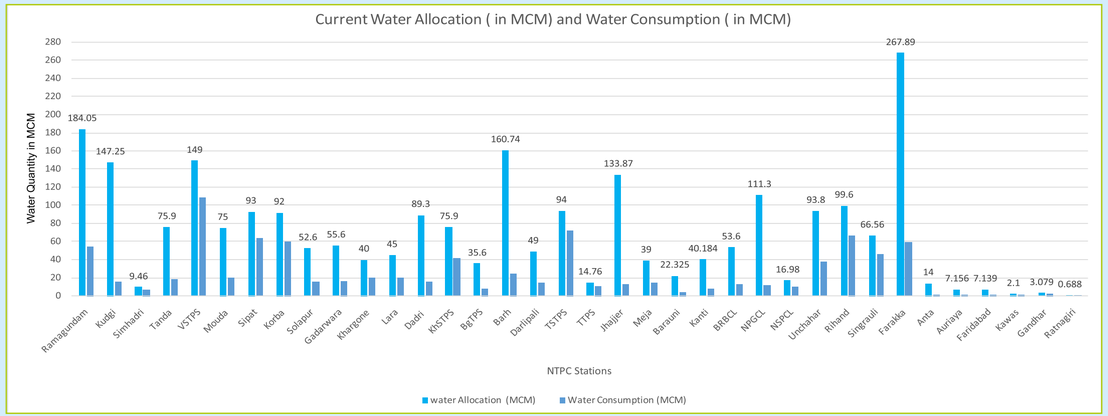
Water Storage reservoir is constructed at NTPC Stations and also storage losses have been reduced by upgrading reservoir Lining (with HDPE liner) to avoid percolation/seepage losses.

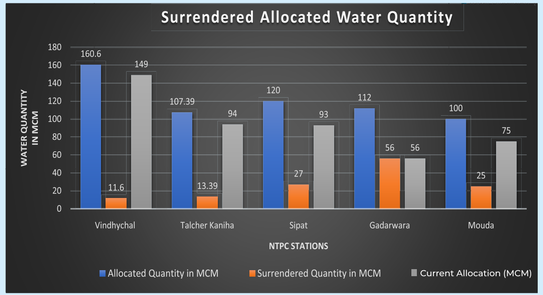


NTPC Stations	Reservoir Area (m^2)
Dadri	51300, 97400
Sipat	696000, 546000, 492000
Tanda	62000, 42000
Talcher-Thermal	21450, 20700
Ramagundam	12100000
Bongiagaon	23172.2
Kudgi	768903, 708200
Solapur	582932
Lara	211344, 194362
Kanti	19400x2
Jhajjer	708050
Darlipali	387*130 , 344*130
Anta	263046x2
Auraiya	265000, 100000
Faridabad	15175
Jhanor	21150x2
	Reservoir Storage (m^3)
Mouda	75000
Khargone	190980
Kawas	355186, 1060617

WATER ALLOCATION AND CONSUMPTION (FY: 21-22)

Current Water Allocation (in MCM) and Water Consumption (in MCM)





Station	Surrendered Quantity in MCM	Year of Surrender	Current Allocation Quantity in MCM
Vindyachal	11.6	2016	149
Talcher Kaniha	13.39	2016	94
Sipat	27	2018	93
Gadarwara	56	2021	56
Mouda	25	2021	75
Korba	Requested surrender 12 MCM (In pipeline)		92

REGULAR PRACTICES ADOPTED FOR SP.WATER CONSUMPTION REDUCTION

To reduce specific water consumption following are regular practices at NTPC stations

Ash Handling System :

- Ash Water Ratio Optimization : Ash water ratio in both Lean slurry disposal system as well as in High Concentration Slurry Disposal is being optimised for water conservation.
- Ensuring dry mode operation of ESP for higher ash utilization
- Continuous monitoring of ash pond water level for reduction of overflow
- Seepage control and Ash dyke toe drains water re-circulation.
- Reducing seepage loss in reservoirs if any.
- Maximization of Dry Ash utilization

Cooling Water System :

- Blow down optimization and use of blowdown water in ash handling system.
- Stopping of CW system drains going outside.
- Control of CT overflow & CT cold basin level.
- Optimise no. of running CW pumps (APC optimisation as well as water consumption reduction)

Coal Handling System

- Use of water in Dust suppression as per requirement only.
- Use of Equipment cooling water in close loop wherever possible.
- Use of treated water from coal settlement pit for dust suppression/ service water for CHP system.

Storm Water Drain :

- Keeping Storm water drains in dry condition during non-rainy season.
- Regular Survey of storm water drains & back track the flow if any.

Air conditioning systems

- Optimization of water consumption by controlling overflow of cooling tower in ESP area, Main Plant , Switchyard, DM plant

Drains

- Regular check of all Drains in Boiler /Turbine area and attending leakages if any.
- Regular check of System leakages and spillages and attending leakages/spillages if any

Township

- Use of STP treated Water in horticulture.
- Overflow/Leakages of water are being attended immediately.

Fire water :

- Reduction of firewater consumption by arresting leakages in fire water pipeline circuit if any.
- Providing necessary water at strategic locations
- Monitoring firewater pressure at various locations.

Drinking Water :

- Control of Leakages / spillages/overflow by frequent walk down surveys

Smart Townships

NTPC is converting two of its townships at “Solapur” and “Khargone” to “Smart Townships”. The work in these townships involves applications of smart solutions like Pan-Township security and surveillance system, smart water metering, leakage identification and water quality monitoring, smart energy metering and use of renewable energy sources, robust IT infrastructure and FTTH connectivity, rainwater harvesting, solid and liquid waste management, use of smart bicycles, electric vehicle (golf carts), Electric Vehicle (EV) Chargers, open gym and citizen services etc. Application of these smart solutions will provide enhanced quality of life to the residents in an environment friendly and sustainable manner.

Water consumption monitoring for every house, rainwater harvesting and STP treated water re-use will reduce the water consumption for the smart townships.

NTPC Solapur

NTPC Khargone

Rainwater Harvesting- Water for Future

NTPC Rihand

NTPC RAINWATER HARVESTING POLICY

Rainwater harvesting (RWH) is a way of collecting and storing rainwater either for reuse or for ground water recharge. It possesses tremendous potential to reduce freshwater consumption and act as a reliable secondary source of water. NTPC shall prioritize surface water storage and reuse over ground water recharge because:

- Surface storage and reuse is more useful. Ground water recharge is a slow process and majority of water recharged done is not available for intended use subsequently.
- It will lead to reduction of burden on other water bodies such as rivers, lakes and ground water sources; indirectly contributing to water table improvement;

To strengthen its water conservation initiatives, NTPC has developed Rainwater Harvesting Policy which would act as the major guiding document for rainwater harvesting. This policy is integral to NTPC Water Policy and shall be considered as its extension. Considering the importance of water as a shared resource, this policy can be further used as a reference for the various water conservation initiatives taken up by NTPC under CSR/SD projects.

Objective

To promote the installation and periodic upkeep of Rainwater Harvesting system in locations of and near to NTPC establishments.

Applicability & Scope

This policy is applicable to All the establishments of NTPC thus including projects, stations, administrative offices, residential townships and guest houses.

Principles

This Policy is guided by following principles:

- Rainwater harvesting (RWH) system, though functional only for a brief duration in a year, is useful as a secondary source of water;
- Adoption of right combination of superior state-of-the-art technologies and global best practices shall increase the quantity and quality of harvested rainwater. Provision of accountability for all locations and mechanism to respond to any aberration from the policy objectives shall yield superior results;
- Promotion of RWH through inclusiveness, capacity building and regular knowledge sharing with concerned stakeholders shall result in capturing of increased quantity of rainfall that would have gone unused otherwise.

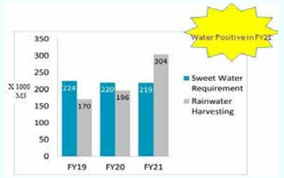
NTPC STRATEGY FOR RWH AT ALL STATIONS :

All the stations are implementing RWH at their stations. Many RWH facilities have already been created. However to assess Rainwater potential and to design the suitable RWH facility a study is being done at all the stations through reputed agencies.

Balance RWH facilities suggested in study will be created in phase manner. By doing so NTPC will be harvesting maximum rain in near future.

Ratnagiri Gas & Power Pvt Ltd (RGPPL)
(A Subsidiary of NTPC Ltd.)

A SWEET WATER POSITIVE PLANT



Rainwater harvesting against total sweet water requirement

Ratnagiri Gas & Power Pvt Ltd (RGPPL) was formed in 2005. RGPPL is situated in Ratnagiri (Maharashtra) on Arabian Sea coast and has a 1967.08 MW capacity combined cycle gas-based power plant, the largest of its kind in India.

Utilizing its coastal location, RGPPL condensers are designed for seawater cooling. As per original scheme, sweet water requirement (600 m³/day) for steam generation, fire fighting & human consumption is sourced from River Vashishthi, which in turn receives water from tailstock of Koyna Hydroelectric Power Plant.

RGPPL has made it a mission to achieve 100% self-sufficiency for its sweet water requirement without drawing any sweet water from River Vashishthi. Through strategic actions taken for rainwater harvesting and water reuse in plant processes, RGPPL has met 77% of its sweet water requirement internally during the year 2018-19, 89% in 2019-20 and to 139% in 2020-21, thereby making RGPPL Only water positive power plant in India which runs totally with rainwater harvesting. In the year 20021-22 also total collection is more than sufficient of our requirement. RGPPL is supplying excess sweet water to the nearby villages through tankers.

BRIEF DETAILS OF PROJECTS/SERVICES CARRIED OUT INHOUSE

Project 1: Rainwater Harvesting (Main Plant)

- Konkan region receives 3,000-3,500 mm rainfall every year during monsoons (June-September) and provides vast potential for rainwater harvesting. The surface run off water is totally going to Arabian sea. To make full use of rainfall without affecting the population in the downstream, RGPPL has taken many steps including construction of check-dams, bunds in storm-water drains, roof drain connections, etc.
- RGPPL has Naphtha/Distillate storage tanks of capacity 48,000 m³ each. After disposal of Naphtha & HSD these floating-roof type tanks have been repurposed for storing 40,000 m³ quantity of water each. For this, modification has been carried out by diverting roof-drains to send water into the tanks.
- Check-dams have been constructed near main water reservoir, where huge quantity of water from township and surrounding areas flows under natural path. Bunds have been constructed in storm-water drains. All the drains & check-dams have been provided with dewatering pumps of 3-15 HP & 12-96 m³/hr discharge. These pumps send rainwater to either to Sludge Pits A & B (normally used for filter backwash water & clarifier drains), Raw Water Storage Tanks 1 & 2 (earlier used for storage of water received from river Vashishthi), or main reservoir sump.
- Modification has been carried out to send water from sludge pits to RWSTs, from RWSTs to FNSTs, and from main reservoir sump to FNSTs.
- Gravity flow channel has been made to divert rainwater from lower Tank Farm to main reservoir. Water is also collected from roof-drains of main plant and township Field Hostel.
- Main water reservoir (EWR) which could not be utilized earlier due to leakages in geo-membrane, was repaired in June 2021, which has increased water storage capacity by additional 120,000 m³. With this RGPPL has achieved its target of total self-sufficiency in terms of sweet water requirement. Existing Storage: 298,500 m³

RAINWATER HARVESTING (MAIN PLANT)

Bunds in Storm-water Drain


Gravity channel water collection in EWR


Runoff water Gravity Collection Channel


Storm-water Drain collection pump


Surface Runoff Water Collection Check dam


Sludge Pit A (before filling)


Sludge Pit A (after filling)


Main Plant Roof Drains (top)


Main Plant Roof Drains (bottom connection)


Storm-water Drain collection pump Near Plant canteen


Storm-water Drain collection pump near DM Plant

PROJECT 2: RAINWATER HARVESTING (TOWNSHIP)

In the township total rainwater coming from Savitri Bhavan hostel roof is harvested and collected in 5 KL tanks and pumped to WTP. In the WTP 7 nos 20,000-liter tanks are installed to store the rain water.


Savitri bhavan hostel Roof Drains WTP collection tank


Rain water storage tanks Township


Rain water collection system

PROJECT 3: STP WATER REUSE (MAIN PLANT)

The treated water from plant STP was earlier pumped to the sea through the cooling tower blow down system. Now total STP liquid discharge is pumped to a collection tank at top most elevation near chhatri point and tank outlet is connected to horticulture network through drip irrigation by gravity.


Plant STP treated water discharge


Plant STP treated water to collection tank


Plant STP Discharge to Horticulture drip irrigation system

PROJECT 4: STP WATER REUSE (TOWNSHIP)

- The treated water from township STP was earlier pumped to the sea through high point basin. Now STP liquid discharge is partially pumped to a collection tank at top most elevation near Vashishti Bhavan and tank outlet is connected to horticulture network through drip irrigation by gravity.
- For utilizing total quantity of township STP discharge in total township drip irrigation Contract proposal is in award stage
- For upgrade existing sewage treatment, a Membrane Bioreactor (MBR) based waste water recycling plant of 500 KLD contract is awarded and work is in progress. Treated water from this STP will be used in plant as process water.

Township STP Discharge to collection Tank

STP discharge collection tank

TS STP Discharge to Horticulture drip irrigation system

TS STP Discharge to Horticulture drip irrigation system

TS STP Discharge to Horticulture drip irrigation system

TOWNSHIP WTP BACK WASH WATER REUSE

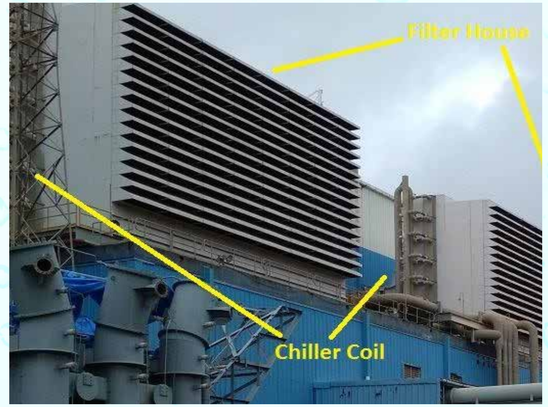
- The Back wash water from township WTP is pumped to Drip irrigation header which is connected to horticulture network in township.

WTP BW Discharge to Drip irrigation Header

WTP BW Discharge to Horticulture drip

PROJECT 6: CHILLER COIL CONDENSATE USE

- RGPPL was envisaged as an integrated energy complex with a power plant and an LNG regasification facility. In this energy exchange process, heat energy of condenser cooling water from power plant is utilized for regasification of LNG and cold LNG is utilized in power plant for inlet air chilling & circulating water cooling.
- When power plant units operate at base load condition, chiller coils are taken into service to enhance efficiency and also because the condensate formed on inlet air chiller coils. This condensate provides water at the rate of 10m³/hour per gas turbine, which is then re-used as process water for plant activities.



Inlet Air Chiller Coils

Inlet Air Chiller Coil Condensate Collection lines

Inlet Air Chiller Coil condensate Collection lines

SURFACE WATER STORAGE FACILITIES

Surface water storage pond at NTPC Simhadri Township

Surface water storage pond at NTPC Korba Township

RWH Pond 1 at NTECL Vallur

Chilka lake Singruali

Surface water storage Ramagundam

GROUND WATER RECHARGE FACILITIES

Rainwater Harvesting at Tanda

Rainwater Harvesting at Anta

Rainwater Harvesting at Faridabad

Rainwater Harvesting at Rihand

Rainwater harvesting at Singrauli

Rainwater harvesting at Farakka

RAIN WATER HARVESTING FACILITIES

NTPC Station	Rainwater Harvesting Facility
Auraiya	13 no of Roof top RWH system and Surface rainwater collection in HDPE lined water reservoir.
Anta	Reservoir & Roof top RWH at Hospital
Barauni	12 nos. of Rainwater Harvesting pits
Bhilai	7 nos. of Rainwater Harvesting pits
Dadri	Stored in surface water reservoir and utilized in plant operations.
Farakka	17 no of RWH pits and 4 No. 100 Mtr long RWH Channels at Township
Faridabad	24 RWH facility at various locations
Jhajjar	Provision for collection of rain water from plant and township through RCC drains in a sump and further transferring to reservoir.
Jhanor	3 Nos of RWH injection wells
Khargone	20 nos. Rooftop RWH pits, 24 Open/Storm water area recharge pits
Kudgi	RWH Recharge pits provided in Township
Kanti	Rainwater harvesting recharge pit (18 Nos.), water storage pond & tank (03 Nos.)
Kawas	RWH in reservoirs & Roof top Rain water
Meja	Rain water Harvesting Pits in Township
Mouda	50 nos of RWH Recharge pits in township. & plant
Lara	31 RWH Recharge Pits in plant & township area.
Ramagundam	42 nos of Rain water Harvesting pits in Township
RGPPL	RWH storage facility 298,500 m^3 capacity
Rihand	RWH recharge facility (large- 11 nos. + small – 106 nos.) 02 Surface rainwater collection structures. Total capacity 1.0 Lac KL/annum
Sipat	Rainwater harvesting facility at school and hospital premises
Singrauli	Chilka Lake Pond, RWH at Ambedkar bhawan
Solapur	57 RWH pits - 1.36 lakh m^3 capacity
Talcher Kaniha	7 nos. Rain harvesting Pits & 1 no. of check dam.
Tanda	Rain Water Harvesting at Admin. building and TG Hall roof-top area
Unchahar	5 Nos. Rainwater harvesting pits
Vallur	Rain Water Harvesting storage Ponds 64,750 m^3 & 10,500 m^3 capacities
Vindhyachal	Construction of Reservoirs with combined capacity of 2.4 lac cum for storage of rainwater in progress to augment the present capacity of 0.4 lac cum

NTPC Unchahar

Community Engagement – Water to Society

NTPC – JAL JYOTI MISSION

This policy was released for providing potable drinking water on sustainable basis to the community near our stations/projects and named “NTPC Jal Jyoti Mission”.

Objectives

- Capacity building of the stakeholders and create awareness in community on significance of drinking water for improvement in quality life.
- Ensuring accessibility of potable drinking water in adequate quantity on regular and sustainable basis leading to improvement in living standards of communities in the vicinity of NTPC’s Stations/Projects.
- Planning and implementation for access to drinking water for 100% coverage of all project affected villages of NTPC under construction is being undertaken. NTPC Policy-Jal Jyoti Mission embarks upon ensuring safe drinking water and rejuvenation of ponds in its project-affected villages.

DRINKING WATER SUPPLY
ARRAH, BIHAR

NTPC has installed 12 nos of RO Water Plant in Bhojpur District under CSR scheme. Product Flow Capacity is 1500 Ltrs/hour. These RO plants have been installed in 04 different Blocks of Bhojpur District, in which 01 no has been installed in Agiaon village of Agiaon Block, 7 nos has been installed in Mohanpur Tola, Bishunpura, Masarh, Kalyanpur, Bakari, Morath and Godhana villages of Udwant Nagar Block, 01 no installed in Echari Village of Garhani Block and 03 nos installed in Trikol, Saripur and Pandeypur villages of Sandesh Block.

RO WATER PLANTS

To ensure that people have access to safe drinking water, NTPC has set up RO water plants at various locations with 3 to 5 years Annual Maintenance Contracts.

WATER ATMS

Water ATMs have been set-up by NTPC at various locations.

PIPED DRINKING WATER SUPPLY

At present only 35 per cent households in rural India has piped water system. NTPC is supplementing the efforts of the Central and State Governments in providing piped drinking water to the masses.

HAND PUMPS

Providing drinking water becomes complicated in rural areas because of the limited or no supply of electricity. In this context, the hand-pump is becoming largely accepted as a reliable and safe mode of water supply. NTPC has installed hundreds of hand pumps benefitting the rural population around its stations.

WATER TANKERS

Water supply through water tankers to inhabitants of nearby community during extreme summers.

REJUVENATION OF PONDS IN NEARBY VILLAGE

Pond is central to the life and prosperity of the whole village ecosystem in rural India. Rain water gets harvested naturally in the pond, the lowest point in the village terrain. Many village ponds are degraded. NTPC is making efforts in restoration of these ponds by de-silting, deepening and widening.

Near by village - NTPC Meja

Near by village - BRBCL

Near by village- NTPC Kahalgaon

Near village by NTPC Lara

Near by village- NTPC Taloher Kaniha

Near by village- NTPC Korba

CONVERSATION OF WATER

NTPC is assisting villages in the construction of Check Dams and rain water harvesting facilities. These help in storing surface water for use both during and after the monsoon. They also help in ground water recharge of the area.

Rainwater harvesting at Govt. School - NTPC Anta

Rainwater harvesting at village Khajurna Kala - NTPC Anta

STATION	POND REJUVENATION WORKS AND WATER RESOURCE CLEANING PROJECTS
UNCHAHAR	• Regeneration of Pond at kaithwal (Arkha). The silt deposited over the years have been cleaned.
DADRI	• Pond development work at Uncha-Amirpur and Rasoolpur village.
MEJA	• 3 nos. check dam for irrigation in Kohdar, Isauta and jhadiahi villages. • Pond renovation in Salaiya Kala Village.
KORBA	• Deepening & Beautification of Gopalpur Pond, Chhurikhurd Pond and Pond at Sumedha.
VINDHYACHAL	• Dredging of Rihand Reservoir catchment area adjoining the Shahpur ash dykes taken up. More than 1.25 lac m^3 of sludge removal done. Proposal for Renovation of MOHR Pond in Sidhi Distt is already being processed.
ANTA	• Weir for collection and storage of rainwater constructed at Khajurna Kala ,Tehsil Anta, Distt Baran(Raj).
TALCHER KANIHA	• Renovation of Pond and construction of bathing steps at Kateni Village & Rangabeda Village. • Construction of drains at Sarathipal Village.
SIPAT	• Pond upgradation at Utarda, Usalapur, Renki Janjee, Parsaahi villages. • Pond deepening, widening works at Karra, Nirtu, Utarda and Sirkikhurd villages.
LARA	• Deepening and re-excavation of 14 numbers ponds done in nearby villages resulting in water capacity addition of 45,691 m^3.
BRBCL	• Pond rejuvenation at Dhundha village.
KBUNL	• Pond rejuvenation at Township.

JALYUKTA SHIVAR ABHIYAAN – COMMUNITY PARTICIPATION AT NTPC MOUDA

Around 82% area of Maharashtra falls in rain fed sector while 52% of area is drought prone. In 2014, 23,811 villages of 26 districts out of total 36 districts of Maharashtra were declared drought-hit. **Jalyukta Shivar Abhiyan**, a flagship programme of Govt. of Maharashtra was launched on 5th December 2014, to make the state water scarcity-free in five years. Among all districts in Vidarbha region, Nagpur has the highest population making it a key location for the programme. In 2015, NTPC Mouda had provided funds of Rs. 2 Cr. to the District Collector of Nagpur for the above programme. The State Govt. with the help of implementing partner, **Art of Living Foundation**, planned and executed water conservation activities in villages of Mouda tehsil of Nagpur district. The **Art of Living Foundation** came up with an innovative technique of converting rain fed nullahs (natural drains) into small ponds throughout the stretch to harvest rainwater for a longer period. Deepening, desilting, and widening of trenches on both sides of nullahs was also undertaken to percolate water. The basic purpose behind this technique is to trap every raindrop that falls in the nullahs.

Overall, work has been done on a 200 km stretch of natural drains benefitting 150 villages of Nagpur. Using NTPC Mouda funds, work has been done upon a 25 km stretch of natural drains benefitting 8 villages of Mouda. In these areas, the only source of water for nullahs is rainwater which used to last only for 6 months of the year (from June to December). Now, the water is available in these nullahs for 10-11 months a year. This has helped farmers to increase winter crop farming and take up summer crops as well. The Quantity of water available in natural drains has increased by 229%. Community participation in planning, operations and maintenance of the project has played a major role in timely completion of the project. The water structures created also adds to the biodiversity by adding green vegetation and provides water for cattle and other animals.

Bhoomi Pooja done by farmers before starting of work

Also, under **NTPC Jal Jyoti Mission**, UV+Ro water ATMs have been installed in nearby villages of the NTPC Mouda plant. In FY 2018-19, one water ATM was installed in Kumbhari village. On receiving positive response, 6 water ATMs were installed in other villages in FY 2020-21.

The programme was implemented in 8 villages of Mouda Tehsil, Nagpur district using NTPC Mouda funds. The names of 8 beneficiary villages are Nisadhkhedha, Khopdi, Chacher, Khandala, Pardikala, Virshee, Rewral, and Dhani.

There were two major expenditures in this programme (8 villages):
- Rent for machineries: Approx. Rs. 1.4 Crores;
- Fuel cost (diesel): Rs. 78 lakhs.

PLANNED OUTPUTS/OUTCOMES

Immediate Outcomes
- Increase in quantum of water available in rain-fed nullahs,
- Increase in duration of water stored in the rain-fed nullahs,
- Increase in area under winter crop (rabi) farming and summer crop (zaid) farming,
- Increase in income from agriculture.

Eventual Outcomes
- Increase in ground water level,
- Increase in green vegetation.

TARGET GROUP FOR INTERVENTION

Direct Target Group

Farmers of water scarce villages of Mouda Tehsil

Indirect Target Group

Households of the beneficiary villages through increase in farm income and increase in ground water level.

KEY PARTNERS/STAKEHOLDERS
- NTPC Mouda: Provide funding
- Art of Living (AOL) Foundation: Implementing Partners (Designing, and implementation)
- State Government: Ownership of programme, Legal sanctions
- Minor Irrigation Dept., Zilla Parishad Nagpur: Ownership of Nullahs, Technical support
- SDM Mouda: Facilitator (Cooperation with Gram Panchayat and villages)
- Gram Panchayat: Cooperation during operations and community mobilization
- Village Community: Operation and maintenance
- Private Agencies: Machineries, Fuel, etc.

IMPLEMENTATION STRATEGY

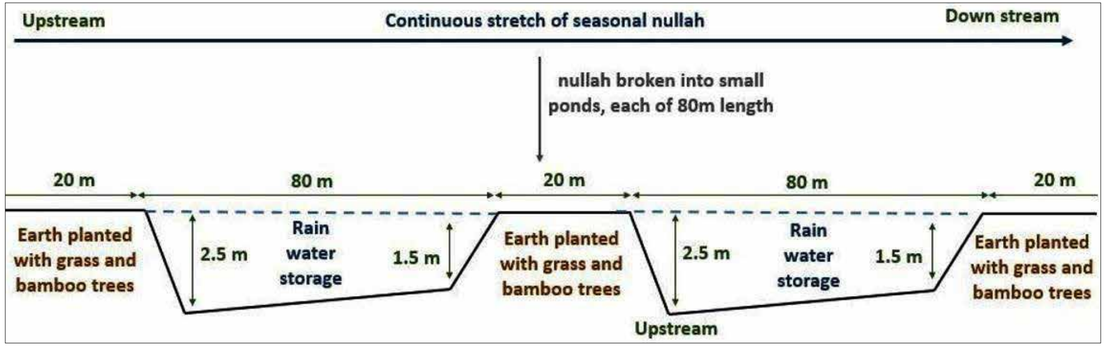
Five- step strategy was followed for the programme.

Step 1: Project Conceptualisation (Planning & Design)

The first step involved identifying the target villages, designing the water conservation technique and doing a feasibility study. The technique was designed by the AOL foundation. The technique involves breaking the complete stretch of nullah into ponds each 80m stretch. After every 80 m stretch the drain is completely covered with earth for a stretch of 20m. This would prevent water run-off downstream. Further, deepening, desilting, and widening of every 80m trenches on both sides of nullah ensures increase in water holding capacity of the ponds. Refer to image below:

Supervision by SDM Mouda

Awareness campaign for village communities



A feasibility study was done to understand technical and financial viability of the programme in the target villages.

Step 2: Community Approval

Once the feasibility report was completed, the AOL team discussed the project proposal with the Gram Panchayat members and farmers of the beneficiary villages for approval and amendments.

Step 3: Implementation

Sanctions were received from BDO and Tehsildar. Technical support was received from the Minor Irrigation Dept. Funds were deposited by NTPC Mouda. Liasioning was done with Gram Panchayats. Awareness campaigns were organised for all beneficiary villages about the programme.

Step 4: Operations

AOL volunteers operated the machines to convert the nullah into deep ponds. The community of the village in which the work was to be implemented provided homely food and shelter to the machine operators.

Step 5: Maintenance

Farmer groups were formed for maintenance of the water bodies. Desilting of water bodies every 8-10 years is the only maintenance activity required post completion of the programme which will be done by the farmer groups.

INVOLVEMENT OF COMMUNITIES

Project Conceptualisation

The project proposal was finalised only after consultation with Gram Panchayat members and farmers of the beneficiary villages. Only after receiving a green signal from them, the sanction process was initiated. 15-20 members from each village were consulted.

Operations

Instead of involving the village community in operations through labour contribution, the community was involved with the machine operators. They further provided guidance to the operators while working on the nullahs. This helped in increasing the daily machine working time from 8 hrs to 20 hrs. The project was completed in less time than expected.

Maintenance

AOL Foundation formed farmer groups for maintenance of the water bodies. Desilting of water bodies every 8-10 years is the only maintenance activity required post completion of the programme which will be done by the farmer groups. In each village, two maintenance groups of 12-15 farmers each have been formed. Thus, a total of 16 maintenance groups have been formed in 8 villages.

Community Empowerment Measures

Two specific measures were undertaken by Art Of Living Foundation for community empowerment:

Awareness Programme

Awareness campaigns were conducted by volunteers of AOL Foundation for all members of beneficiary villages. The campaign focused on sensitizing village communities about the water conservation programme, the technique, the benefits, and contribution- cooperation required for them.

Farmer Group

Farmers were mobilised into groups and provided training for maintenance of the water bodies post completion of the project. Discussion with Gram Panchayat members revealed that farmers have reduced their demand for bore wells as water availability has increased.

SOCIO-ECONOMIC BENEFITS

From data received from Gram Panchayat of beneficiary villages, it has been derived that work done upon 1 km of nullah has benefitted on average 64.25 acres of agricultural land. Thus, the water structure created over a stretch of 25 km of rain fed nullah has benefitted approximately 1,600 acres of agricultural land. Water is available for 10-11 months for farming on 1,600 acres of land. As per discussion with beneficiary farmers, before implementation of the programme, winter crop farming was practiced on only 20% of the total land. As compared to baseline figure, winter crop farming is now practiced on more than 90% of total land (1600 acres). In 2021, the output of rabi crops i.e. wheat, chilly and green vegetables have increased by 2-times. Further, the cultivation of chilli crops stretches to the summer season fetching a good price in the month of May. The increase in output has increased the revenue from agriculture. As compared to 2017, revenue from agriculture has almost doubled in 2021. The programme was completed in June 2020. In order to capture the actual impact of the programme, the impact assessment is planned in May 2022 i.e. after completion of two years of agriculture cycle.

Farmers interacting with machine operators

ENVIRONMENTAL BENEFITS

The 25 km stretch of nullah has been broken down into 250 ponds. On average, the duration of water availability in rain fed nullahs (converted to ponds) has increased by 4.5 months i.e. from 6 months to 10.5 months during a year. The 250 rainfed ponds created through the project have resulted in harvesting more than 410 million litres of water per year. An increase by 246% over baseline figure (average values taken).

There has been minimal increase in groundwater level as it is a gradual process. Similarly, the increase of green vegetation is a gradual process. It is expected that new green vegetation (grass, bamboo) in a total 8 villages will cover an area of 16.67 acres.

NARMADA LANDSCAPE RESTORATION PROJECT

NTPC in collaboration with United States Agency for International Development (USAID) is supporting a unique Biodiversity Project titled “Narmada Landscape Restoration Project” along River Narmada between Maheshwar and Omkareshwar dams. With an investment of about Rs 25 Crs, this project will be benefitting the local population, Indore City, and Madhya Pradesh at large as the project is aimed to enhance green cover, improve water retention, the crop diversity including to promote organic farming and marketing. The project is being taken up involving Global Green Growth Institute (GGGI) Headquartered at Seoul and Indian Institute of Forest Management Bhopal. This project is also one of its kind in India and implementation is likely to become a role model for replication across the country.


Point when Choral meets Narmada


Intercropping wheat and maize demo


Check dam on a stream near Bedia

RECLAMATION OF 100 ACRES OF WASTELAND – NTPC RAMAGUNDAM

Economically unproductive lands suffering from environmental deterioration are known as wastelands. These wastelands include salt affected lands, sandy areas, gullied areas, undulating uplands, and areas rendered barren after Jhum cultivation.

Wasteland reclamation is the process of recovery of bad or wasteful land and turning it to a useful or beneficial purpose. In other words, it is a method of turning a waste land into a good land for agricultural, social, commercial and industrial purposes.
One of the efficient methods of wasteland reclamation of agricultural land is soil-moisture conservation & water harvesting which is predominantly applied for the following purposes:

- To control runoff and thus prevent loss of soil by soil erosion;
- To maintain or to improve soil fertility;
- To conserve runoff water;
- Water harvesting techniques to gather water to form catchment areas.

NABARD created a Farm Sector Promotion Fund (FSPF) with focus on promoting innovative and feasible concepts/ projects and transfer of technology for enhancing production and productivity in agriculture and allied sectors.

NABARD approached NTPC Ramagundam with the proposal to support Wasteland Development through Natural Resource Management activities (i.e. soil-moisture conservation measures & water harvesting, plantation, micro irrigation, vegetable cultivation, etc.) in 100 acres of area in Kannala village in Peddapalli district, Telangana.

NTPC Ramagundam stepped forward to support the farmers of Kannala village of Palakurthy Mandal by taking up the soil-moisture conservation measures & water harvesting interventions in 100 acres of area with a cost outlay of 20.00 Lakhs.

NTPC has taken up this noble initiative with an objective to:

- Recharge of rainwater which in turn raises the ground water level;
- Increase the availability of water for agricultural purpose;
- Increase in cultivation area for the farmers, thereby increasing income of small and marginal farmers.

Interventions made by NTPC for the soil-moisture conservation & water harvesting by providing:

Trench cum Bund, Water Absorption Trench

Trench cum Bund/Water Absorption Trench are constructed to store rain water within the fields which cause percolation of water to the root zone. This moisture retention would help the crops not to go dry during the dry spells.

Farm Pond

Farm ponds are constructed which are small tank or reservoir like structures, constructed for the purpose of storing the surface runoff from the catchment area.

Recharge of Dried up Well

The runoff near by the dried up Well is guided towards recharge pit through a silt trap. The filtered water enters the well through a pipe.

Check Dam

Check dams are constructed which are small barriers built across the direction of water flow on shallow rivers and streams for the purpose of water storage. The small dams retain excess water flow during monsoon rains in a small catchment area behind the structure.

Grass Seed

The newly constructed bunds like Trench cum Bund, Water Absorption Trench & Farm Pond are fortified with green cover; and thereby the erosion of soil on surface of bunds is controlled.

Kitchen Garden

Sapling kits were distributed to 100 families. Each family had cultivated kitchen garden at their respective backyards.

Block Plantation

5,000 saplings were planted as a part of Block Plantation. Under this activity, Mango, Papaya, Guava and Sithapal species were planted in open plots.

Significant outcomes by these initiatives are Increased in farm area for cultivation, Increase in average ground water level, Increase in farmer's income. Harvested and recharged rainwater led to farm diversification, more availability of crop residues and better income. Taking the consideration of vagaries of climate change, these interventions have created better opportunities for the communities.

IRRIGATION FACILITIES TO BPL FARMERS THROUGH BOREWELLS AND ELECTRIC MOTOR PUMPS - NTPC RAMAGUNDAM

India being an agrarian country, our farmers depend mainly on groundwater for irrigation. With increasing population, lesser land holdings and urbanisation, borewells are dug for groundwater extraction. Borewells are basically vertical drilled wells, bored into an underground aquifer in the earths surface, to extract water for various purposes.

Borewell is also a permanent solution for water availability for farmers. With each year of usage, the underground water tables refill themselves with the rainwater and the bore well would be ready and working permanently. Borewell is a sustainable and eco-friendly construction. It helps not only resolve the water scarcity problem but also ensures that long distance water supply is not needed.

Water pumps are machines for moving water, they play a fundamental part in agriculture as they move water from its source to the fields and crops.

Nagaram Village in Sircilla District Telangana had been a severely draught affected area for a long time, due to which developmental processes have suffered and led to extreme poverty in village.

Realising the need of the people in the Nagaram Village in Sircilla District, NTPC Ramagundam stepped forward to support in the development of the irrigation facility to 85 group of farmers belonging to BPL families (covering 219 individuals) by providing bore wells and electric motor pumps.

The support of Rs. 131.75 Lakhs was provided for these developmental works at Nagaram village.

NTPC has taken up this noble initiative with an objective :

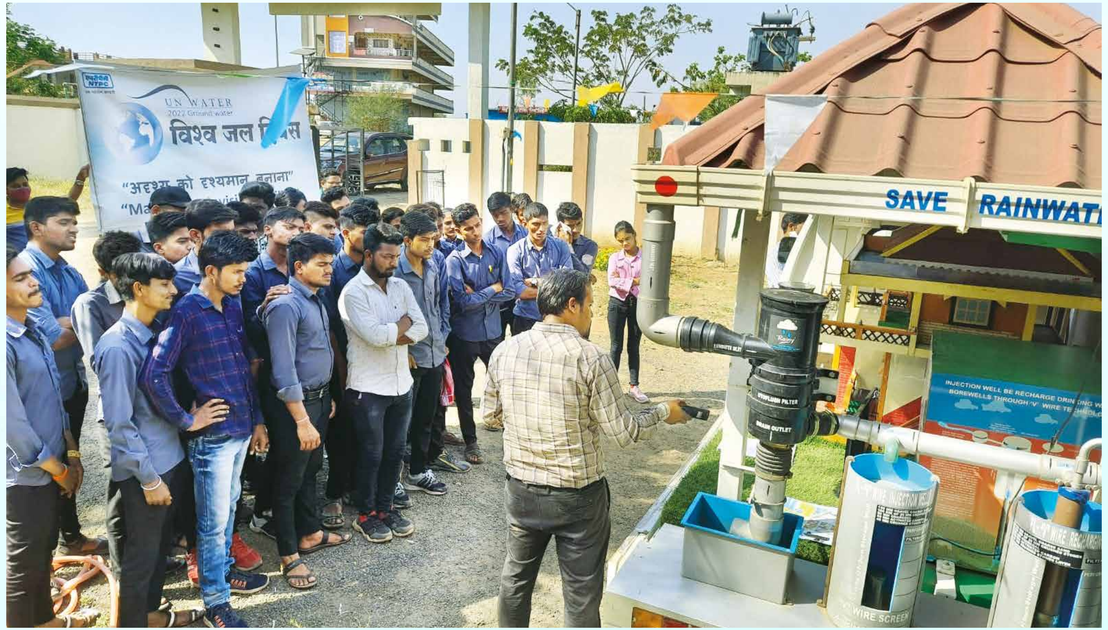
- To increase income of farmers through ameliorating irrigation facilities;
- To increase the food crop yield and growth of water intensive crops.
- To reduce inequalities faced by the socially and economically backward farmer groups.
- To empower the state of socially and economically backward farmer groups.

Significant outcomes by this initiatives are Increased land area for cultivation, Increased household income. An average annual increase of 46% in income is achieved from the intervention. Poverty Reduced and Social Harmony Increased.

By NTPC's Intervention, Farmers now are able to grow additional crops including paddy due to availability of irrigation facility.

WATER CONSERVATION AWARENESS

Various Program on Water Conservation awareness are being conducted for NTPC employees, their family members, school children and local population in the nearby vicinity of NTPC power stations.



AWARDS

NTPC Barh received Best Water Power Plant Award instituted by Mission Energy Foundation for 2021

NTPC Sipat: Received Best Water Efficient Power Plant Awards instituted by Mission Energy Foundation for 2020.

TERI-IWA UNDP- Water Sustainability Awards 2021-22

NTECL Vallur: Runner up Award under the category: Innovation in Water Technology.

NTPC Sipat: Runner up Award under the category : Excellence in Water Use Efficiency: Industrial Sector.

NTPC Mouda & Art of Living (AOL) Foundation together won the runner-up Award under the category: 'Excellence in Participatory Water Management'

Best Water Efficient Power Plant Awards

NTPC Dadri received Best Water Efficient power Plant Awards instituted by Mission Energy Foundation for 2020 & 2021.

NTPC Limited

A Govt. of India Enterprise

Regd. Office

NTPC Bhawan

SCOPE Complex, 7, Institutional Area,

Lodhi Road, New Delhi 110003

Tel No. 011 2438 7333

Fax No. 011 2436 1018

Email: ntpccc@ntpc.co.in

Website: www.ntpc.co.in