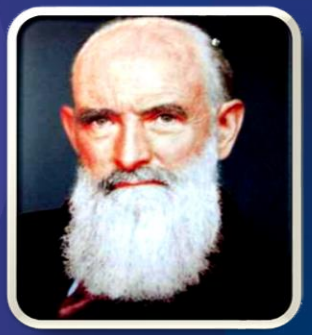
# Bosch Limited, Bidadi Plant, Karnataka

## CII National Energy Award for Excellence in Energy Management 2022 ( Auto, Engineering & Railway Sector )



Nothing is so perfect
Which cannot be
improved further

Robert Bosch


**Presenters :**

**Rajendra S, Senior General Manager**

**Shamanna V, Senior Manager**

**Anand V, Deputy Manager**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# Excellence in Energy Management 2022

## Location Overview


**Water Neutral by 2025**

- STP Treated Water; ETP Treated Water
- Rainwater Harvesting; Ozonation Plant

**395,234m² Total Area**

- NGF 82,257m²
- Built Area 297,807m²

**CO2 Neutral since 2020**

- 26%- Solar energy (8.6MWP )
- 51% - Procured Green Energy

**834 Seats Office Capacity**

- Seating Capacity Spread across B101, B102, FCM

**3800 Plants**

- Herbal Garden (12,947m²)
- Fruit Garden (1,936m²)
- 220 Saplings Planted in 2021

**88 Industrial Units**

- Toyota, Coca Cola, Mitsubishi

**BidP1 Phase 1 inaugurated in year 2015 & Phase 2 in 2019**

# Excellence in Energy Management 2022

## Product Portfolio

10 Value Streams

347 M&SS
1082 BCA
1381 FMP

3 BUs
DP, DI, SD

29,300m² NF3
1283 MAEs

A Pump

PF conv

Glow Plug

VE Pump
(relocated)

PF CRS

CP4

CB18, CB28

1954 — 1955 — 1965 — 1985 — 2006 — 2009 — 2010 — 2017 — 2020

DV, Elements

CP1

CP1H

HF Rail

LSF Mini



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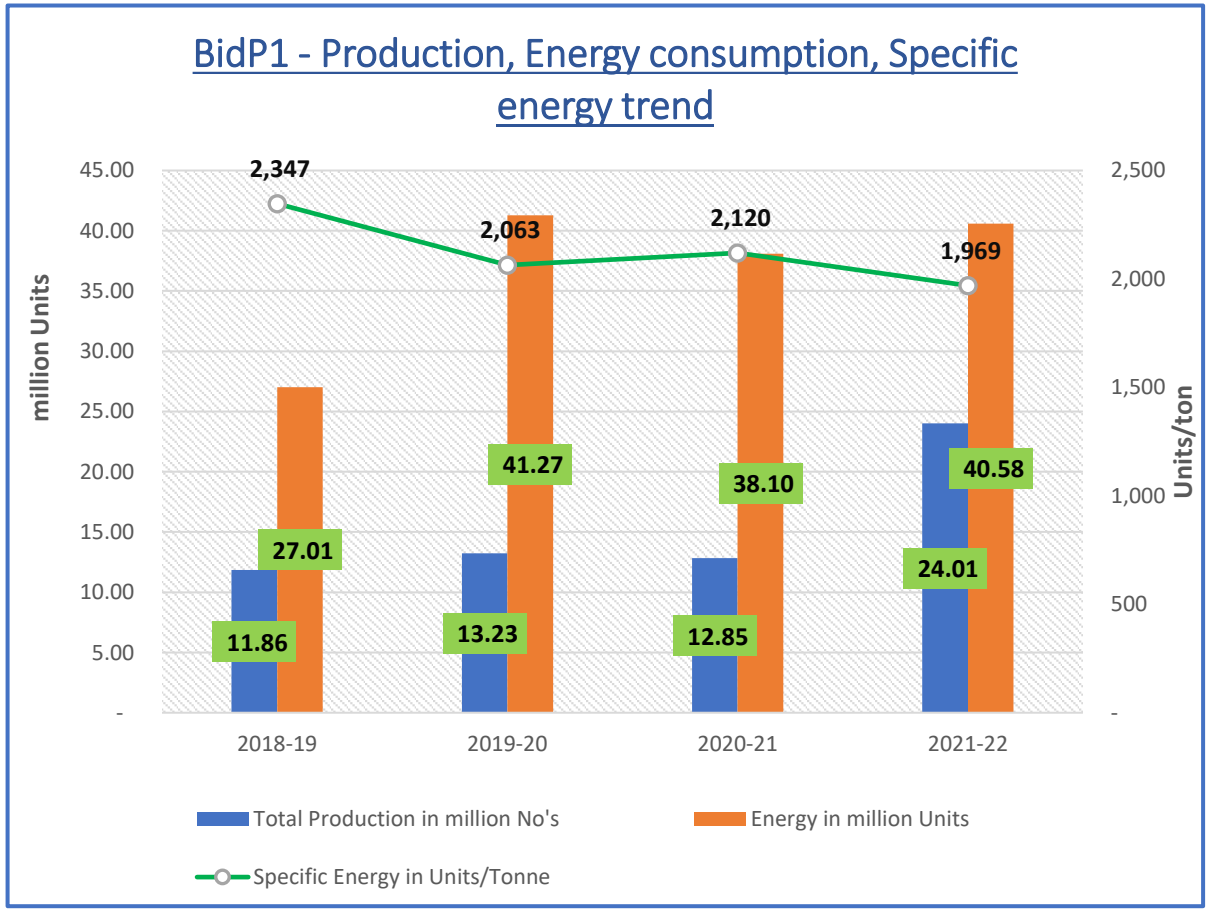
## Production data, Energy consumption & Specific Energy consumption




- **2019-20**
  - Relocation up to 700 machines happened during Phase 2
  - Relocation of Heat treatment & Surface treatment shop & machine & process trials activities
  - Additional Utilities equipment's added
- **2020-21**
  - Covid Lockdown for 2 months
  - Low volumes & staggered shift operations till August due to Covid restrictions
  - As per Covid guidelines, 100% fresh air circulation introduced, instead of recirculation in Production Hangers
- **2021-22**
  - 15% Energy reduction through Projects
  - Record Production volumes & New product LSFmH (Lambda sensor) introduced

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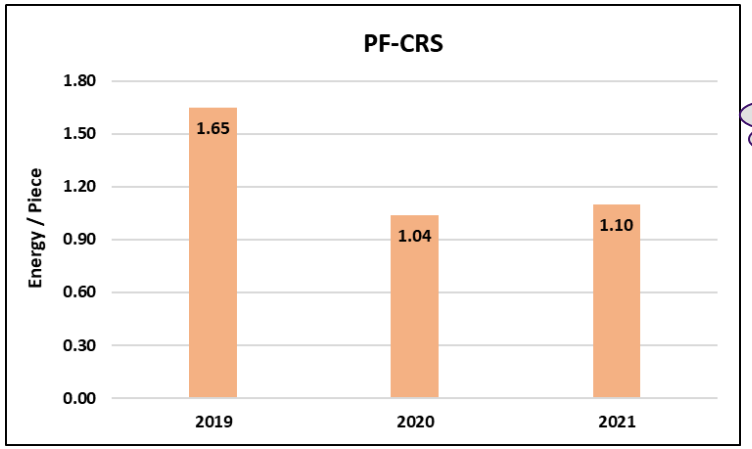
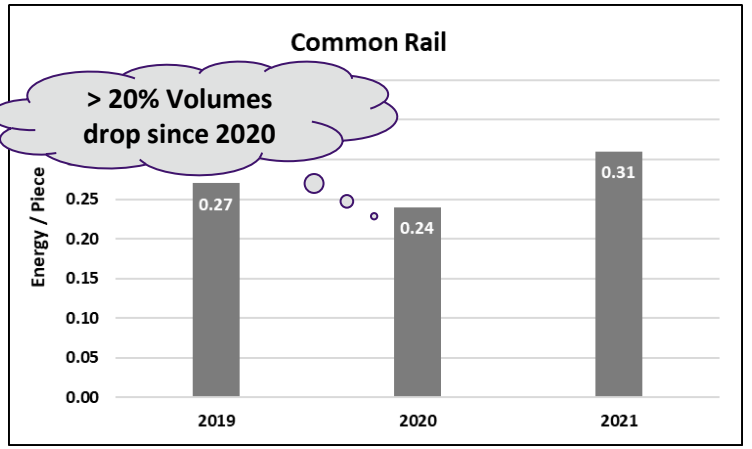
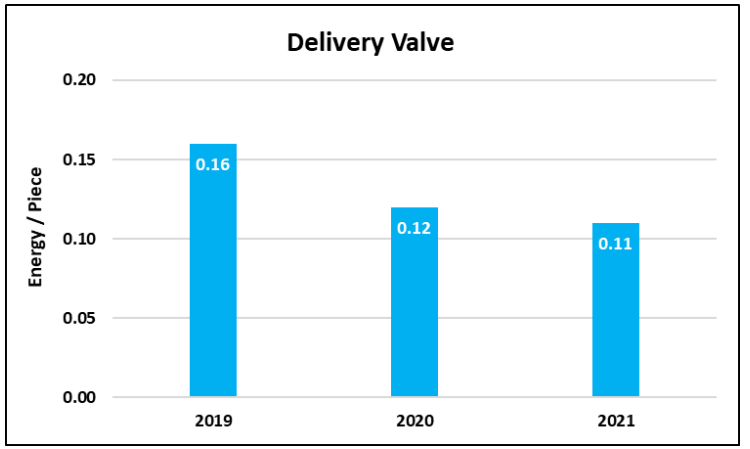
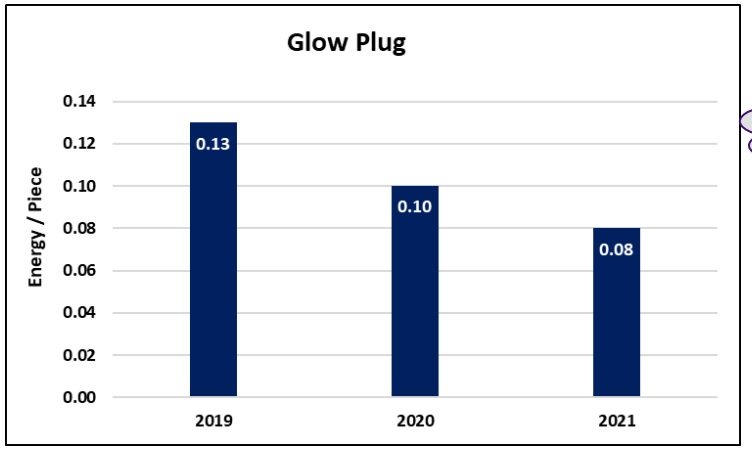
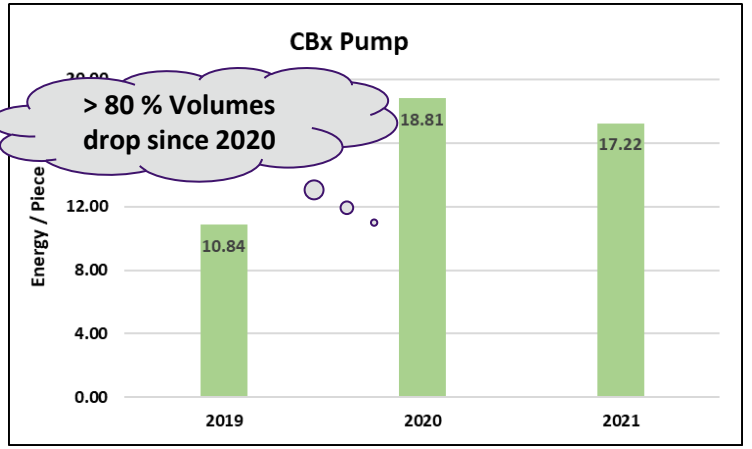
## Specific Energy of Products – 2019 - 2021

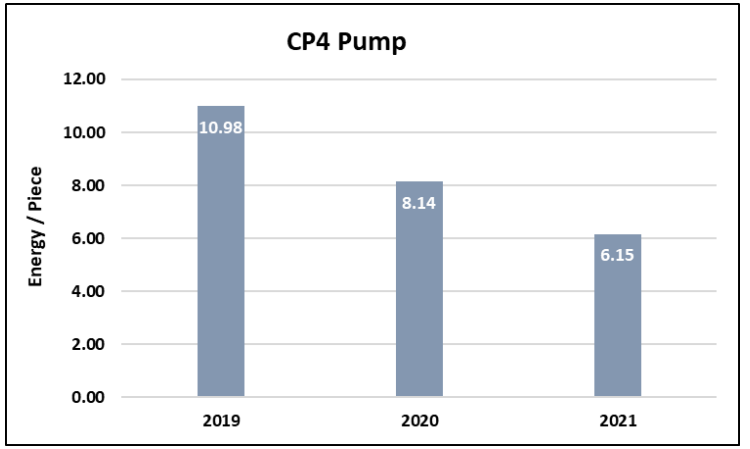




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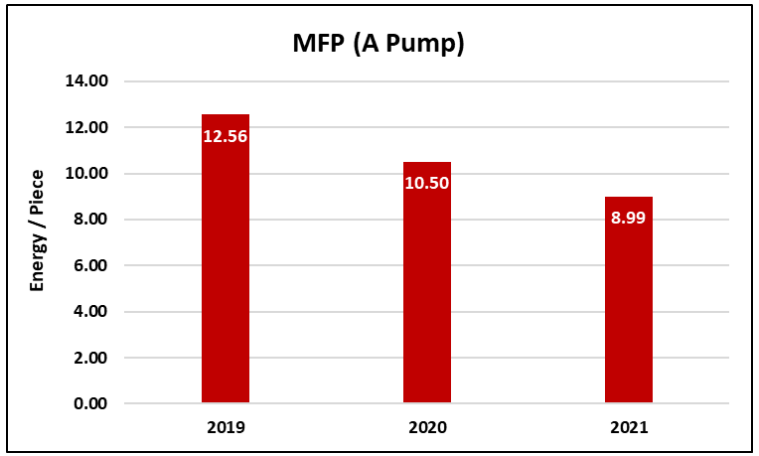
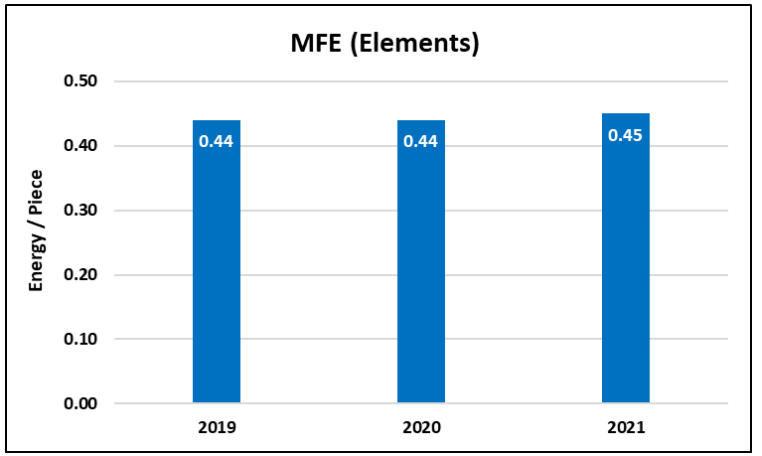
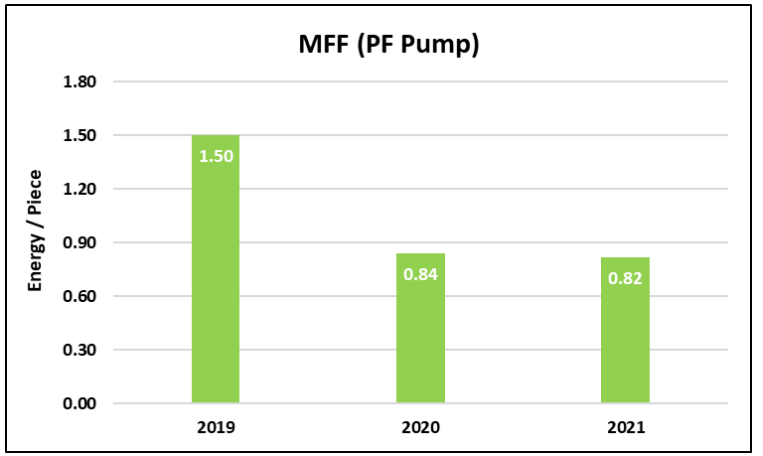
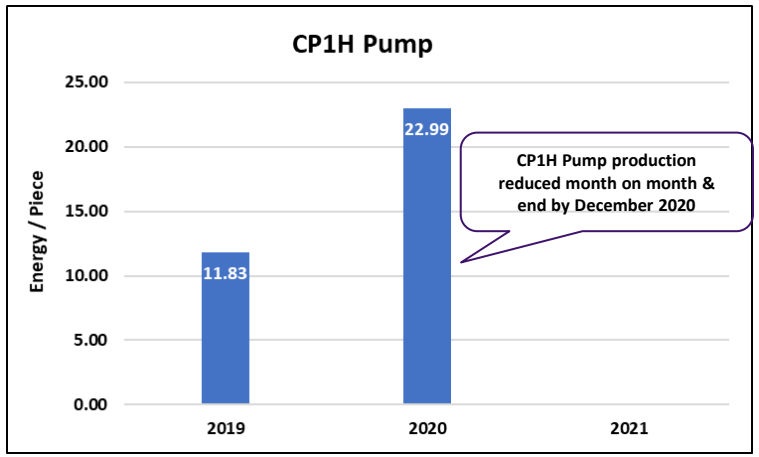
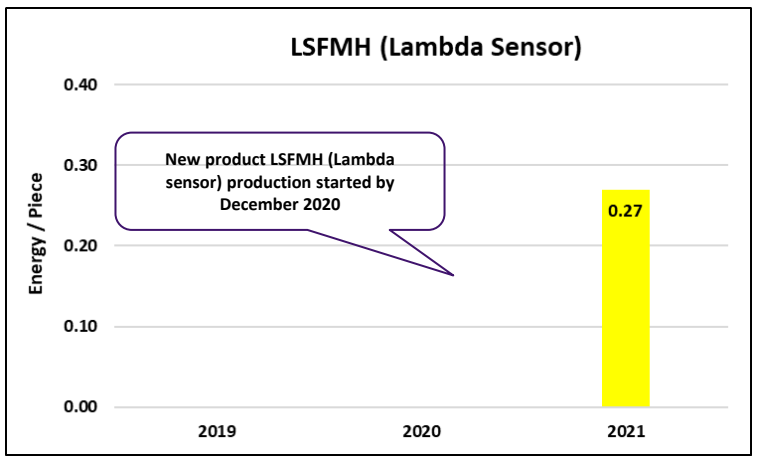
## Specific Energy of Products – 2019 - 2021

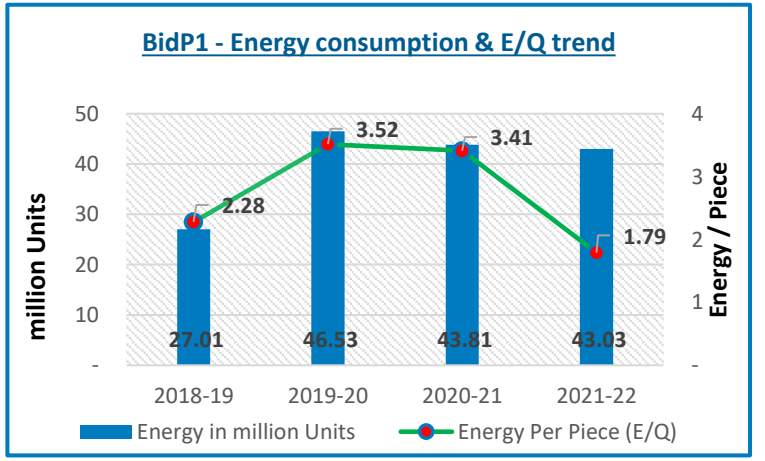




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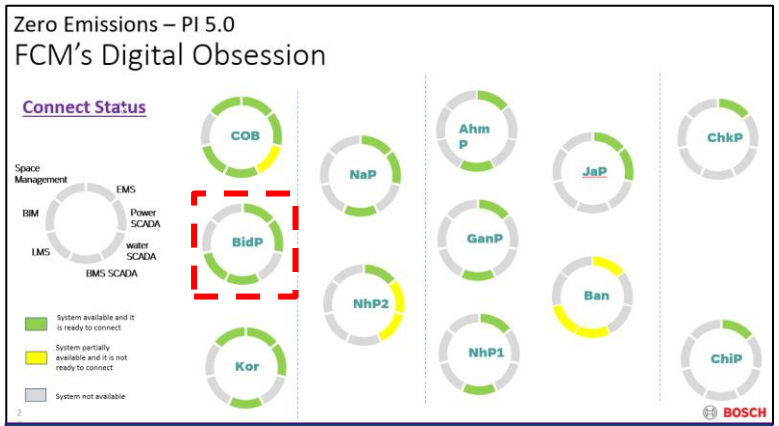
# Excellence in Energy Management 2022

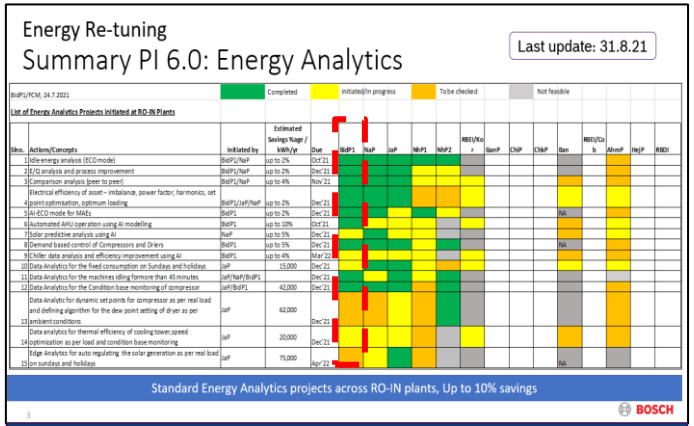
## Benchmarking




No.1 in Digital platform connectivity

| | BidP | NaP | JaP | NhP2 (AA platform) |
|---|---|---|---|---|
| Total Utilities MAE | 325 | 255 | 140 | 8 |
| Total Production MAE | 585 | 658 | 214 | 150 |
| Total MAEs | 910 | 913 | 354 | 158 |
| Connectivity status - Utilities | 293 | 255 | 38 | 90 |
| Connectivity status – Production MAE | 338 | 139 | 54 | |
| **% connectivity** | **69.3** | **38.99** | **26** | **57** |

No.1 in Energy meter connectivity




Maximum energy analytics solutions done

| Slno | Equipment / Activity | Unit | Industry standard (ASHRAE) | Min | Max | Bench mark data | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | BidP | BanP | NhP2 | NaP | JaP | ChkP | RBDI | GanP | RBEI/Kor | ChiP | AhmP | HejP | BSH | PuP | RBAI (NhP1) |
| 1 | Compressed Air system | kW/cfm | 0.18 to 0.20 | 0.15 | 0.22 | 0.16 | 0.22 | 0.2 | 0.18 | 0.19 | 0.18 | 0.17 | | NA | 0.16 | 0.16 | | - | | 0.16 |
| 2 | Chillers & Pumping system | kW/TR | 0.72 to 0.78 | 0.17 | 1.05 | 0.58 | 0.6 | 0.67 | 0.67 | 0.66 | 0.67 | 0.8 | | 1.05 | | 0.55 | | Nil | | 0.87 |
| 3 | DG sets | kWh/ltr | 3.5 to 4 | 2.32 | 4.5 | 3.68 | 3.7 | 3.5 | 4.5 | 3.15 | 3.61 | 3.24 | | 3.27 | 3.6 | 2.32 | | 3.2 | | 3.8 |
| 4 | AHUs / Blowers | cfm/kW | 1000 to 1600 | 1233 | 1712.28 | 1400 | 0.0011 | | 1450 | 1621 | 1133.33 | 152 | | 1712.28 | | 1233 | | - | | 752 |
| 5 | House Keeping | Person / 1,000 $m^2$ | | 0.24 | 3.02 | 0.46 | 0.45 | 0.24 | 0.44 | 0.51 | 0.63 | NA | | 1.2 | 0.75 | 0.485 | | 1.23 | | 3.02 |
| 6 | Gardening | Person / 1,000 $m^2$ | | 0.09 | 1.71 | 0.14 | 0.19 | 0.138 | 0.09 | 0.1 | 0.43 | Nil | | 1 | | 1.71 | | 0.15 | | 1 |
| 7 | General Electrical Maintenance | Person / 1,000 $m^2$ | | 0.04 | 0.46 | 0.04 | 0.17 | 0.08 | 0.05 | 0.46 | 0.31 | 0.13 | | 0.28 | | 0.25 | | - | | 0.36 |
| 8 | General Utilities Maintenance | Person / 1,000 $m^2$ | | 0.12 | 1.9 | 0.12 | 0.13 | 1.9 | 0.16 | 0.53 | 0.45 | 0.13 | | 0.47 | 0.5 | 1.00 | | - | | 0.73 |
| 9 | Power Maintenance | Person / MW of load | | 0.37 | 4.31 | 1.87 | 1.28 | 0.37 | 1.3 | 2.28 | 2.4 | Nil | | 4.31 | 8 | N. A. | | - | | 2 |
| 10 | Energy consumption of plant - all products | kWh/pc | | 0.15 | 7.8 | 1.8 | | 2.15 | 4.4 /2.2 | VE- 37 NHA - 1.03 TMC - 3.7 | 2.78 | | | NA | 1.36 | N. A. | | 7.8 | | |
| 11 | Lighting | W/$m^2$ | 5 to 6 | 1.98 | 2.5 | 2.38 | | | 2.42 | 2.47 | | | | 1.98 | | 2.5 | | - | | 2.47 |
| 12 | Office Air conditioning | kW/$m^3$ | | 0.01 | 0.052 | 0.011 | 1.2 | 0.028 | | 0.01 | | | | 0.052 | | 0.0052 | | - | | 0.01 |
| 13 | Hangar cooling | kW/$m^2$ | | 0.03 | 0.36 | 0.03 | | | 0.029 | 0.03 | | | | NA | | 0.03 | | - | | 0.36 |
| 14 | Energy consumption per head count in offices | kWh/person /day | | 0.142 | 176 | 10 | | 0.142 | 2 | 16.3 | | | | 176 | | 1.75 | | - | | 3.5 |
| 15 | Water consumption | KLD/person | 0.2 to 0.3 | 0.057 | 0.61 | 0.25 | 0.09 | 0.61 | 0.3 | 0.09 | | | | 1.2 | 0.057 | 0.17 | | 39.6 | | 1.02 |
| | | | | | | | | | | | | | | | | | Efficient values | | | |
| | | | | | | | | | | | | | | | | | Higher values | | | |

Bench-mark data: Bosch & ASHRAE, most greens for BidP

| Key area | KPI | BidP1 | NaP | JaP |
|---|---|---|---|---|
| Compressors | FAD efficiency % | 93 | 84 | 80 |
| | kW/CFM | 0.17 | 0.18 | 0.19 |
| | Overall efficiency % | 97.8 | 96.9 | 95.1 |
| Chillers | ikW/TR | 0.248 | 0.29 | NA |
| Lighting (shopfloor) | W/$m^2$ BEE & super ECBC reference - 6 | 2.38 | 2.42 | 2.47 |

Key area Energy performance







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# Excellence in Energy Management 2022

## List of Major Encon project planned in FY 2022-23

**List of Major Energy Conservation Projects - 2022-23**

| Sl.No. | Area | Short description | Technological area | Energy savings MWh/annum | Energy Cost Savings mINR/annum | Capex Cost mINR | PBP years | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1 | FCM | EC fans for B101 Clean room AHU's | HVAC | 244 | 1.85 | 3.90 | 2.1 | |
| 2 | FCM | VFD for MEE calandria recirculation pumps | Electrical drive system | 28 | 0.21 | 0.42 | 2.0 | |
| 3 | FCM | Compressed air leakage arresting in MAEs and distribution system | Compressed air | 207 | 1.57 | 3.45 | 2.2 | |
| 4 | FCM | VFD for air blowers of CT in ETP | Electrical drive system | 28 | 0.21 | 0.42 | 2.0 | |
| 5 | FCM | Heat Recovery in Air Compressors | Heat recovery | 831 | 6.32 | 40.40 | 4.1 | LNG savings - 3360 MMBtu |
| 6 | FCM | Digitilization Projects - Solar edge Analytics, AI based compressor optimization, Chiller energy analytics etc | Digitalization | 530 | 0.30 | 0.87 | 2.9 | |
| 7 | VS | Energy reduction Projects from VS MAE's | Shut down / Idle load | 600 | 4.56 | - | 0 | |
| **TOTAL** | | | | **2,468** | **15.03** | **49.5** | | |

**Saving's Expected – 6 %**





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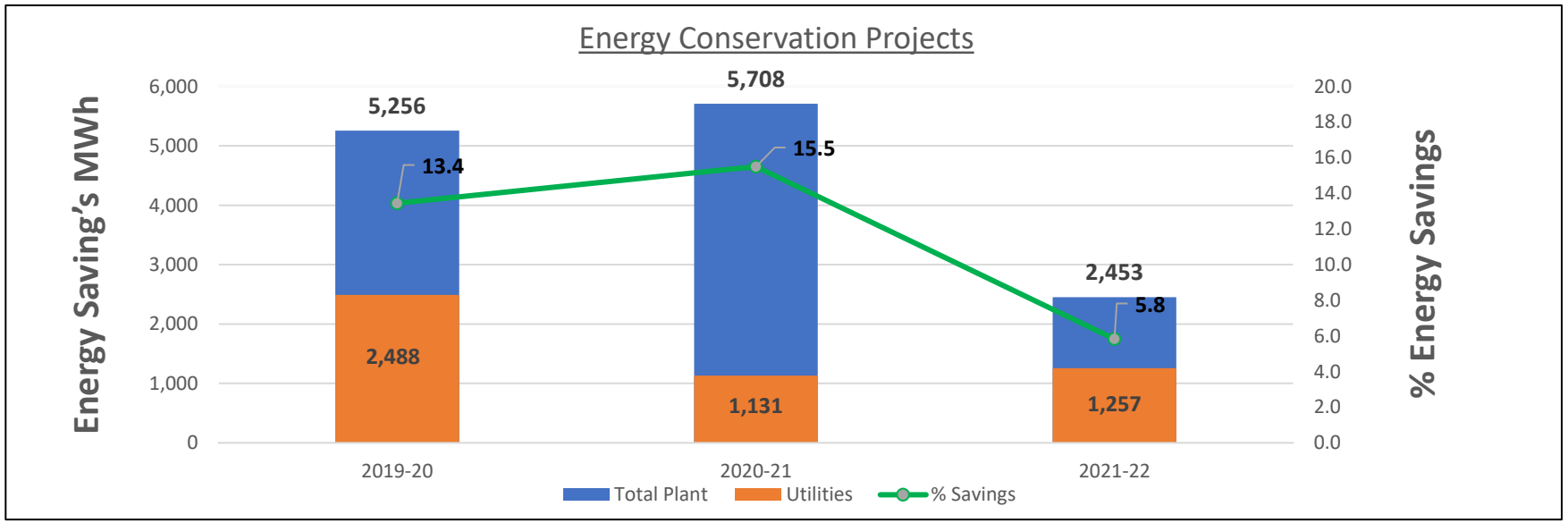
# Excellence in Energy Management 2022

## Energy Saving projects implemented in FY 2019-20 to 2021-22

| Year | No. of Energy saving projects | Investments in mINR | Electrical Savings (Million kWh) | Thermal savings (Million KLcal/MTOE | Savings (Million INR) | Impact on SEC (Electrical, Thermal) % |
|---|---|---|---|---|---|---|
| FY 2019-20 | 11 | 19.77 | 5.26 | NA | 37.84 | 11 |
| FY 2020-21 | 15 | 1.00 | 5.71 | NA | 42.53 | 13 |
| FY 2021-22 | 14 | 31.93 | 2.45 | NA | 18.52 | 6 |





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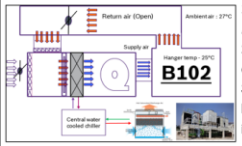
# Excellence in Energy Management 2022

## Energy Saving projects implemented

### Best Practice example : Introduction of Free cooling mode in AHU

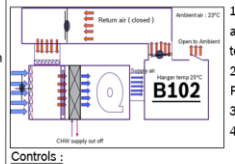
**Project Description - before:**




1. Shop cooling by 2 stage AHU by indirect coil cooling
2. 25% Fresh air + 75% Re circulation of cool air maintaining 25 deg.
3. Chillers & cooling tower connected load is higher to maintain the same irrespective of ambient temp.

Controls :
- Enthalpy at hanger (delta of 3kJ/kg ) , VSD controlled blower
- Auto control CHW valve , Temperature control

**Project Description – after :**




1. 100% free cooling by blowing ambient air to shop, when ambient temp <25 deg
2. Chillers & cooling tower load Reduces
3. Exhaust thru roof LAMILUX panels
4. Auto controlled with ambient temp

Controls :
- Smoke / Fire emergency , Rain water sensor , Wind sensor
- Enthalpy & temp

**Results :**
1. Energy consumption will be reduced about **665 MWh/ a**
2. Reduction of heat load on chiller plants
3. Set temperature of 25°C for at shop maintained with utilization of ambient air
4. 100 % fresh & exhaust at shop
5. Automated system with all safety controls in HVAC

Energy Reduction 18 %

**Transferability / Yokoten :**

Introduction of LAMILUX for exhaust control system & BMS

Can be horizontally deployed in all shop based on site conditions

Savings of 665 MWh / Annum

Savings of 4.6 mINR/ Annum

Savings of 297 MWh / Annum

Savings of 2 mINR/ Annum

### Best Practice example: Conversion of Fluid Chillers

**Project Description - before:**

1. Media used in Fluid chillers was Air cooled
2. Energy consumption was high due to more no. of chillers inside the hangar.
3. Maintenance of cooling fan is high on cost & efforts

Condenser fan

**Energy Consumption: 8,030 MWh/year**

**Project Description – after :**

1. Changed / Conversion of cooling media from air to water
2. Elimination of heat load emission inside hangar. No fan noise in shop floor.
3. Chiller maintenance gets simpler

(frequency of check reduced by 50%)
Condenser fan replaced By Compact Brazed-type Heat Exchanger

**Energy Consumption: 7,733 MWh/year**

**Results:**
1. Energy consumption will be reduced about **297 MWh**
2. Reduction of heat load on chiller plants
3. Set temperature of 24°C for fresh coolant achieved (process reqt.)
4. Aesthetic Improvement

**Transferability / Yokoten:**

Can be horizontally deployed in all Fluid chiller system based on site conditions.

### Eco Mode - CBx VS (Grob - M65B0-G320-HM1)

**Before :**
- In CBx VS, 4 Grobs machines are used for housing manufacturing.
- Each Grob machine is having separate coolant tank.
- For churning of coolant every 2 hours, pump is switched on for 10minutes.
- This churning will help in mixing and avoids fungus formation inside the coolant tank

**After :**
- Pump used for churning is 4.0Kw motor. After many trails, churning time optimized at 5minutes.
- Thereby 50% reduction in power consumption in each machine. Same timings horizontally deployed in all the 4 machines.
- Total units saved per day is 4unit/machine


**Targetted result :**
- Energy saving – **5.14 MWh/ yr**
- Cost savings - **35.98 TINR/Yr.**

**Transferability / Yokoten :**
- Approach also horizontally deployed in other Grob machines

Savings of 5.1 MWh / Annum

Savings of 0.036 mINR/ Annum







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# Excellence in Energy Management 2022

## Energy Saving projects implemented

### Process optimization-CP1H VS(Aktivit-M65B0-3703070546)

**Project Description - before:**

- Acktivit washing machine has 75Kw HP Pump motor which was controlled by Soft starter.
- In Auto sequence, HP washing is required for 20Sec & 18Sec for automation
- How ever HP pump motor was working continuously, and sequence controlled through valves

**Project Description - after :**

- Variable frequency drive (VFD) is introduced, which HP pump motor in full speed for HP washing & reduced speed during automation sequence. With this modification, we achieved energy savings without effecting process.
- Heat losses in HP pump motor reduced

Savings of 54.3 MWh / Annum

Savings of 0.38 mINR/ Annum

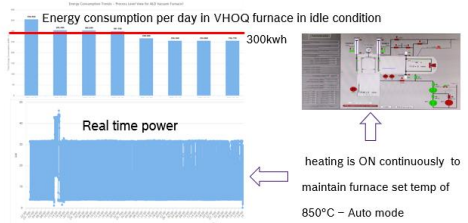
**Targetted result:**

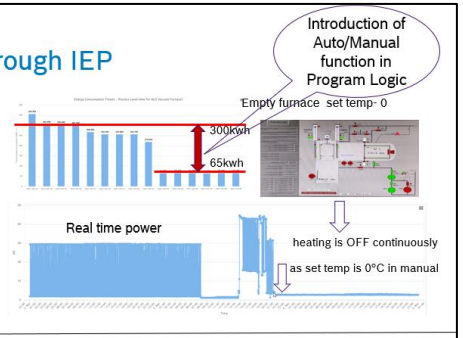
- Energy saving - **54.31 MWh/ yr**
- Cost savings - **0.38 mINR/Yr.**

**Transferability / Yokoten:**

- Approach Can be horizontally deployed

### Energy savings in ALD VHOQ furnace through IEP




Savings of 51 MWh / Annum

Savings of 0.38 mINR/ Annum

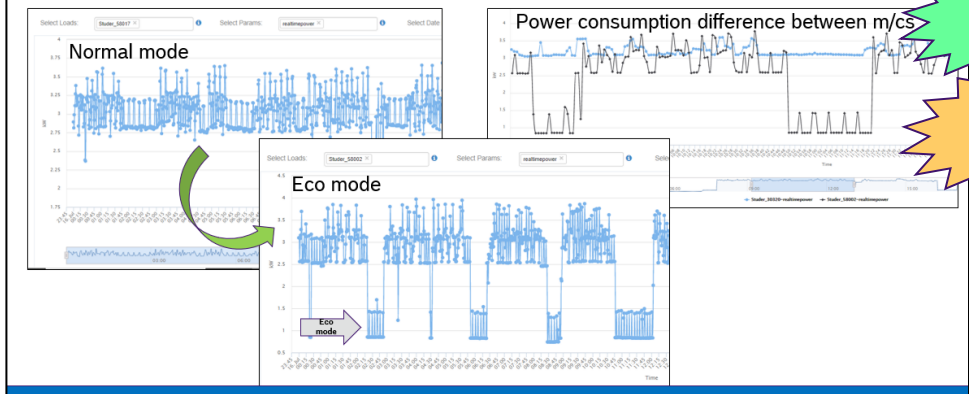
**Targeted result:**

- Energy saving – **51 MWh/ Yr.**
- Cost savings - **383 TINR/Yr.**

**Transferability / Yokoten:**

**Horizontally deployed to ALD brazing furnace**

### Idle Energy saving on Studer machines



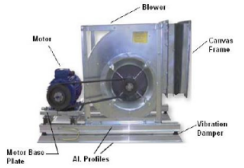

Estimated energy saving of 10,725 kWh/annum with Eco mode implementation

Savings of 10.7 MWh / Annum

Savings of 0.075 mINR/ Annum

### EC+ fan for B101 AHUs

**Present condition**: Belt driven blower for 3SCU(3Stage Air Handling Unit)




Energy Losses due to

- 1)Belt loses
- 2)Leakages
- 3) Non energy efficient induction motor

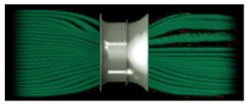
**Proposed condition**: EC+ Fan all 16 nos. AHU's.

Present Energy consumption:135.9 kWh/day

Estimated reduction: 68.3 kWh/day

**Concept:**

We can use high efficiency Fan with smart Modulation using VFD



Static and dynamic pressures- Higher efficiency, lower energy consumption & minimum operating cost.

Highlights:

- Aerodynamic Efficiency up to 92%
- 40% reduction over centrifugal fans
- Overall efficiency improvement of 85%
- 2-4% gain by switching from IE2 to IE4 / IE5 motors
- 20% higher fan efficiency compared to EC fan.
- Fan life increase from 8 years to 20 years

Savings of 676 MWh / Annum

Savings of 5 mINR/ Annum

Energy Savings – 676.9 MWh /Year, 5Mio.INR, ROI: 2.29 Year





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# Excellence in Energy Management 2022

## List of Major Energy Conservation Projects – 2019-22

| Sl.No. | Year | Short description | Technological area | Energy savings MWh/annum | Energy Cost Savings mINR/annum | Capex Cost mINR | PBP years | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1 | 2019-20 | Energy saving through scheduled base auto operation of phase 1 office area ahu's | shut down / base load | 235 | 1.69 | - | 0 | |
| 2 | 2019-20 | Inclusive Energy Platform - Buildings, Utilities, MAE: Energy reduction projects through Energy Analytics(RBEI software now called Deepsights) | Analytics | 560 | 4.03 | - | 0 | |
| 3 | 2019-20 | Conversion of Fluid Chillers: from Air-cooled to Water-Cooled in B101 & B102 | Cooling | 379 | 2.73 | 18.0 | 6.6 | |
| 4 | 2019-20 | Elimination of 3 X 10 kW & 4 X 3 kW chiller for Hydraulic power pack MAE's | Cooling | 179 | 1.29 | 0.57 | 0.4 | |
| 5 | 2019-20 | Energy reduction Projects from VS MAE's (70 Projects) | shut down / base load | 2,768 | 19.93 | - | 0 | |
| 6 | 2020-21 | Compressed air management system (CMS) for all compressors | Compressed Air | 85 | 0.63 | 1.20 | 1.9 | |
| 7 | 2020-21 | PF control for load & power quality improvement | Power | 45 | 0.34 | 0.02 | 0.1 | |
| 8 | 2020-21 | Nano fluid for chiller compressor | Cooling | 90 | 0.67 | 0.21 | 0.3 | |
| 9 | 2020-21 | Ensaver for lighting circuit | Lighting | 65 | 0.48 | 0.22 | 0.5 | |
| 10 | 2020-21 | Heat pump installation at HT shop | Heating | 578 | 4.31 | 0.05 | 0.01 | |
| 11 | 2020-21 | Energy reduction Projects from VS MAE's | shut down / base load | 4,577 | 34.10 | - | 0 | |
| 12 | 2021-22 | Smart AHU control LSFmH | AHU | 52 | 0.39 | 0.70 | 1.8 | |
| 13 | 2021-22 | Energy efficient lighting system | Lighting | 600 | 4.47 | 9.00 | 2.0 | |
| 14 | 2021-22 | EC fan for B101 hanger AHU's (16 no's) | AHU | 406 | 3.02 | 20.10 | 6.6 | |
| 15 | 2021-22 | Energy savings by Nano fluid injection for 600 TR chiller no. 5 | Cooling | 70 | 0.52 | 0.90 | 1.7 | |
| 16 | 2021-22 | Energy Re-tuning process in Utilities | Compressed Air | 75 | 0.56 | - | 0.00 | |
| 17 | 2021-22 | Energy reduction Projects from VS MAE's | shut down / base load | 1,196 | 8.91 | - | 0 | |

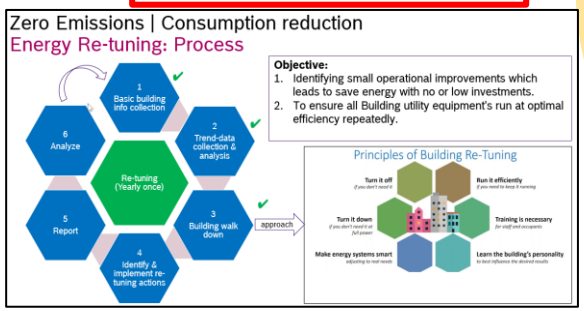
Saving's yielded : 2019-20 – 13.4% | 2020-21 – 15.5% | 2021-22 – 5.8%

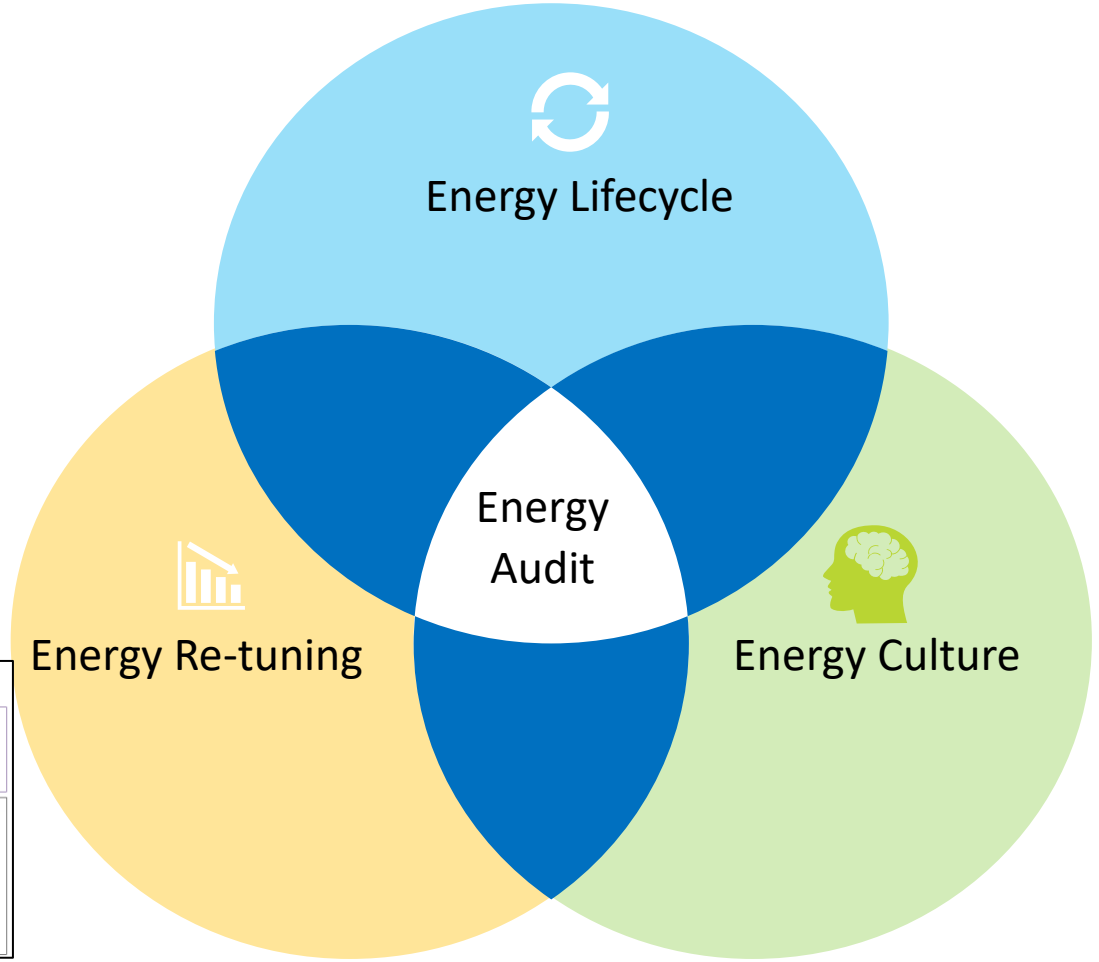
# Excellence in Energy Management 2022

## Energy Consumption Reduction – 4E approach

**Energy audit**
Auditor identifies opportunities for energy saving project for long term & short-term basis

**Energy Re-tuning**
Emphasize on optimization of energy through Energy analytics, Compressor optimization .




**Energy Life cycle**
Data collection of lifecycle of Asset management & Replacement cycle at optimization

**Energy Culture**
Significant savings can be achieved through employee's behavior & attitude towards energy savings

# Excellence in Energy Management 2022

## Innovative Projects : Digital Transformation @ BidP1


**Till 2020**

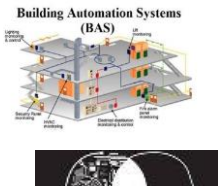
- BMS
- Power SCADA
- Solar SCADA
- LMS
- IEP
- CMS
- 60% MAE connectivity with IEP
- Manual LPC

**2021**

- 70% MAE connectivity to IEP
- Energy analytics
- AI solutions using IEP
- Interfacing of Standalone systems to VLAN
- Solar prediction and performance


**2022**

- CAFM (Computer Aided Facility Management - IBMS+BIM)
- 80% MAE connectivity to IEP
- E/Q reporting
- Active Cock pit : Digital LPC



*Central Database*




*Digital Twin*

**2023**

- 90% MAE connectivity
- Smart and Prescriptive maintenance
- Digital Dash Board



***Data Analytics system ( e.g Bosch I.O ,RBEI IEP)***

Connect → Communicate → Consolidate → Cognitive





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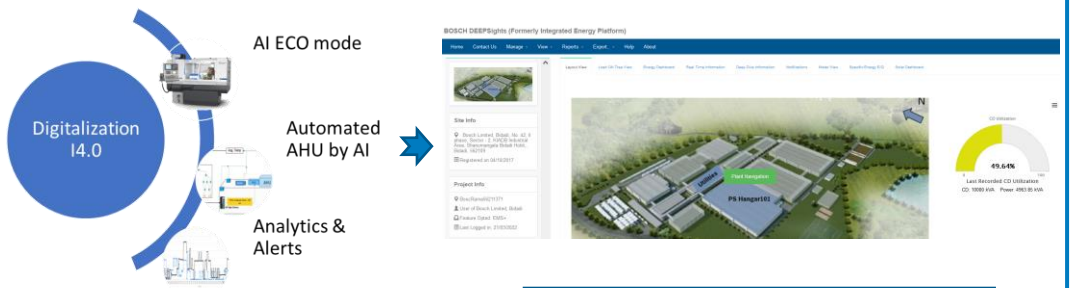
# Excellence in Energy Management 2022

## Innovative Projects : Enhanced Energy Efficiency through Digitalization

### ▶ Method

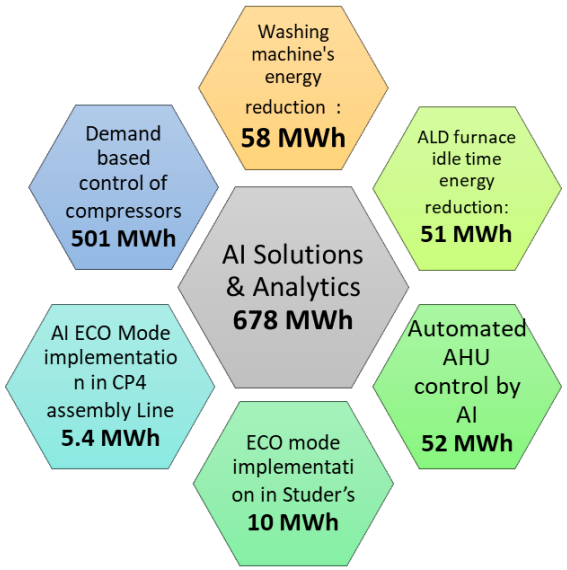



Digitalization & connectivity

DEEP Sights platform

- Energy Analytics using data from Energy portal – **DEEPSights** (formerly IEP)
- Used **AI algorithms** to optimise energy consumptions in MAEs
- Reduced idle energies in MAE using **Energy Analytics** and implementing ECO mode concept.
- 4C Approach : **Connect**, Communicate, Consolidate, **Cognitive**

### ▶ Results




- MAE connectivity – 70%
- No. of Digital projects completed – 6 nos
- Energy savings: 678 MWh
- Platform created for horizontal deployment across the plant

**Energy analytics & AI solutions | 678 MWh Energy savings (15%), 488 tons of $CO_2$**

# Innovative Projects : Enhanced Energy Efficiency through Digitalization

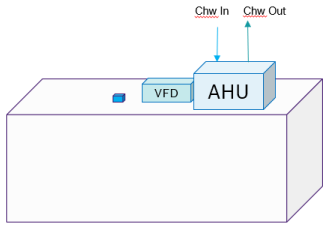
Automated AHU control by AI model- **52 MWh**

## Project 1 :Automated AHU Control by AI model @ LSFmH cleanroom

### Enhanced Energy efficiency and CO2 Reduction through Digitalization

Automated AHU control by AI – System overview

Sustainability




**Initial condition:**

- AHU runs at constant speed
- Temperature & RH control is not dynamic
- Over/under cooling of room when sudden change in load.

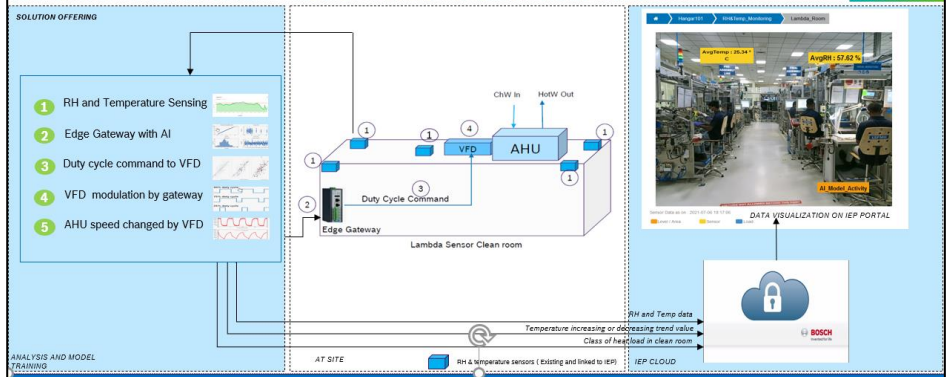
VFD – Variable Frequency drive, AHU – Air Handling Unit, RH – Relative humidity, AI – Artificial Intelligence

Opportunity : Adopt dynamic heat load-based room cooling and optimize energy consumption

### Enhanced Energy efficiency and CO2 Reduction through Digitalization

Solution Architecture – Edge AI With Bosch DEEPSights

Sustainability

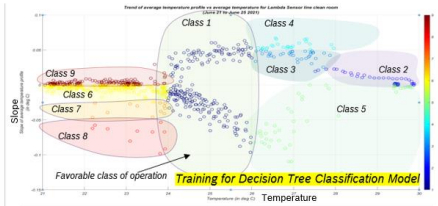



Dynamic heat load-based room cooling using AI

### Enhanced Energy efficiency and CO2 Reduction through Digitalization

How AI model works? Decision Tree Classification

Sustainability



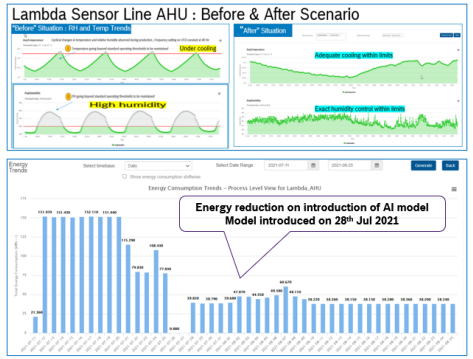

| Sl. No | Conditions | Class | Trigger signal to gateway |
|---|---|---|---|
| 1 | Temperature in 24 to 26 deg C range | Class 1 | No action required on gateway |
| 2 | Above 26 deg C and Slightly increasing trend 0 < slope < 0.025 | Class 2 | Increase frequency by 0.5 Hz |
| 3 | Above 26 deg C and higher increasing trend 0.025 < slope < 0.05 | Class 3 | Increase frequency by 1 Hz |
| 4 | Above 26 deg C and very high increasing trend slope > 0.05 | Class 4 | Increase frequency by 2 Hz |
| 5 | Above 26 deg C and decreasing trend Slope < 0 | Class 5 | No action required on gateway |
| 6 | Less than 24 deg C and slight decreasing trend 0 > slope > -0.025 | Class 6 | decrease frequency by 0.5 Hz |
| 7 | Less than 24 deg C and high decreasing trend -0.025 > slope > -0.05 | Class 7 | decrease frequency by 1 Hz |
| 8 | Less than 24 deg C and high decreasing trend -0.05 > slope | class 8 | decrease frequency by 2 Hz |
| 9 | Less than 24 deg C and increasing trend Slope > 0 | class 9 | No action required on gateway |

99.6% Accuracy Obtained after training with 40 days of data

### Enhanced Energy efficiency and CO2 Reduction through Digitalization

Automated AHU control by AI – Summary & Results

Sustainability




**Next steps:**

- Horizontal deployment @ BidP1– **4 more AHUs, 140 MWh energy savings**
- AI solution for **Compressed air management**
- AI solution for **Water Management**
- AI solution for **Solar energy** generation
- Horizontal Deployment at other plants **– NaP, NhP1 & ChkP in progress**

Energy Savings – 52,200 kWh (64%)





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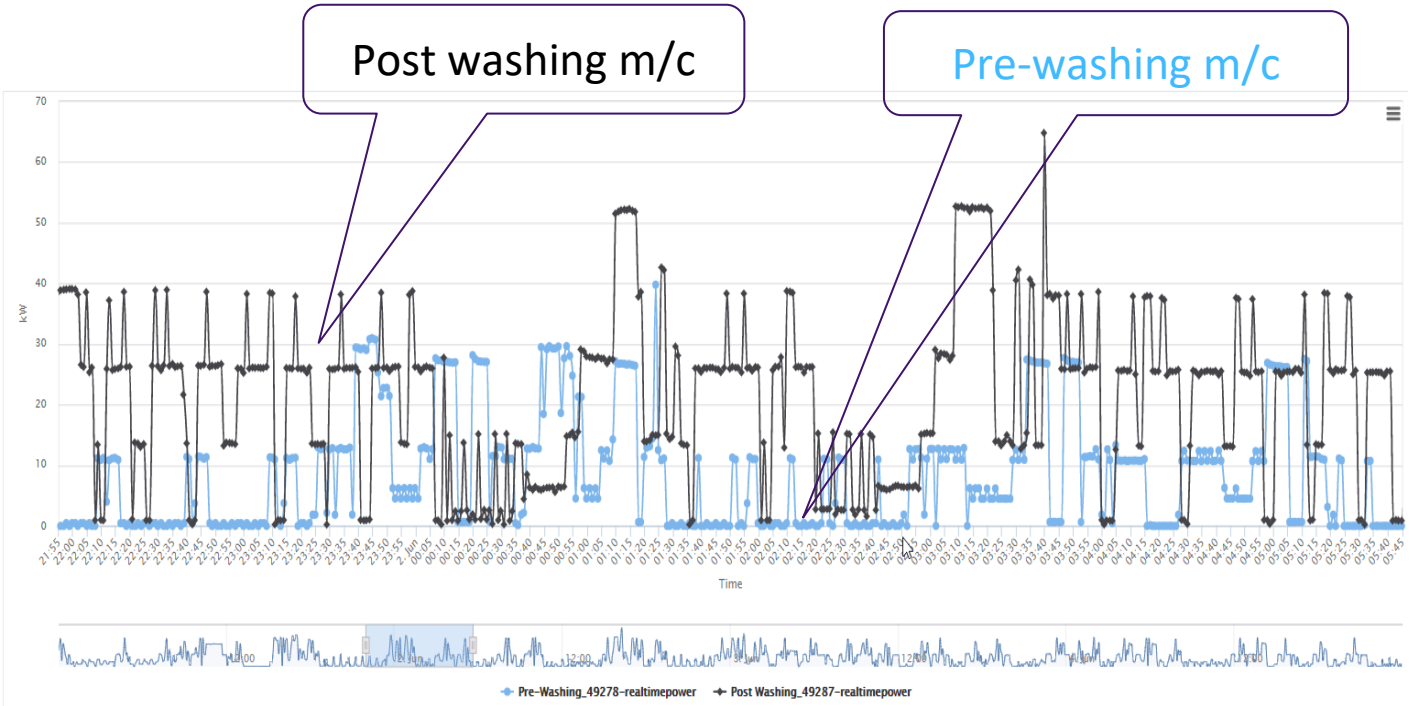
# Innovative Projects : Enhanced Energy Efficiency through Digitalization

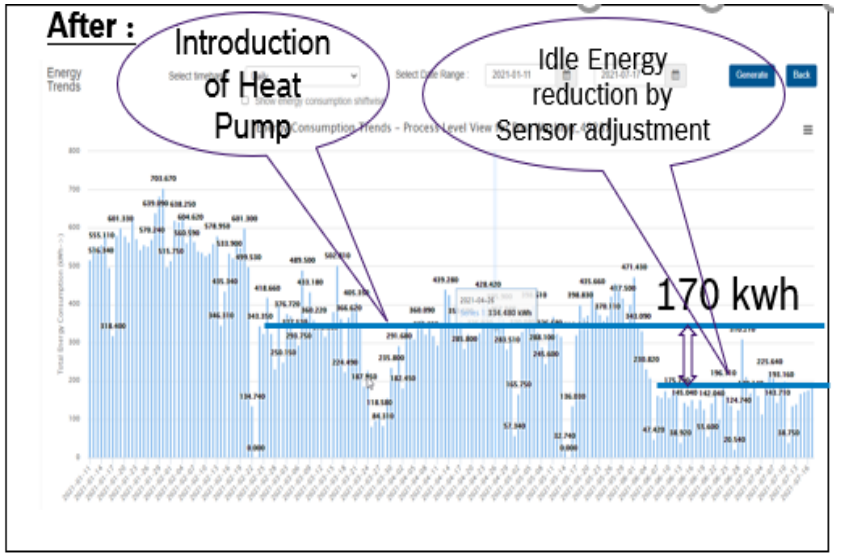
## Project 2 : Deep dive Energy Analytics in Post Washing machine

Washing machine's Energy reduction - **58 MWh**

- ***Comparison between Pre & Post Washing machine at Heat Treatment shop***
- ***Deep dive Energy Analytics in Post Washing machine***
- ***Energy Conservation by Idle energy reduction in Post washing M/c***







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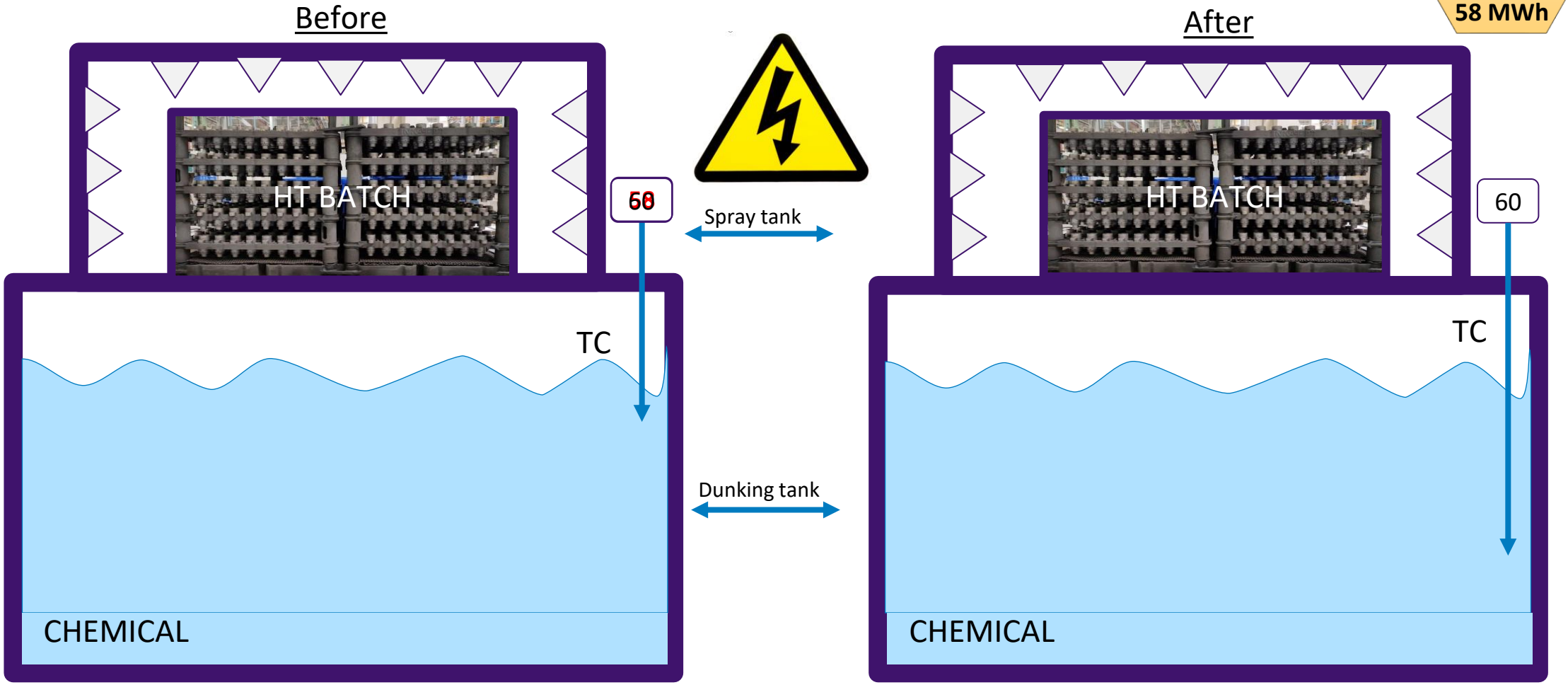
# Innovative Projects : Enhanced Energy Efficiency through Digitalization

## Project 2 : Deep dive Energy Analytics in Post Washing machine

Washing machine's Energy reduction - **58 MWh**





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# Innovative Projects : Enhanced Energy Efficiency through Digitalization

## Project 3 : Demand based control of Compressors using CMS (Compressor Management System)

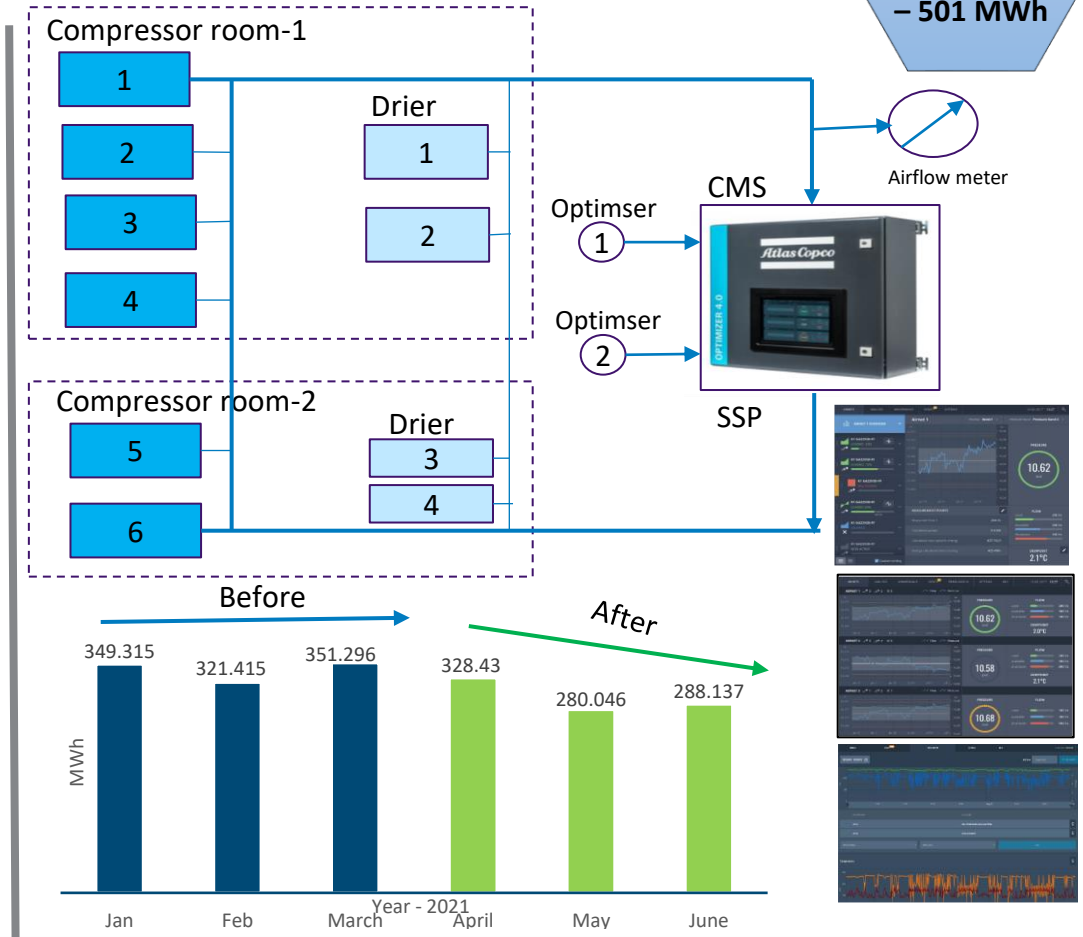
Demand based control of compressors **– 501 MWh**

**Before situation :**

- Individual compressors on VSD mode with partial load in each
- Manual sequencing of the compressor for running of hours equalization
- Manual data management system
- Uneven load distribution on compressors

**After situation :**

- All compressors & Driers are connected to CMS
- CMS receives signals from Optimizer 1&2
- CMS drives the compressors & driers on common pressure set point (SSP- single set point)
- Constant pressure at the outlet to plant is maintained
- CMS triggers standby compressors & driers in case of any trip on running equipment's




Energy Savings – 501 MWh





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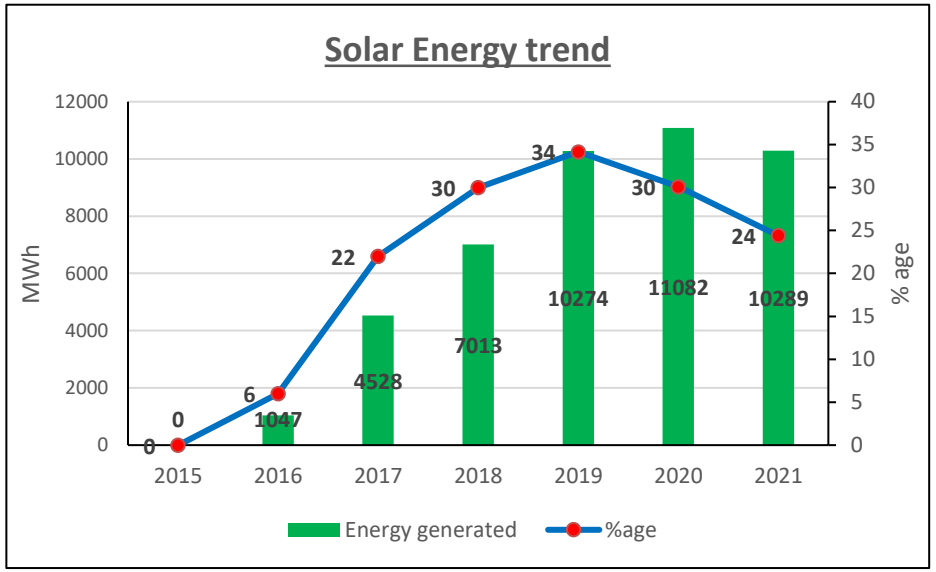
# Excellence in Energy Management 2022

## Utilization of Renewable Energy sources

| Year | Technology | Type of Energy | Onsite/Offsite | Installed Capacity (MWp) | Generation (million kWh) | % of overall electrical energy |
|---|---|---|---|---|---|---|
| **2019-20** | Electrical | Solar PV | On site | 8.7 | 11.52 | 24.98 |
| **2020-21** | Electrical | Solar PV | On site | 8.7 | 10.67 | 25.25 |
| **2021-22** | Electrical | Solar PV | On site | 8.7 | 10.13 | 23.44 |
| **Q12022** | Electrical | Solar PV | **Off site (40% share)** | 25 | 12.23 | 50.65 |

### Solar PV installation Investment's

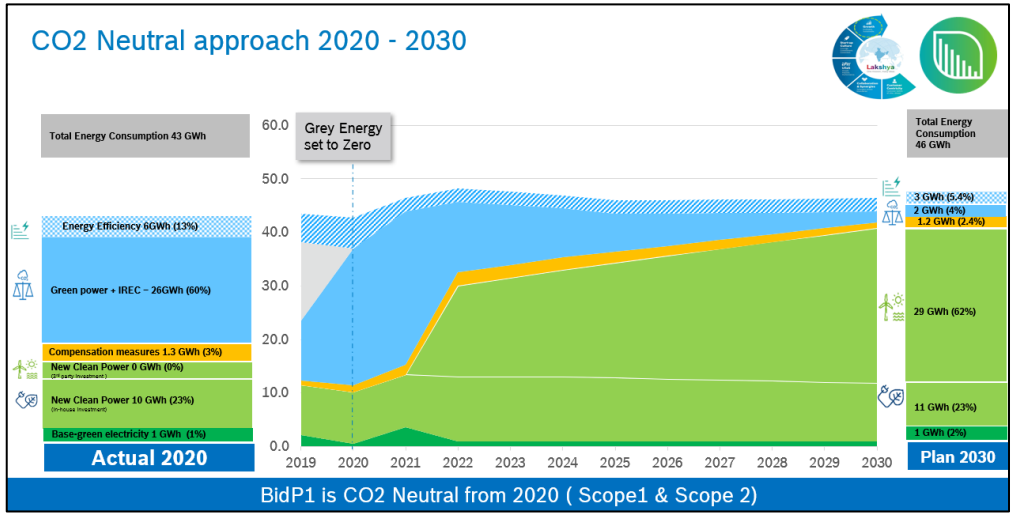
| Year of Installation | Solar PV capacity (MWp) | Investment in mINR |
|---|---|---|
| 2015 | 3.5 | 223 |
| 2016 | 1.2 | 55 |
| 2018 | 4.0 | 210 |

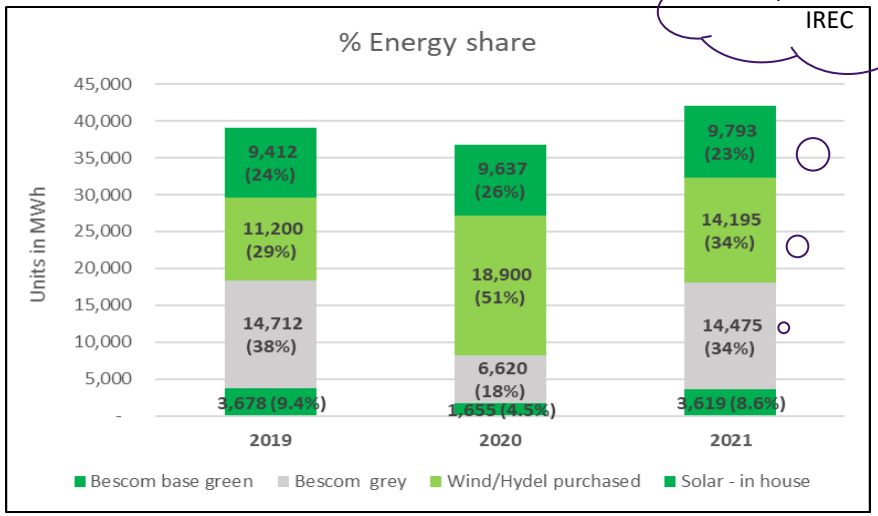



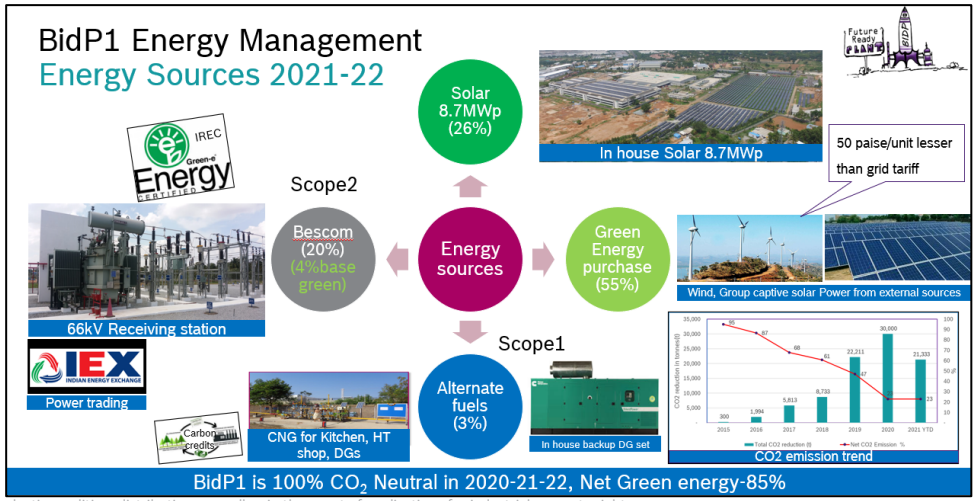
# Excellence in Energy Management 2022

## Utilization of Renewable Energy sources

Opted for DERS for cost benefit & compensated with IREC







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# Excellence in Energy Management 2022

## Waste Generation & Management system

### General Waste recovery (Metal, Paper, wood)

| Sl.No. | Year | Type of Waste | Quantity in Tons | GCV | Disposal Method |
|---|---|---|---|---|---|
| 1 | 2019-20 | Non-Hazardous recycle waste | 976 | Nil | Recycling |
| 2 | 2020-21 | Non-Hazardous recycle waste | 533 | Nil | Recycling |
| 3 | 2021-22 | Non-Hazardous recycle waste | 575 | Nil | Recycling |

### Hazardous Waste recovery (Used oil & Solvents)

| Sl.No. | Year | Type of Waste | Quantity in kl | GCV | Waste as % of total fuel |
|---|---|---|---|---|---|
| 1 | 2019-20 | Hazardous waste recovery | 74 | 6000 to 8000 | Recycling |
| 2 | 2020-21 | Hazardous waste recovery | 176 | 6000 to 8000 | Recycling |
| 3 | 2021-22 | Hazardous waste recovery | 253 | 6000 to 8000 | Recycling |

### Co-Processing & Site Assessment details

About Agency & Authorization

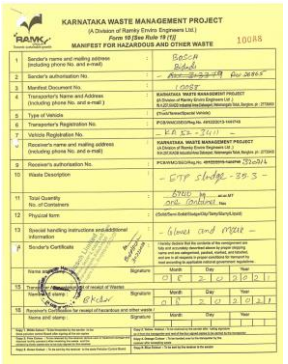
Advance Eco Resource Management
Industrial & hazardous & Other waste management.

**A**dvance **E**co **R**esource **M**anagement (AERM), is engaged in providing industrial Hazardous Waste Management Solutions. They are specialized in managing **Incinerable Hazardous waste and also Incinerable Other waste** which are specified by the KSPCB.

Here they are working under the principle of AFR (**Alternative Fuel Resource).** It's like collecting Incinerable industrial waste from different Industries and process them into Alternative fuel which shall be a substituted for **coal and other fossil fuels** in industries.

Site assessment done by Bosch team on 26.06.2022

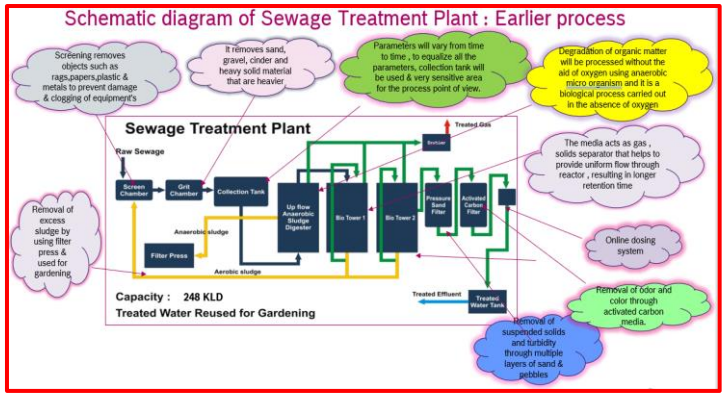
Manifest for Hazardous waste



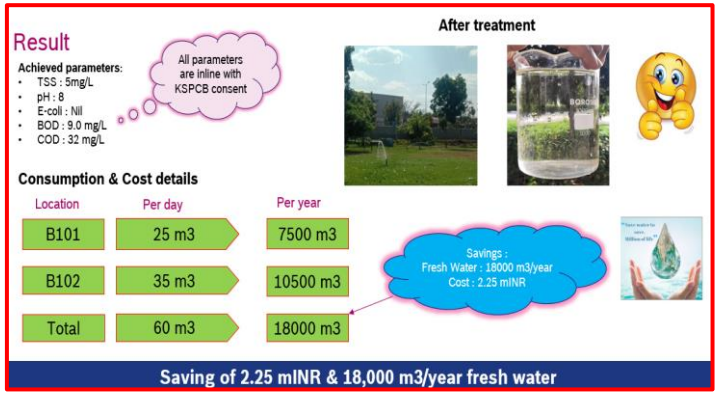
PO released to the Coprocessing Vendor

# Excellence in Energy Management 2022

## Waste Generation & Management system

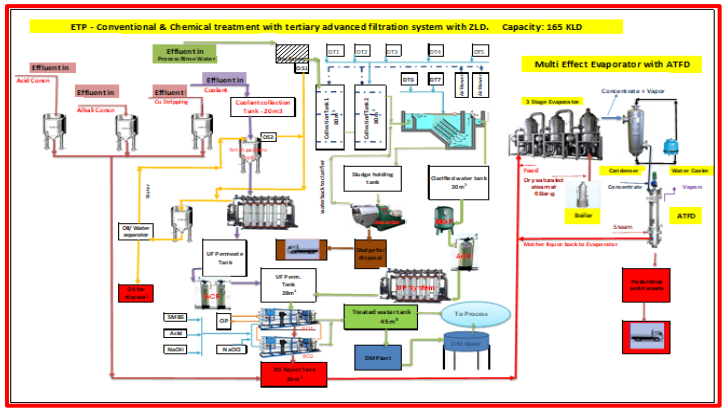



Overview of STP Process




Details of water parameter & savings


Review mechanism by management




Overview of ETP Process

Sludge processing & handling


Monitoring of ETP water quality





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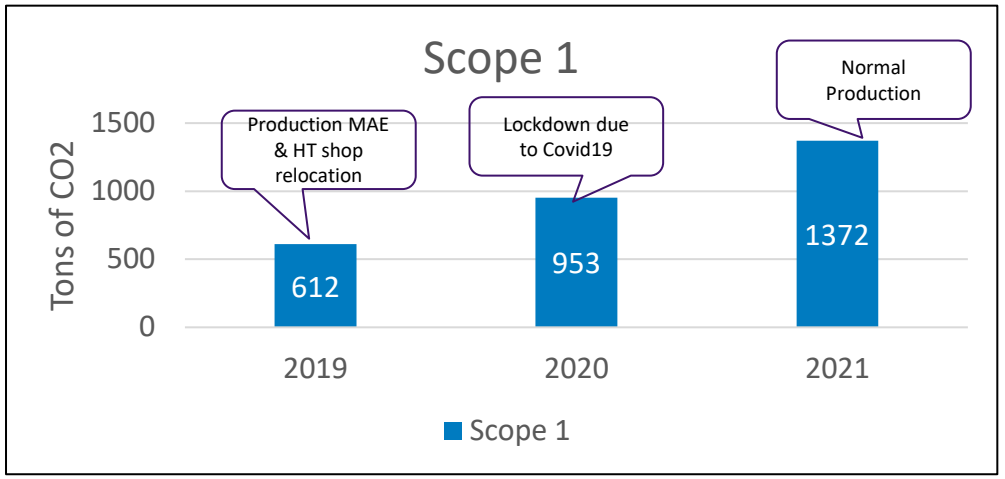
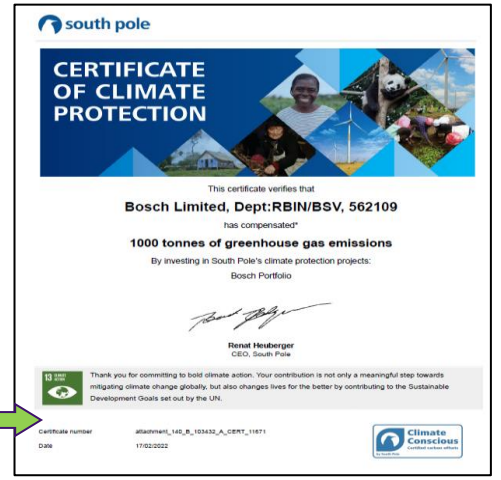
# Excellence in Energy Management 2022

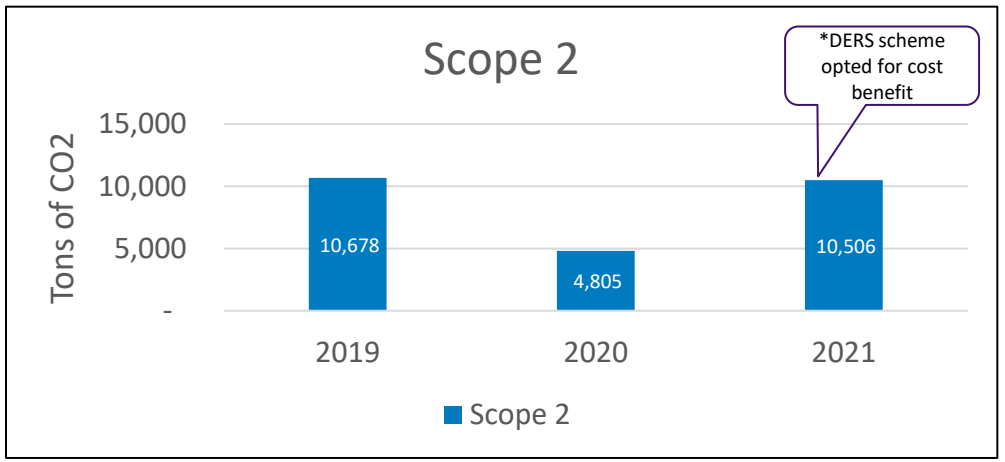
## GHG Inventorisation




**Scope 1 includes:**

- Stationary combustion:
  - Natural gas & LPG for Heat treatment process
  - Diesel for diesel generators
- Mobile combustion - Vehicles used internally
- **Compensated through Carbon Credits**

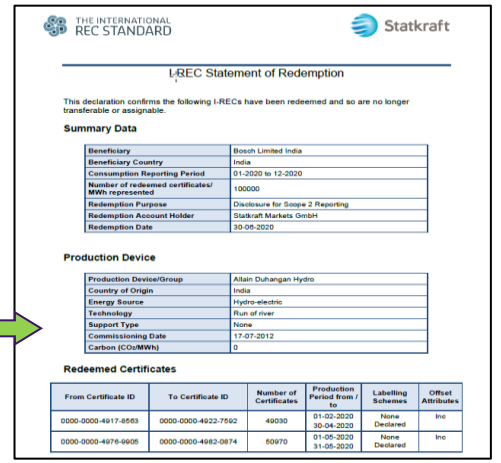



**Scope 2 includes:**

- Purchased electricity from grid
- It excludes renewable energy generated (onsite & offsite)
- **Compensated through IREC's**

* DERS : "Discounted Energy Rate Scheme" from Electricity Board





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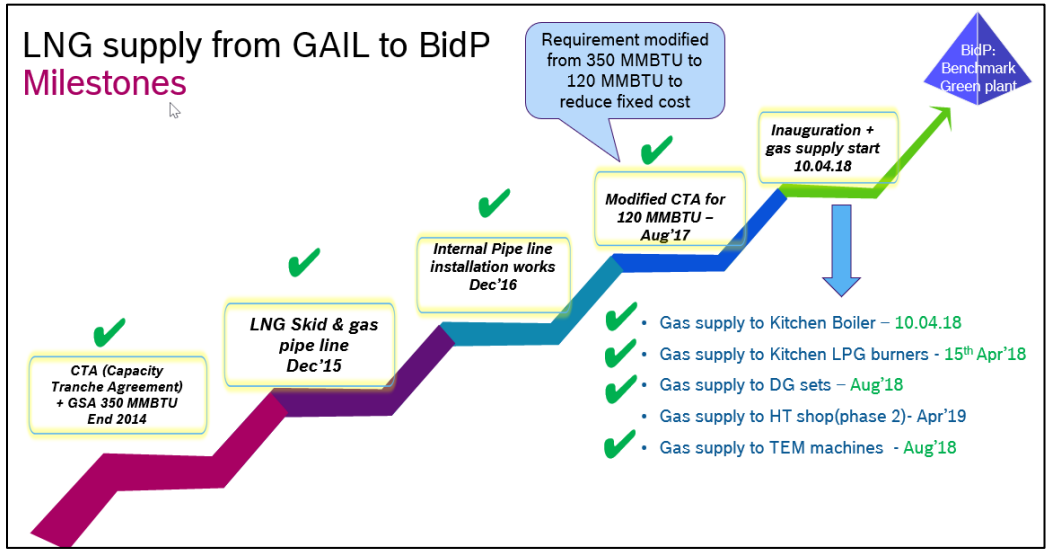
# Excellence in Energy Management 2022

## Thermal Energy: Scope2 emission reduction




### LNG supply to BidP
### Details of LNG usage and benefits

| Slno | Area | Existing fuel | Present consumption/ day | Proposed fuel | CO2 reduction tons/Yr | Cost benefit mINR/yr | Due date |
|---|---|---|---|---|---|---|---|
| 1 | Kitchen Boiler | Diesel | 300 ltrs | LNG | 150 | 0.6 | Completed |
| 2 | Other Kitchen equipments (LPG burner, chapatti m/c) | LPG | 70 Kgs | LNG | 35 | 0.3 | Completed |
| 3 | DG sets | Diesel | 50 ltrs | LNG | 25 | 0.13 | 30.08.18 |
| 4 | HT shop | LPG | 256 $m^3$ | LNG | 128 | 1.2 | 30.04.19 |
| 5 | TEM m/c | Methane | 50 $m^3$ | LNG @ 16bar | 25 | 0.13 | 30.08.18 through quads |
| | | | | **Total** | **363 tonnes/yr** | **2.36 mINR/Yr** | |

Glimpses of Infrastructure:

# Excellence in Energy Management 2022

## Supply Chain Excellence : Sustainable supply Chain - GRECO

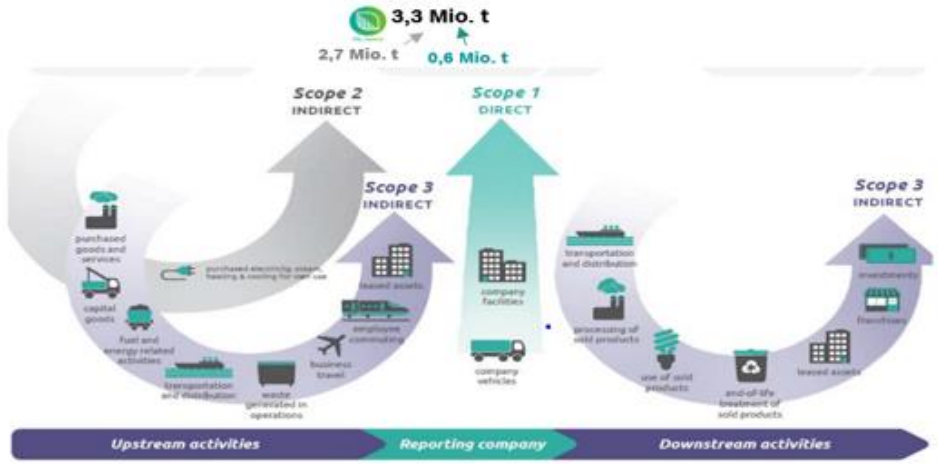
**GREEN**

**CONSCIOUS**

**SUPPLY CHAIN**

Inspired By G1 target for 15% $CO_2$ reduction by 2030

$CO_2$ – Scope 3




| Location | AIR | ROAD | SEA | Total (tCO2) |
|---|---|---|---|---|
| BidP | 12808 | 706 | 37 | 13557 |
| BanP | 8464 | 664 | 52 | 9179 |

**$CO_2$ Reduction -Region India**

**Transform –Sustainable Supply Chain – SCOPE 3 Indirect: Upstream and Down Stream**

carbon neutral





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# Excellence in Energy Management 2022

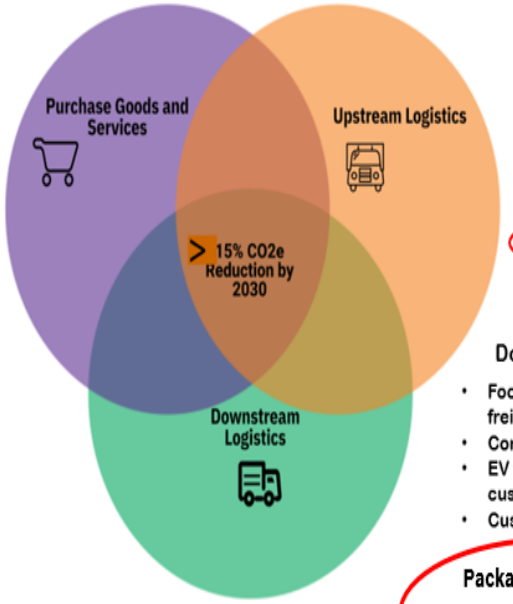
## Supply Chain Excellence : Sustainable supply Chain - GRECO

### CO2e Reduction
### Design Thinking Ideas_ Quick-Wins

Total 42 Ideas

**Purchase Goods and Services**

- Focus on sourcing policy
- Focus on TIER-1 energy guzzler suppliers (HT, ST, Foundry, Steel Plant etc.)
- Continuous engagement on CO2e best practices sharing – once in 2 sprints
- State –wise Contract demand analysis & bundle for green energy
- Business partner to compensate Carbon credit cost-in case of no reduction in CO2e
- Supplier award criteria to be developed




**Upstream Logistics**

- Focus on converting Air freight to Sea freight– Import ( > 90% CO2e reduction possible)
- Robust planning for imports
- Emission reduction thru consignment weight management
- EV for milkrun within 100kms
- ~~Intelligent Packaging Reduces Trips~~

**Downstream Logistics**

- Focus on converting Air freight to Sea freight– Export (4079 t)
- Control on domestic air freight (5022 t)
- EV for Fine Deliveries & WH to customers (approx. 100 t reduction)
- Customer pick-up from WH (17,000t)

**Packaging:**

- Returnable packaging
- Pack density

## Use EV within 100 KM. Radius (LCV/Milkrun)

**Cost benefit analysis**

**Business case**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Present condition** | | | | | | | | | Remarks |
| **M/s. AID with Diesel truck** | | | | | | | | | |
| Case1 | Origin | Destination | No of Trips/Day | Truck capacity(MT) | Fuel | Cost / Trip | Cost / month | Cost / year | |
| | BidP | M/s.AID | 2 | 2T | Diesel | 2000 | 96000 | 1152000 | |
| **Future condition** | | | | | | | | | |
| **M/s. AID with EV** | | | | | | | | | |
| Case2 | BidP | M/s. AID | 1 | 2T | Diesel | 2000 | 48000 | 576000 | First year cost will be installation of Charging point at Parking bay - 50000INR Approx. |
| | BidP | M/s.AID | 4 | 0.5 T | EV | | 39000 | 468000 | |
| | Total Savings | | | | | | 100800 INR/year | | |
| Case 3 | BidP | M/s.AID | 8 | 0.5 T | EV | | 39000 | 468000 | |
| | Total Savings | | | | | | 684000 INR/year | | |

50% Co2 reduction /year Case 2

100% Co2 reduction /year case 3





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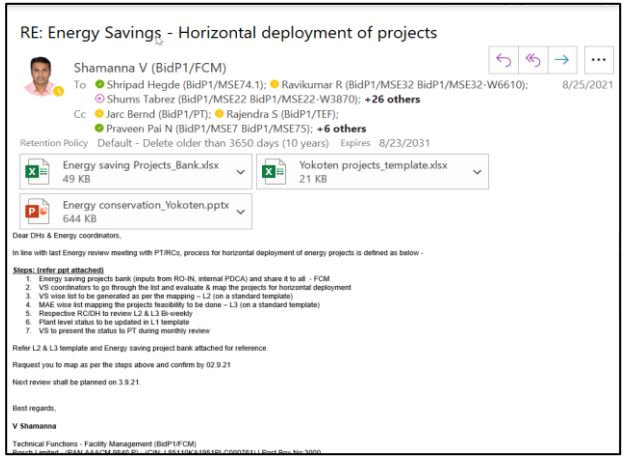
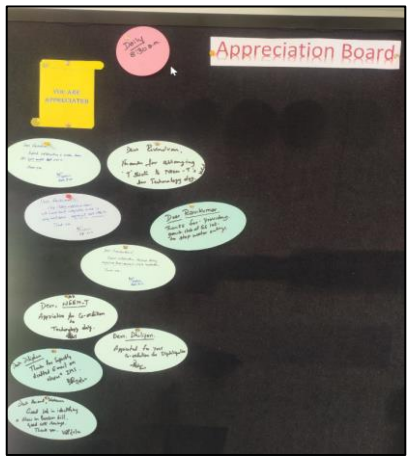
# Excellence in Energy Management 2022

## Teamwork, Employee Involvement & Monitoring


Online monitoring ( Deep Sights )




Monthly Review with PM's

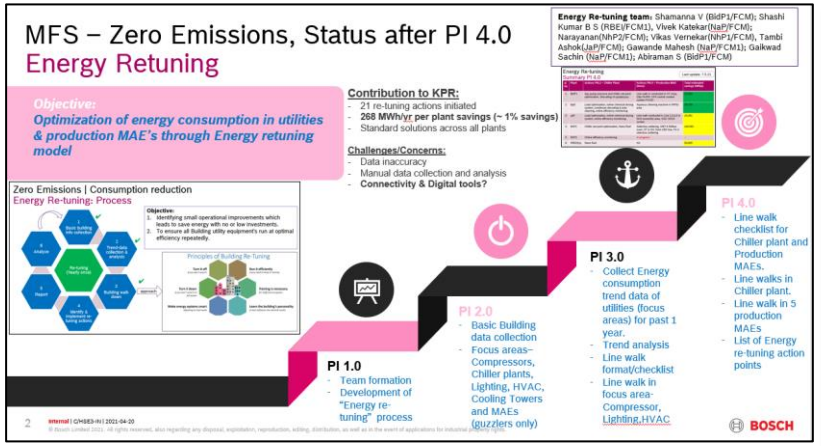



Appreciation board

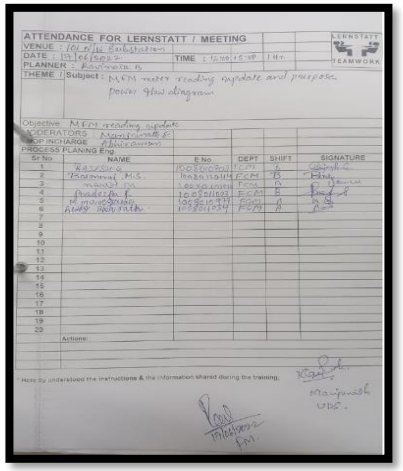
Team Learnstatt

| Projects with EEF Special Budget BP2021 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Sums | | | | Limits | |
| Release of tranche 2b (re-allocation of returned budget) | | | 7,081 | 1,334,870 | 8,232 | 1,331,211 | | > 2,6 |
| | | | | | | t/o 50% funded by EEF | | |
| ID | Site | Title | Energy saving | Capex costs | Overhead costs | Capex costs BP21 | PBP | GWh per m€ invest | Released |
| PS-BidP-21-01 | BidP | Heat recovery from Compressors | 402 | 15,854 | 732 | 15,854 | 0.5 | 25.4 | 06/2021 |
| PS-BidP-21-02 | BidP | Introduction of Solenoid valve in MAE's Air supply | 335 | 12,805 | 0 | 12,805 | 0.4 | 26.2 | 06/2021 |
| PS-BidP-21-03 | BidP | EC fan for all 101 hanger ahu's(16 no's) | 850 | 195,122 | 0 | 195,122 | 2.6 | 4.4 | 02/2021 |
| PS-BidP-21-04 | BidP | Energy efficient lighting system | 600 | 100,000 | 0 | 100,000 | 1.9 | 6.0 | 06/2021 |
| PS-BidP-21-05 | BidP | Optimization of Compressed air by intermediate controller | 280 | 8,750 | 0 | 8,750 | 0.4 | 32.0 | 06/2021 |
| | | | Total € | 332,531 | | | 6 | | |
| | | | Total 82 INR/€ | 27,267,532 | | | | | |
| | | | Turnover mINR | 19,834 | | | | | |
| | | | % Share for EEF | 0.14 | | | | | |

Separate budget for Energy Conservation – 2021 & % investment




Collaboration with RO-IN FCMs







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# Excellence in Energy Management 2022

## Awards and achievements

## International Awards: “CO2 & Energy Efficiency”


CERTIFICATE

BOSCH
Invented for life

In recognition of extraordinary achievements for environmental protection at Bosch we proudly grant the 3rd Place of the

**Bosch EHS Award 2018**
**$CO_2$ Energy Efficiency**

to
Shamanna Venkatesh
(BicP/FCM)
and his team

for the project
Approach for $CO_2$ Neutrality at BidP

Christoph Kübel
Member of the Board of Management

Torsten Kallweit
Head of HSE and Sustainability (C/HSE)

BOSCH EHS Award 2018
for $CO_2$ Energy Efficiency




Award presented by **Filiz Albrecht (G6)** in the presence of **Torsten Kallweit (C/SE HSE-Sh)** on 7th Jul, 2022 at Stuttgart, Germany

3rd Place

1st place




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# Excellence in Energy Management 2022

## Awards and achievements


CII-SR EHS Excellence Awards

State Safety Award


Manufacturing Today Conference & Awards


5th CII IQ National Safety Competition


Best Energy Efficiency Plant Award





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# Excellence in Energy Management 2022


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