

22nd National Award for

Excellence in Energy Management

24 - 26 August 2021

2021

AUROBINDO PHARMA LIMITED UNIT I , HYDERABAD

| Sr. No | Name | Designation | Mobile Number | Email address |
|--------|-----------------------------|-----------------------|---------------|---------------------------------------|
| 1 | Mr. Suresh Lakshminarayanan | General Manager | 9600046931 | Suresh.Lakshminarayanan@Aurobindo.com |
| 2 | Mr. BSR Sarma | Asst. General Manager | 9848604295 | Sreeramasarma.bommaraju@aurobindo.com |
| 3 | Mr. Venkateswarlu Adike | Senior Manager | 9010178686 | Venkateswarlu.Adike@aurobindo.com |
| 4 | Mr. RamanaRao Morla | Deputy Manager | 9110523594 | Ramanarao.morla@aurobindo.com |

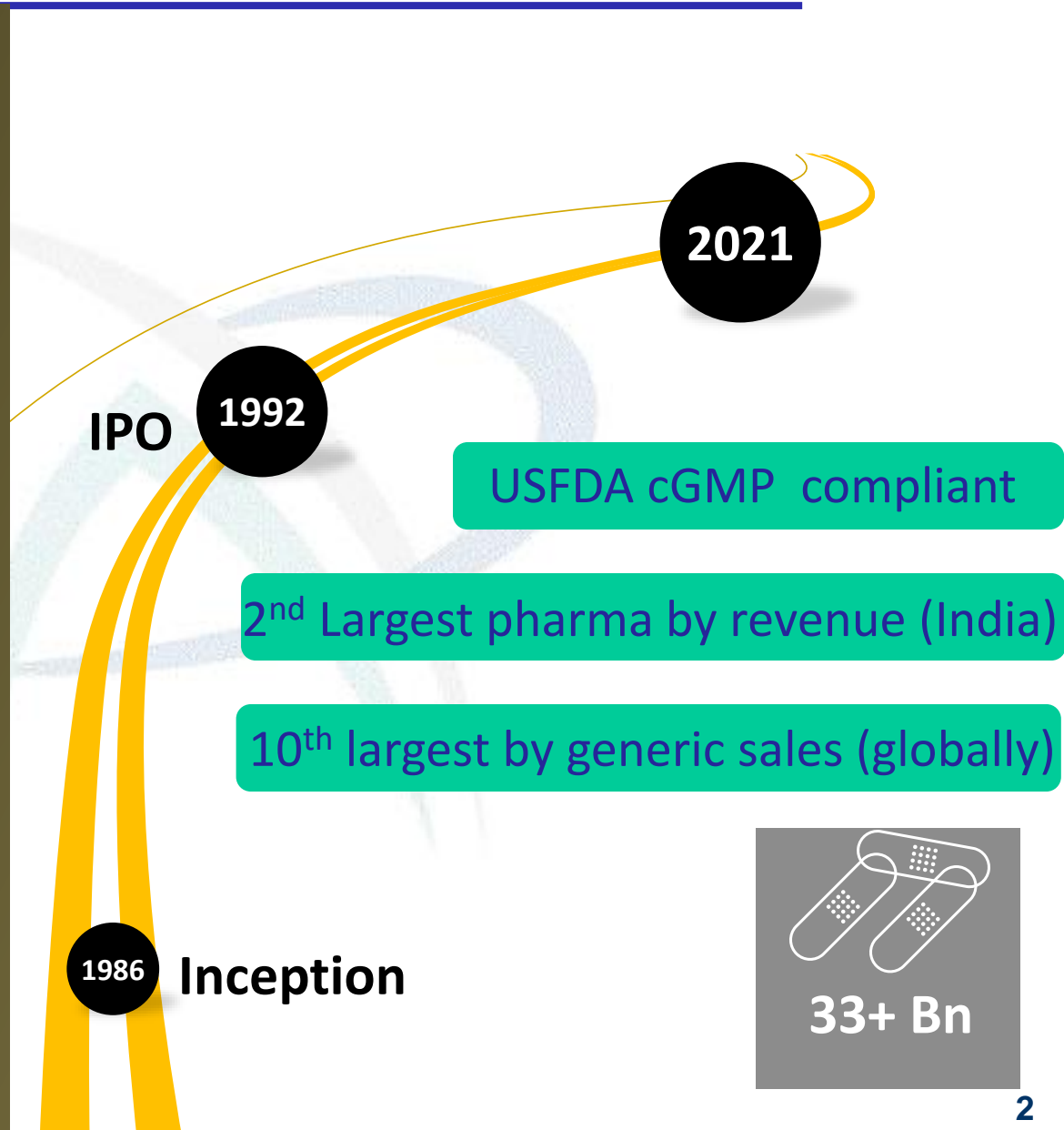
Brief introduction on Company/Unit



Employees **22k+**

Market presence **155+**

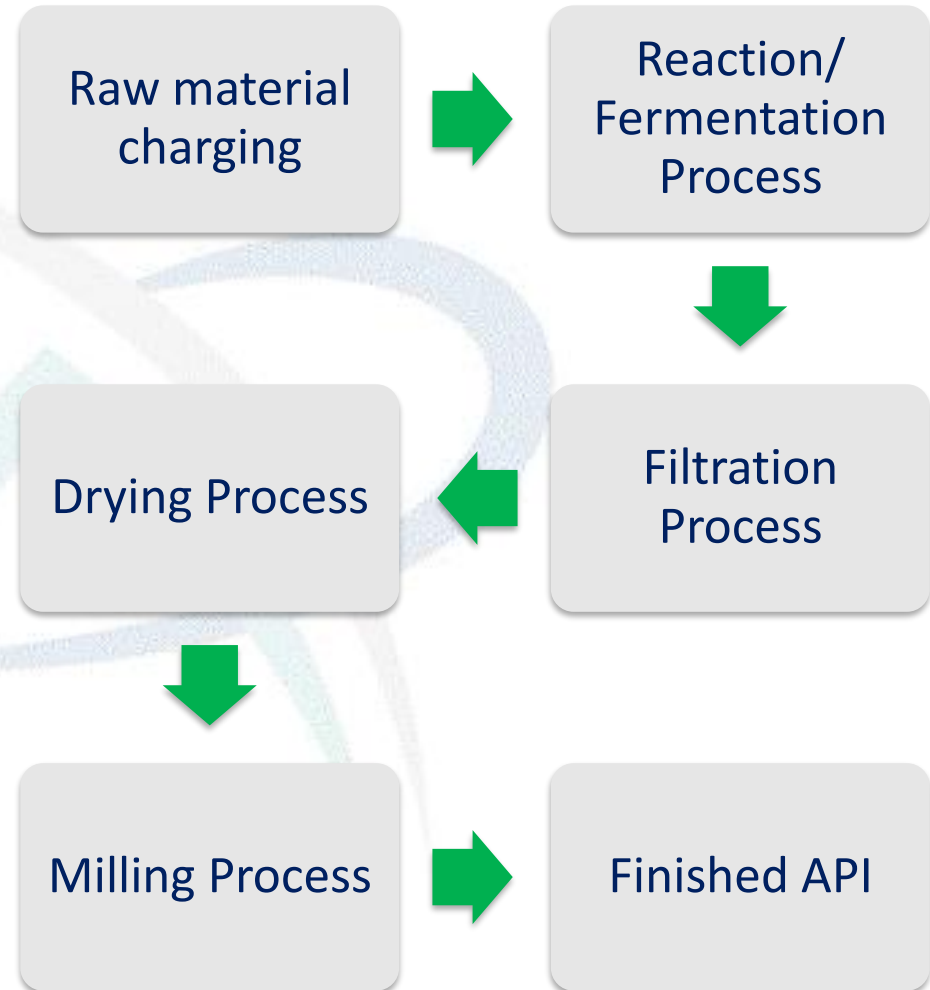
Mfg. Facilities **29**



1. Details of the Products / Processes

- Metformin
- Metoprolol
- Bisoprolol
- Gabapentin
- Cefpodoxime
- Ciprofloxacin
- Atorvastatin

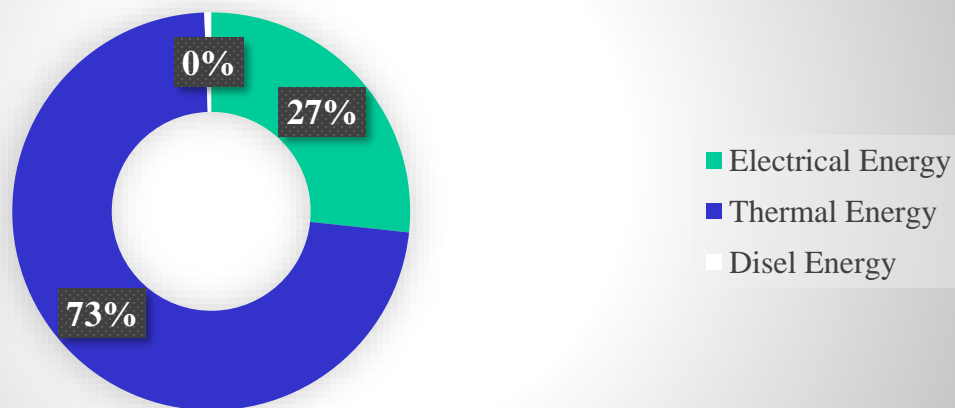
Major products :



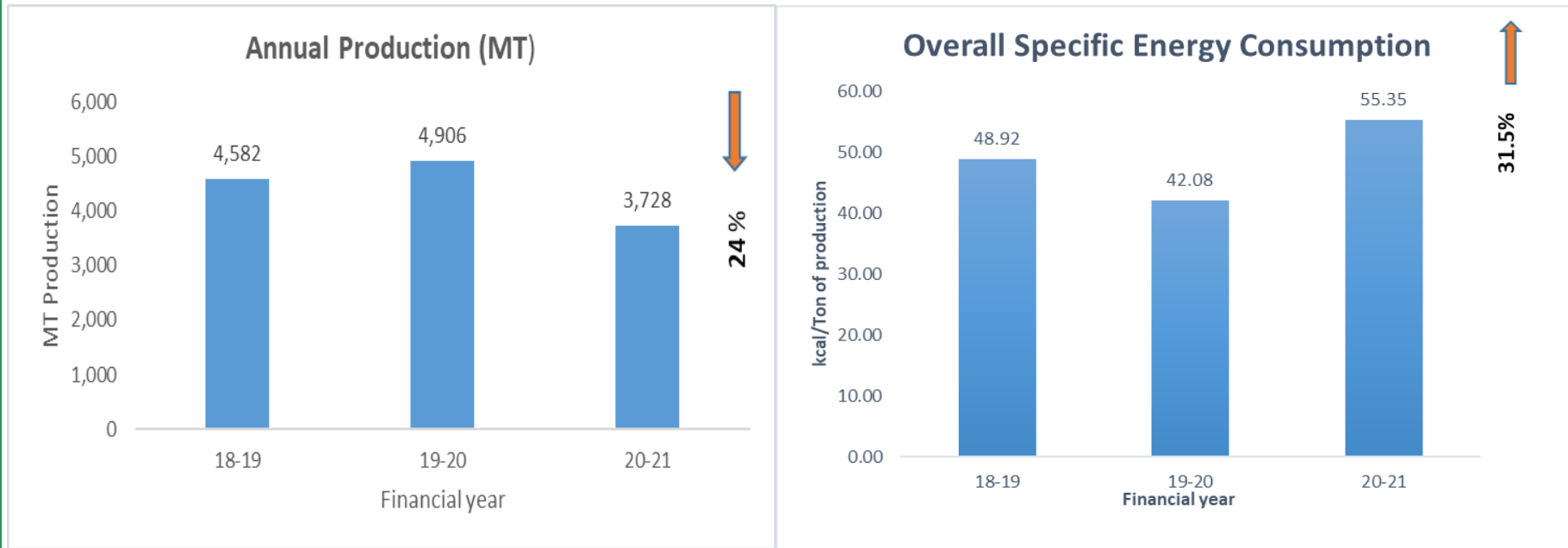
2. Energy Consumption Overview

| Parameter | Unit | 18-19 | 19-20 | 20-21 |
|--|-------------------------|----------|----------|----------|
| Annual Electrical Energy Consumption | million kWh/year | 81 | 75 | 65 |
| Annual Electrical Energy Equivalent | Million kcal/year | 69,531 | 64,525 | 56,325 |
| Annual Thermal Energy Consumption | Million kcal/Year | 1,53,501 | 1,41,300 | 1,48,861 |
| Annual Diesel Consumption | KL/Year | 115 | 64 | 120 |
| Annual Diesel Energy Equivalent | Million kcal/Year | 1,125 | 626 | 1,174 |
| Overall Energy Consumption | Million kcal/year | 2,24,157 | 2,06,451 | 2,06,360 |
| Overall Energy Consumption | MTOE/ Year | 22,416 | 20,645 | 20,636 |
| Annual Production | MT/Year | 4,582 | 4,906 | 3,728 |
| Specific Electrical Energy Consumption | Million kWh/Ton | 0.018 | 0.015 | 0.018 |
| Specific Thermal Energy Consumption | Million kCal/ Ton | 33.74 | 28.93 | 40.24 |
| Overall Specific Energy Consumption | kCal/ Ton of Production | 48.92 | 42.08 | 55.35 |

Energy Distribution FY 20-21 (kcal)



3. Impact of Covid & Overall Specific Energy Consumption



Social distancing



Masking



Regular hand wash

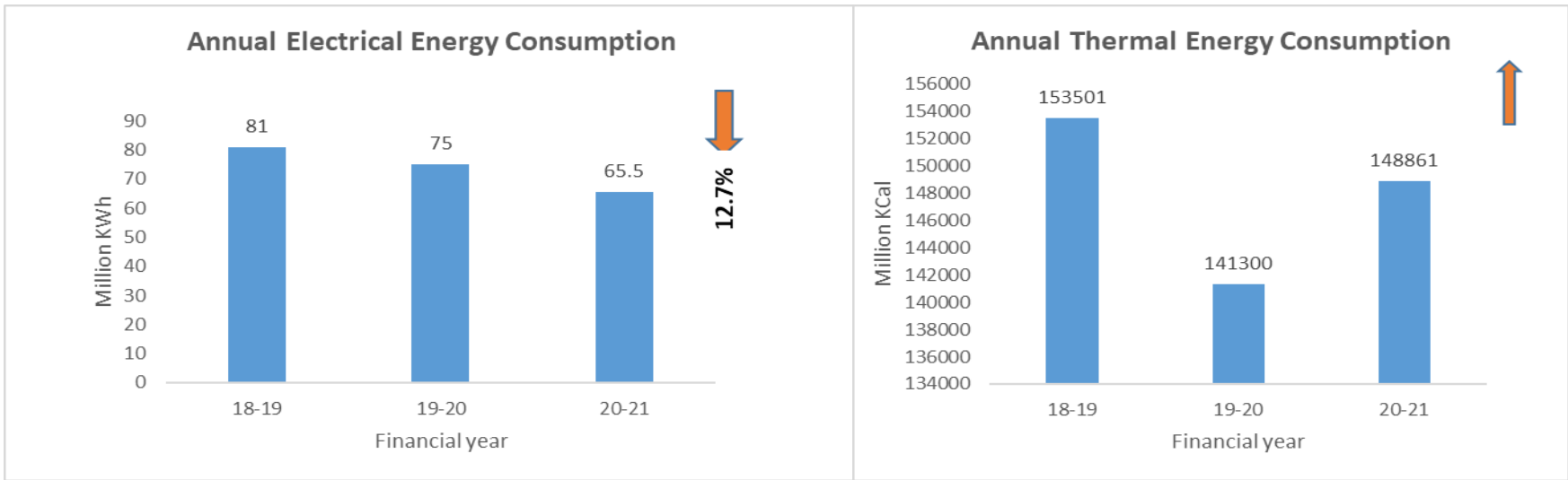


Sanitization

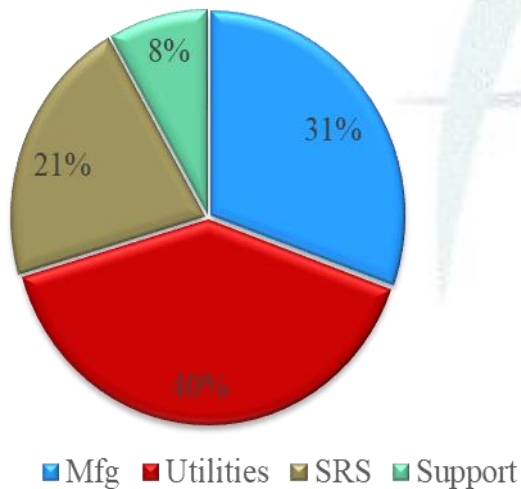
An increase in SEC in the FY 2020-21 was observed due to low production and non-linear nature of consumptions

Implementation of various energy conservation activities contributed reduction of 18.2 % in overall SEC of the Plant

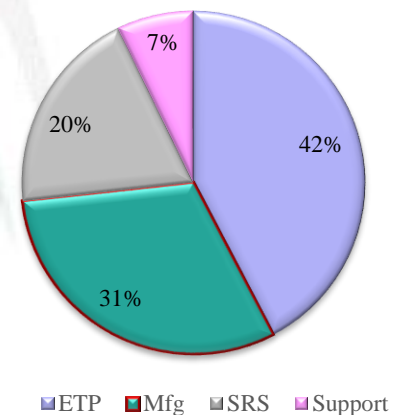
3. Specific Energy Consumption in last 3 years (FY 2018-21)



Power Distribution



Steam Distribution



4. Major Encon Projects in FY 2021-2022

| S No | Project Details | Proposed Investment (₹ Million) | Expected Monetary Savings/ Annum (₹ Million) | Payback (Months) |
|--------------|--|---------------------------------|--|------------------|
| 1 | Installation of Double effect VAMs (2000 TR) by replacing Air Cooled Chillers and Reciprocating Chiller for +5 oC applications - Under Final Stages of implementation | 35.0 | 42.40 | 9.9 |
| 2 | Installation of Energy Efficient Vertical inline Pumps by Replacing the Existing Old Pumps | 19.5 | 13.1 | 17.9 |
| 3 | Replication of Oil Free Refrigeration (OFR) Technology and Automation of Chilling Plants - Under Final Stages of implementation | 12.7 | 5.02 | 30.30 |
| 4 | Installation of Energy Efficient pumps by replacing old inefficient pumps | 3.6 | 0.9 | 49.3 |
| 5 | Replacement of Reciprocating Chillers with energy efficient Screw Chillers in +5 Group | 10.96 | 10.1 | 13.0 |
| 6 | Replace CMU 09, CMU 010 , 80 TR -20 oC with energy efficient water cooled screw system with -20 , 87 TR System | 5.21 | 3.7 | 16.7 |
| 7 | Replace CMU 023 & CMU 024, 80 TR, -20 oC with energy efficient water cooled screw system with -20 , 87 TR system | 3.97 | 1.7 | 27.7 |
| 8 | Replacement of higher size motors with Premium Efficiency Optimum Size Motors | 0.64 | 0.5 | 16.8 |
| Total | | 91.5 | 77.4 | 23 |

5. Information on Internal benchmark - Utility

Refrigeration Plants :

| Description | Design Temp (oC) | Design SEC (kW/TR) | Operating SEC (kW/TR) | Target SEC (kW/TR) |
|---------------------------------------|------------------|--------------------|-----------------------|--------------------|
| Reciprocating Chillers (Water Cooled) | +5 | 0.86 | 0.91-1.1 | 0.87 |
| | -20 | 1.59 | 1.65-1.72 | 1.60 |
| | -30 | 1.83 | 2.1-2.5 | 1.9 |
| | -35 | 1.95 | 2.52-2.71 | 2.0 |
| Screw Chillers | +5 | 0.63 | 0.68 – 0.82 | 0.65 |

| Description | Design SEC (kW/CFM) | Operating SEC (kW/CFM) | Target SEC (kW/CFM) |
|-----------------|---------------------|------------------------|---------------------|
| Air Compressors | 0.16 | 0.22-0.29 | 0.18 |

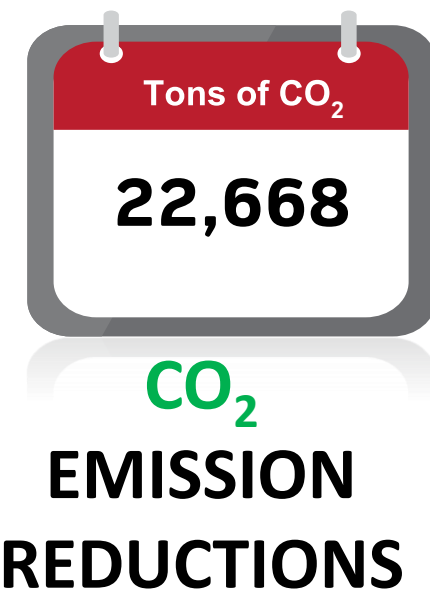
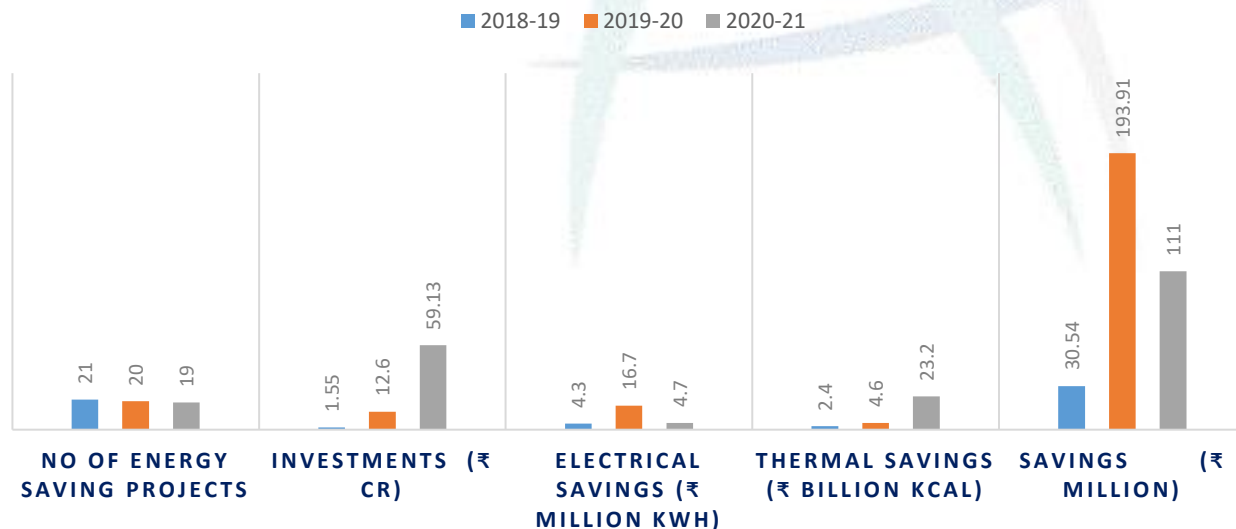
| Description | Design SFR (KG/KG) | Operating SFR (KG/KG) | Target SFR (KG/KG) |
|-------------|--------------------|-----------------------|--------------------|
| Boiler | 4.5 | 4.8 | 4.55 |

6. Energy Saving projects implemented in last three years

Summary of Energy Saving Projects Implemented in the last 3 years

| Year | No of Energy Saving Projects | Investments (₹ Million) | Electrical Savings (₹ Million kWh) | Thermal Savings (₹ Million kcal) | Savings (₹ Million) | Impact on SEC (Electrical, & Thermal) |
|---------|------------------------------|-------------------------|------------------------------------|----------------------------------|---------------------|---------------------------------------|
| 2018-19 | 21 | 15.5 | 4.3 | 2379.1 | 30.54 | -2.6% |
| 2019-20 | 20 | 125.7 | 16.7 | 4574.1 | 193.91 | -8.8% |
| 2020-21 | 19 | 591.3 | 4.7 | 23212.8 | 111 | -12.9% |

SUMMARY OF ENERGY PROJECTS (2018-20)



#1 OIL FREE REFRIGERATION (OFR)



Start

28/12/19

To Improve Energy Efficiency of Chilling plants

Finish

17/03/20

Solution Implemented

OFR Circulation Technology

- Replacing compressor oil with Specially Designed oil for better lubrication
- VFD to Compressor for Smooth start & Optimum Loading
- Magnetic Catalytic Filter with pump to remove NH_4OH and generate turbulence in Refrigerant flow
- Magnetic Oil Separator to remove oil traces



6.96

Lakh Units/Year

SAVINGS: ₹ 43.1 Lakh/Y

INVESTMENT: ₹ 73.68 Lakh

MOTNHS

20.6

#2 CAPTIVE POWER PLANT

Start

17/11/18

Replacing existing aged boiler with Cogeneration Power Plant

Finish

14/08/20

Solution Implemented

- Installed 3.95 MW Captive Power Plant
- Caters steam to process & Power for production
- Reduced the power cost taken from GRID
- Replaces the existing aged Process Boiler
- CMD reduced from 12 MVA to 10.5 MVA



3,686

Tons/Year

SAVINGS

₹674.7 Lakh/Y

INVESTMENT

₹ 40 Crore

YEARS

5.9

#3 REPLACEMENTS IN REFRIGERATION PLANTS

Start
01/04/20

Replaced aged low effective Evaporators & Condensers in Refrigeration Systems

Finish
31/03/21

Solution Implemented → **ROOT CAUSE ANALYSIS (RCA)**

- Assessed the current level of performance
- Identified the gaps through Root Cause Analysis
- Improving the Turnaround and Yielding Better Results



5.24

Lakh Units/Year

SAVINGS: ₹ **34.2** Lakh/Y

INVESTMENT: ₹ **4.45** Lakh

MOTNHS

2

#4 OPERATIONAL IMPROVEMENTS

Start

01/04/20

Optimization of Utilities such as Chillers, pumps and Air Compressors

Finish

31/03/21

Solution Implemented

Arrived Effective Maintenance

- Decreasing Evaporator Temperature
- Descaling, Fills & CT lines cleaning
- Swapping of pumps, line size modifications
- Reduce the pressure setting in Air Compressors



7.31

Lakh Units/Year

SAVINGS: ₹ **47.55** Lakh/Y

INVESTMENT: ₹ **15** Lakh

MOTNHS

0.4

#5 MEMBRANE BIO REACTOR

Start

23/12/17

To enhance efficiency and reduce footprint in terms of aeration tank capacity

Finish

01/12/20

Solution Implemented

Membrane Bio Reactor (MBR)

- Enhanced the life of downstream RO membranes by prevention of deposition of suspended solids.
- Enhanced the biological efficiency
- Helped in breakdown of hard molecules due to high concentration of MLSS



2,492

Tons/Year

SAVINGS: ₹ **132.1** Lakh/Y

INVESTMENT: ₹ **440.0** Lakh

YEARS

3.4

#8 RO PLANT, COOLING TOWER and ETP REVAMPING



Start

01/04/19

Optimization of LTDS treatment such as
STP, Process LTDS waste water and CT
Blow Down

Finish

31/03/20

Solution Implemented → 300 KLD RO plant, Cooling Towers

- Reduced the load on MEE
- Improves efficiency of Refrigeration Plants and CTs
- Complying with PCB directive of further treating treated STP



11.34

Lakh Units/Year

SAVINGS: ₹ **62.4** Lakh/Y

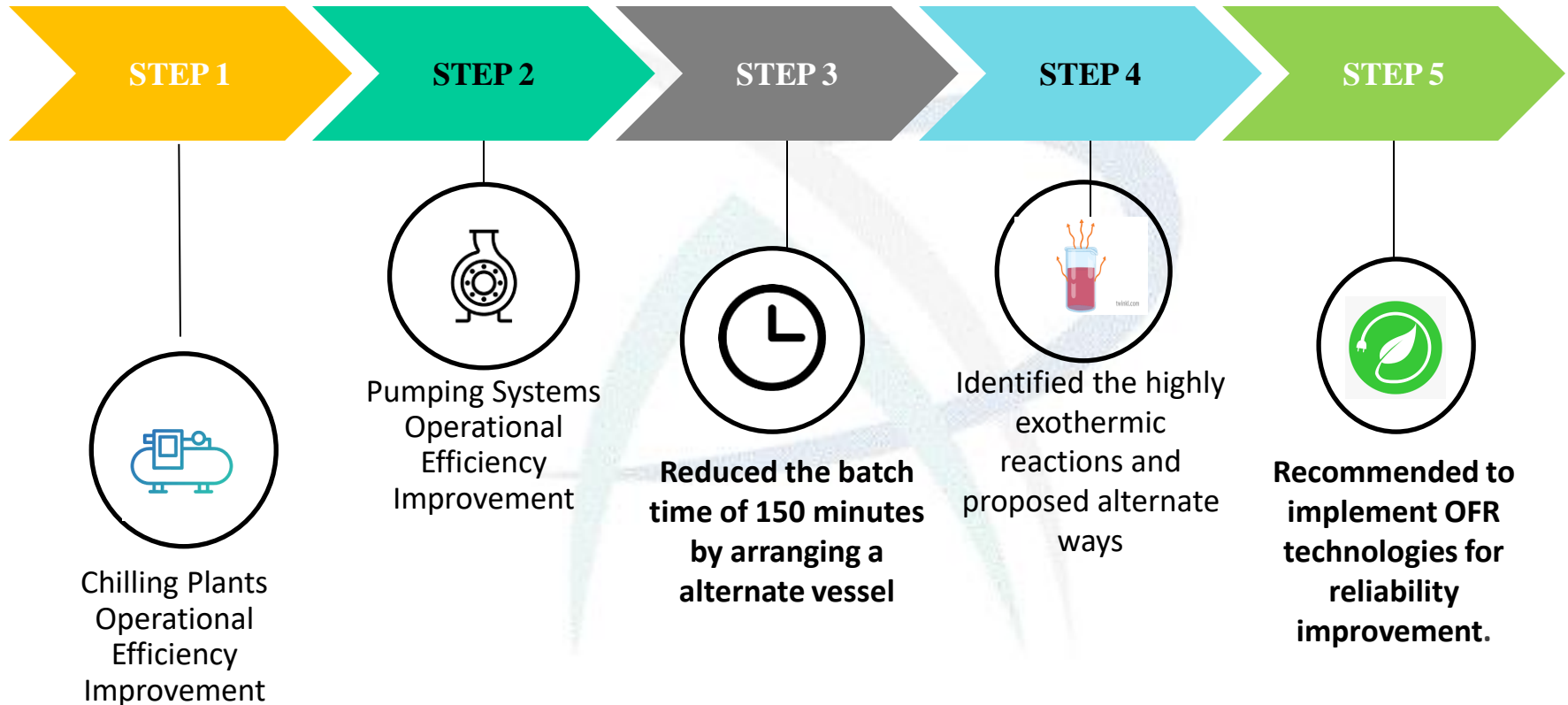
INVESTMENT: ₹ **1272** Lakh

YEARS

20

6. Innovative Projects implemented

ROOT CAUSE ANALYSIS- for delay of batch time –Cefuroxime Axetil (Unit I)



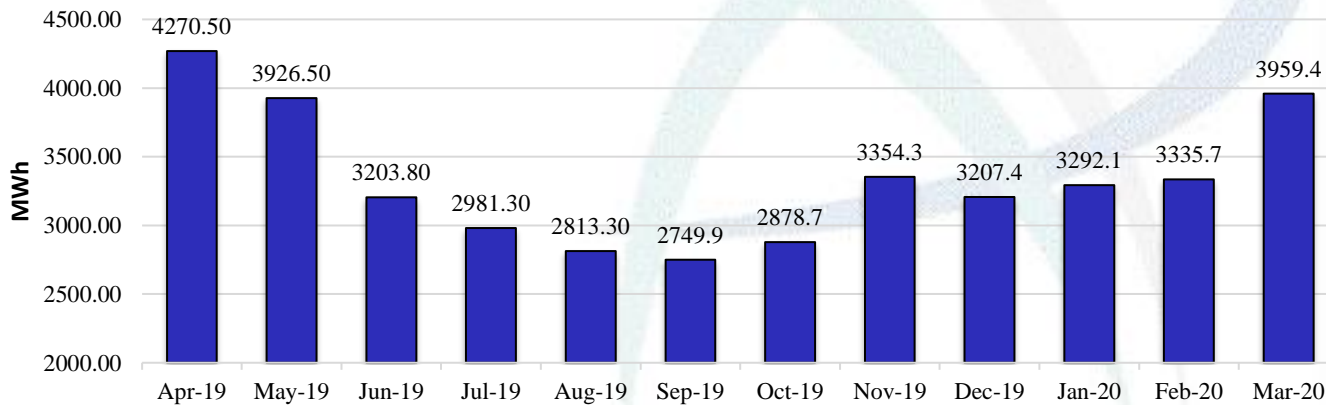
8. Utilisation of Renewable Energy sources

Start
13/12/16

Installed 30MW Solar Power Plant

Finish
01/05/17

| Technology (electrical) | Type of Energy | Onsite/Offsite | Installed Capacity (MW) | Generation (million kWh) | % of overall electrical energy |
|-------------------------|----------------|----------------|-------------------------|--------------------------|--------------------------------|
| Solar PV | Solar | Off Site | 30 | 44.2010 | - |



442.01

Lakh Units/Year

SAVINGS: ₹ 24.3 Crore/Y

INVESTMENT: ₹ 130 Crore

YEARS
5.3

9. Waste utilization and management

| S.No | Type of waste generated | Quantity of waste generated (MT/year) | | | Disposal method |
|------|---------------------------|---------------------------------------|---------|---------|---|
| | | 2018-19 | 2019-20 | 2020-21 | |
| 1 | Plastic waste (Poly bags) | 12 | 46 | 57 | Disposed through authorized scrap dealers for recycling |
| 2 | Bio-medical waste | 6 | 5 | 5 | Incineration / Landfill |
| 3 | Hazardous waste | 6,217 | 5,338 | 4,867 | TSD / Landfill |

| S.No | Particular | 2018-19 | 2019-20 | 2020-21 |
|------|---|---------------------------------|---------|---------|
| 1 | Name of the Fuel | Hazardous waste (Organic Waste) | | |
| 2 | Quantity of waste Fuel used (MT/year) - disposed to cement units (Used as alternate fuel) | 4,663 | 6,229 | 3,864 |

Waste with heat value is not utilised directly in the plant,
 Sending to the Cement industry / Co- Processing units where it is used as an alternate fuel

10. GHG Inventorisation

- Sustainability report under progress of publication (**Expected by 2021**)
- As a part of the continual improvement, the company has initiated monitoring of the CO2 emissions for public reporting.
- Carbon foot print, reduction targets and action plans yet to be established.

| Year | Total Emissions (kgCO ₂ e) | Total kgCO ₂ / Ton of Final Product |
|---------|---------------------------------------|--|
| 2018-19 | 41,81,60,088 | 91,252.12 |
| 2019-20 | 39,96,40,542 | 81,461.04 |
| 2020-21 | 35,70,62,042 | 95,775.02 |

| S.No | Type of system installed | Investment (Rs in Million) | Operating Cost (Rs in Million) | Running Hours |
|------|---|----------------------------|--------------------------------|---------------|
| 1 | Continuous Ambient Air Quality Monitoring Station | 3.2 | 0.16 | 24 |

11. Green Supply Chain Management

| S.No | Projects Implemented | Benefits Achieved | Description |
|------|---|---|--|
| 1 | Shipper Stuffing Project | Rs 190 Million | <ul style="list-style-type: none"> Increased loading by 30% to 33% Extra optimization in container with shipper stuffing, Saved freight on additional container had it not been shipper stuffed. It enabled no dependency on the wooden pallets. |
| 2 | Double Stacking Injectable Project | | <ul style="list-style-type: none"> Successfully implemented with 50% extra space |
| 3 | Paperless / Digital Logistics Execution – OTM Project | Decreased Paper consumption and paper less / Digital transactions | <ul style="list-style-type: none"> First Pharma company in India to adopt OTM. Cloud based Solution Freight Payments linked from OTM to ERP. |
| 4 | AIR vs SEA – Mode Control | Decreased Carbon Emissions | <ul style="list-style-type: none"> Increased Sea transportation over Air transportation by pallet systems. Decreased air Tonnage from 572 Tonnage to 456 Tonnage |
| 5 | GST e-Invoicing | Decreased Paper consumption and paper less / Digital transactions | <ul style="list-style-type: none"> Invoices are authenticated electronically and hence paperless Invoice information will be transferred from the portal in real-time. Govt. Initiatives for ease of doing business of exporters/importers |

12. Teamwork, Employee Involvement & Monitoring

Summary of Projects implemented through Kaizens 2019-20

| With investment (Revenue) | | | | | | | |
|----------------------------|------------------------------|-------------|-----------|-----------------|------------------|--------------------|---------------|
| S No | Initiative department | Initiatives | Completed | To be completed | Investment | Savings /Annum Rs. | ROI in months |
| 1 | Mechanical | 28 | 9 | 19 | 9,09,000 | 14,66,324 | 7 |
| 2 | Utility & Boiler | 4 | 2 | 2 | 1,74,300 | 14,30,005 | 0 |
| 3 | Electrical & Instrumentation | 12 | 8 | 4 | 2,82,360 | 5,94,571 | 6 |
| Total | | 44 | 19 | 25 | 13,65,660 | 34,90,900 | |

| Without investment | | | | | | |
|--------------------|------------------------------|-------------|-----------|-----------------|------------------|-------------------------------|
| S No | Initiative department | Initiatives | Completed | To be completed | Savings /Annum | Remarks |
| 1 | Mechanical | 2 | 2 | 0 | 3,04,389 | All initiatives are completed |
| 2 | Utility & Boiler | 6 | 6 | 0 | 39,23,869 | All initiatives are completed |
| 3 | Electrical & Instrumentation | 0 | 0 | 0 | - | - |
| Total | | 8 | 8 | 0 | 42,28,258 | closed |

13. Daily Monitoring & Reporting System

UTILITY REMOTE MONITORING & REPORTING SYSTEM

BLOCK : CENTRAL UTILITY [+5 SYSTEMS]

COMPRESSOR NO: CMU 15

REPORT

| DATE & TIME | PRESSURE VALUES | | | TEMPERATURE VALUES | | EMS | REMARKS |
|--------------------|-----------------|---------------|----------------|--------------------|---------------|----------------------|---------|
| | Discharge (bar) | Suction (bar) | Lube Oil (bar) | Cold Well (°C) | Hot Well (°C) | Total Current (Amps) | |
| 20-05-2019 12:00 | 10.4 | 2.7 | 4.2 | 8.6 | 12.5 | 141.9 | |
| 20-05-2019 13:00 | 5.7 | 5.8 | 5.6 | 9.5 | 11.6 | 0.0 | |
| 20-05-2019 14:00 | 10.3 | 3.5 | 5.0 | 7.9 | 9.4 | 104.7 | |
| 20-05-2019 15:00 | 11.0 | 3.7 | 5.2 | 8.1 | 9.6 | 110.7 | |
| 21-05-2019 13:00 | 11.0 | 3.0 | 4.7 | 12.8 | 16.6 | 143.5 | |
| 21-05-2019 14:00 | 10.3 | 2.8 | 4.4 | 10.5 | 14.0 | 135.4 | |
| 21-05-2019 15:00 | 12.0 | 3.0 | 4.6 | 9.6 | 12.7 | 152.0 | |
| 21-05-2019 16:00 | 13.1 | 3.3 | 4.9 | 11.4 | 13.8 | 162.6 | |
| 21-05-2019 17:00 | 10.2 | 2.7 | 4.3 | 9.6 | 12.2 | 133.7 | |
| 21-05-2019 18:00 | 10.0 | 2.6 | 4.3 | 10.9 | 13.4 | 131.8 | |
| 21-05-2019 19:00 | 11.5 | 2.8 | 4.5 | 11.2 | 13.4 | 144.6 | |
| 21-05-2019 20:00 | 12.4 | 3.0 | 4.7 | 11.0 | 12.9 | 152.9 | |
| 21-05-2019 21:00 | 12.1 | 2.9 | 4.6 | 10.1 | 12.1 | 150.6 | |
| 21-05-2019 22:00 | 12.7 | 3.0 | 4.7 | 9.5 | 11.3 | 155.2 | |
| 22-05-2019 12:00 | 10.9 | 3.0 | 4.7 | 11.8 | 15.2 | 145.0 | |
| 22-05-2019 13:00 | 10.6 | 2.9 | 4.6 | 11.0 | 13.0 | 141.6 | |
| 22-05-2019 14:00 | 10.7 | 2.9 | 4.5 | 11.1 | 14.4 | 143.1 | |
| 22-05-2019 15:00 | 10.7 | 2.9 | 4.6 | 11.5 | 15.1 | 145.2 | |
| 22-05-2019 16:00 | 10.7 | 2.9 | 4.6 | 11.8 | 15.6 | 144.9 | |
| 22-05-2019 17:00 | 10.4 | 2.8 | 4.5 | 10.7 | 14.4 | 141.2 | |
| 22-05-2019 18:00 | 10.0 | 3.4 | 5.0 | 8.6 | 9.1 | 100.9 | |
| 22-05-2019 19:00 | 10.7 | 3.6 | 5.2 | 8.0 | 8.5 | 107.5 | |
| 22-05-2019 20:00 | 10.9 | 3.6 | 5.3 | 8.1 | 8.7 | 107.8 | |
| 22-05-2019 21:00 | 11.0 | 3.7 | 5.4 | 8.3 | 9.0 | 108.4 | |

REVIEWED:

CHECKED:

DATE:

DATE:

HOURLY

- Real Time Parameters
- Loading Pattern
- Manual Data Collection

DAILY

- Performance Reports
- KPIs
- Overall Consumption

MONTHLY

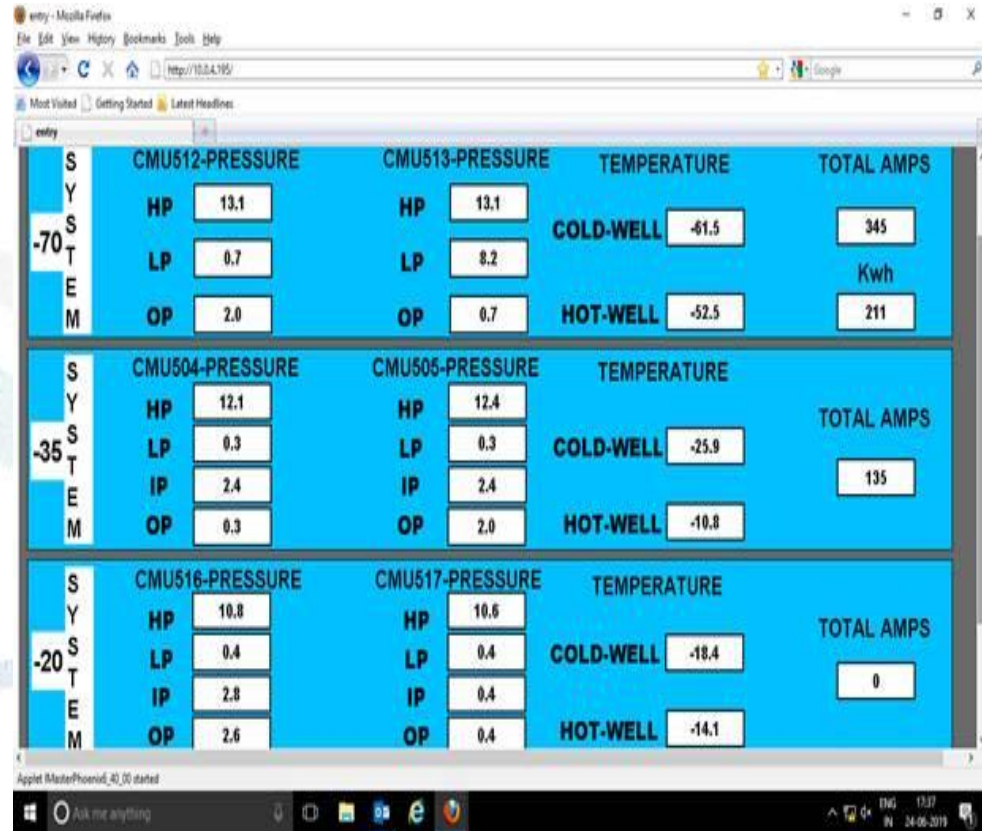
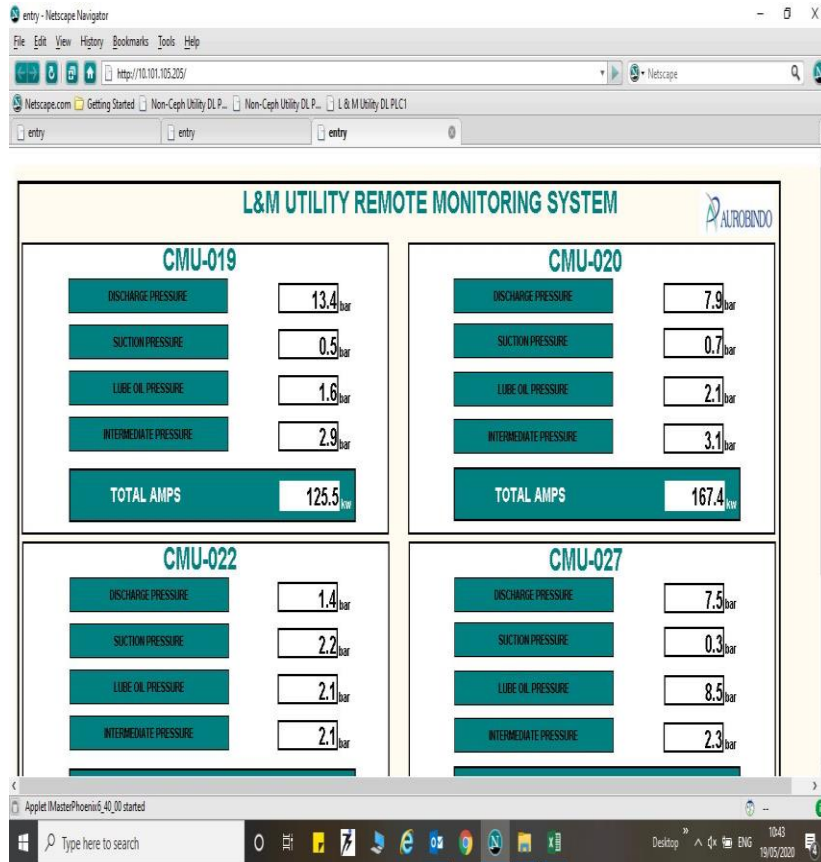
- Avg. Monthly Report
- Recommendation for any service / Maintenance
- Inter - Unit Comparisons

14. Energy Audit Instruments

| S No | Instruments | Make |
|------|------------------------------------|-------------|
| 1 | Power Quality Analysers (2 Nos) | Krykard |
| 2 | Flue Gas Analyser | Kane(NEVCO) |
| 3 | Thermal Imager | Testo |
| 4 | Ultrasonic Flow Meter | Eesiflo |
| 5 | Ultra Sonic Thickness Gauge | Eqinox |
| 6 | Pitot tube | Nevco |
| 7 | Digital Manometer / Pressure meter | Comark |
| 8 | Hotwire Anemometer | Testo |
| 9 | TDS / pH Meter | Aquisol |
| 10 | Stroboscope / Tachometer | Extech |
| 11 | Humidity, DBT & WBT Meter | Testo |
| 12 | Digital Pressure Guage | Testo |
| 13 | Lux Meter | Extech |
| 14 | Stop watch | Extech |
| 15 | Psling Psychrometer | Dimple |



15. Real Time Energy Monitoring System



Implemented across all Refrigeration Systems – 25 Nos
Daily Monitoring, Reporting and Reviewing

16. Energy Management System

Senior Management

- Driving Energy Management System
- Approval & Budget Sanctions
- Allocation of all required resources

Vice president (Corporate Engineering)

- Providing Technical Inputs
- New and Innovative Energy Conservation Ideas
- Review and Submissions to Senior Management

Energy Cell (Corporate)

- Energy Assessments with all portable instruments
- Review and of Energy Conservation Proposals
- Coordinating with all stake Holders for Implementation

Engineering Head (Unit wise)

- Support in Energy Assessments (Allocation of all Resources)
- Prepare and submission of energy conservation
- Seeking approvals at plant level

Energy Team - PoC (Unit Wise)

- Daily data monitoring and reporting on energy projects
- Participate in Energy Assessments along with Energy Cell
- Ground level implementation of energy conservation proposals

17. Learning from past CII award programs

i) Procurement (New & Replacements) of energy efficient motors

Procurement of Energy Efficient Motors yearly around 300 motors with tentative savings of 6 -7 Lakh units in a year

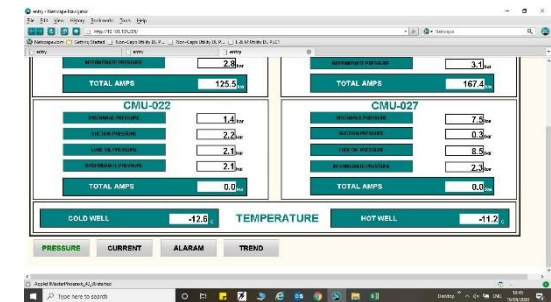


ii) Replacement of old & Reciprocating Chilling plants with new Screw Chilling plants

- Reciprocating Chilling plant having excess energy
- Replaced new screw type energy efficient Chillers

iii) Implementation of IoT Based (Industry 4.0) Online Energy Monitoring System

- Implemented across all 25 No's of Chilling Plants –
- Daily monitoring and attending the discrepancies



18. Adoption of Energy Efficient Equipment



Implementation of OFR Systems – Refrigeration Systems

- Improved **reliability & safety** in Refrigeration Systems
- Savings to the tune of **32-48%** observed in the existing plants



Procurement of No Air Loss Drain Valves in Compressed Air Systems

- Avoided loss of compressed air to atmosphere
- Attractive payback period of 3 months



Procurement of Double Stage VAMs

- Reciprocating Chillers are energy intensive – 38 % excess consumption
- Replaced Old reciprocating type Chilling Plants



Procurement of Vertical Inline Pumps – replacements & New projects

- Energy Efficient and reduced power consumption by 18 %
- Low foot print , Less maintenance and down time

19. ENERGY WEEK CELEBRATIONS - API



Organised for the first time in Aurobindo during 11th to 19th Dec 2020.



Around 1000 participants across all API units



309 Energy Conservation Ideas received from plants



Competitions held -Poster making on Energy Conservation, Best Energy Conservation Idea and Essay Writing etc

Few Best Ideas Received

- Adiabatic Cooling for Air Cooled Refrigeration plants
- The highly efficient Power Economy agitator systems for process Reactors
- Reactor drain collection using three way valve controlled TDS transfer system
- Plastic waste to Energy Conversion through Boiler(incenerator)
- Shuffling / integrating of Cooling Towers based on Load
- Implementation of Auto on /off lighting system for Warehouse



Training & Capacity Building Programmes

- Given training on Energy Conservation Opportunities, Best Operating Practices & Case studies across all units
- Topics - Refrigeration Plants, Pumping Systems, Cooling Towers, Air Compressors, Boilers and associated utility systems
- Groups - Utility Managers, Operators and AMC



Practical Orientation on Energy Performance Assessment

- On-Site measurement of Parameters - Performance Assessment
- Data analysis - Comparison with design parameters



Training Programme on RCA & RCM

- Procedures of Analysis, Tools and Concepts
- Analysis of Case studies – with practical approach

21. Awards & Recognitions



Operational Excellence Company of Year 2021

- Organized by Energy & environment Foundation (EEF)
- Under Global Health Care Conference Awards Competitions
- Event was held during 15 -16 April 2020, New Delhi (Virtual)



Best Energy Efficient Organization -- 2nd Runner Up

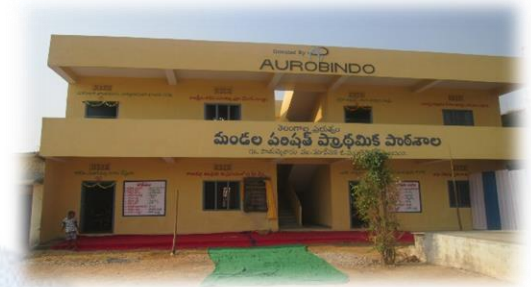
- Under Large Scale Industry Categorization
- 4th edition CII National Energy Efficiency Circle Competition 2020
- Event was held during 14 – 15 May 2020, New Delhi



Best Energy Efficient Unit – Unit I

- APL Unit-I awarded as “Energy Efficient Unit” under Pharma & Bulk Drugs category
- Event was held during 25th to 28th August 2020 at CII Virtual Platform

22. CSR Activities



- 14 Villages Adopted
- 48 Water Drinking Plants
- 350 + Healthcare Programme
- 21 Educational Institutions



Thank You



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