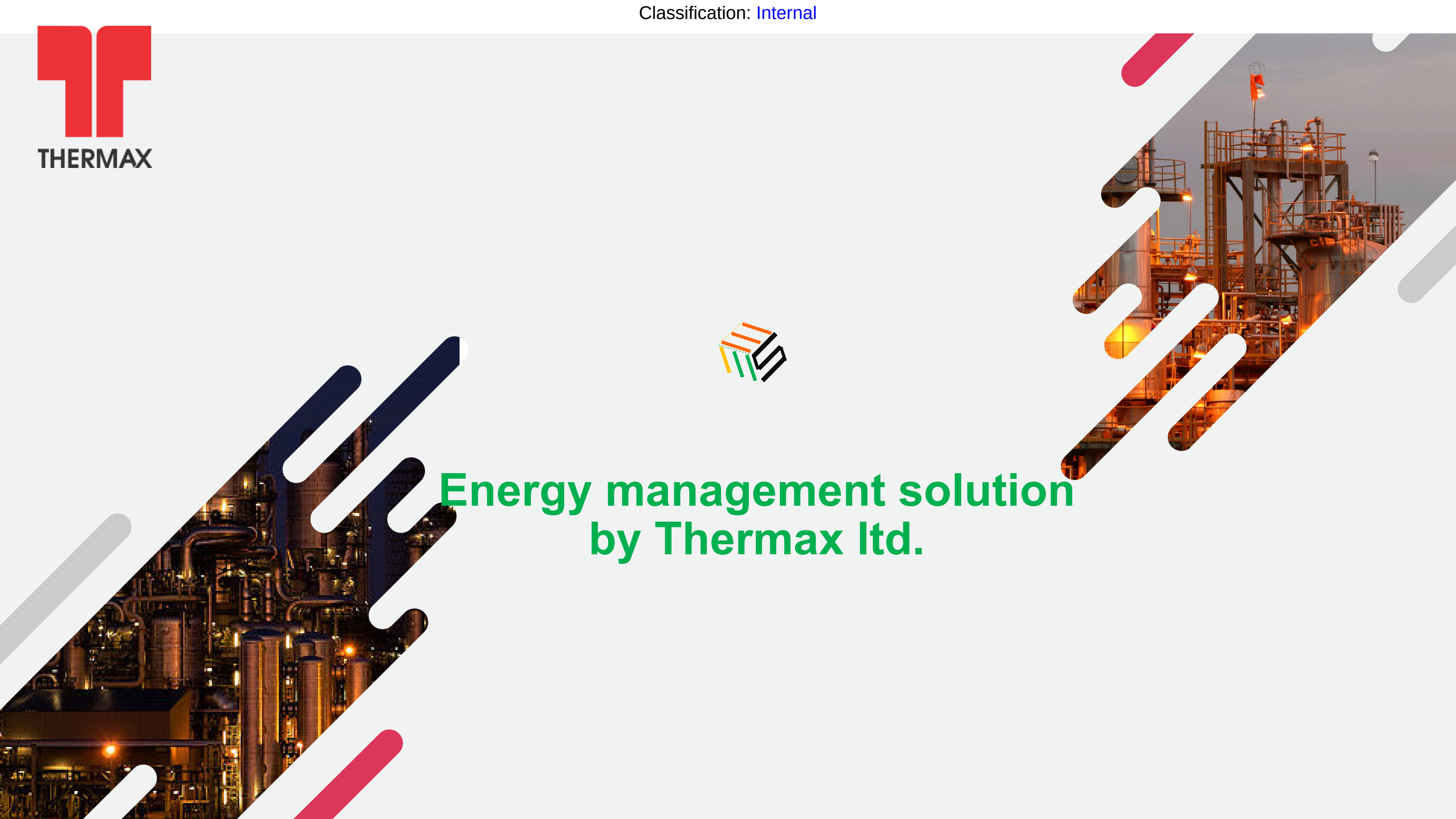




Energy management solution by Thermax Ltd.

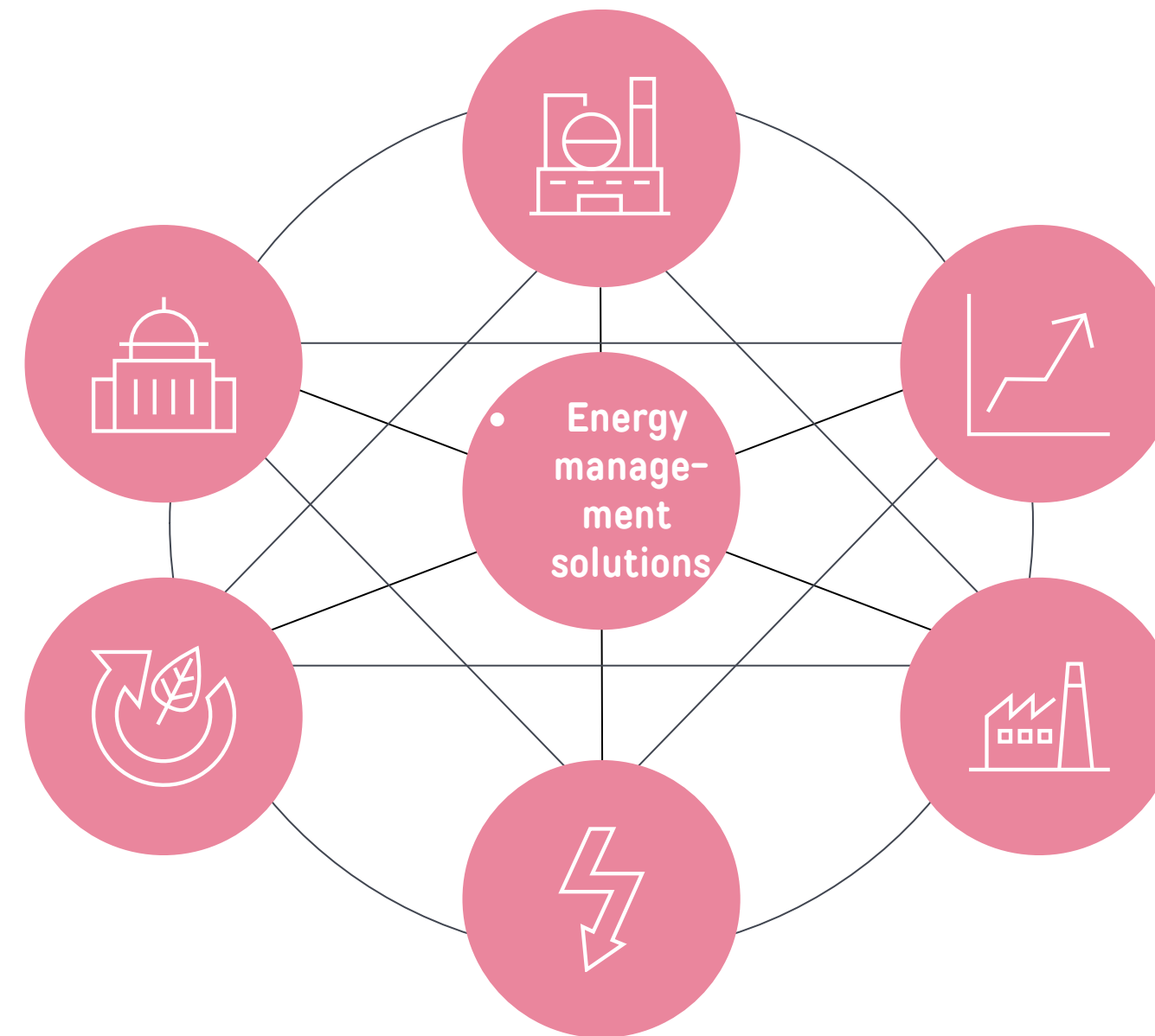


There are significant tailwinds accelerating energy efficiency as a top-team agenda in industries globally

- **Complex Set up**
- Phased plant expansion results in need for automation and load management system

- **Government Push**
- Stringent regulation and policies for reduction in specific energy consumption, emission, water consumption

- **Sustainability commitment**
- Focus on renewables energy sources for business growth and adoption of digitized solution



- **Steep rise in fuel price**
- Reduction in grid price with increase in raw material cost is putting pressure to optimize CPP power cost.

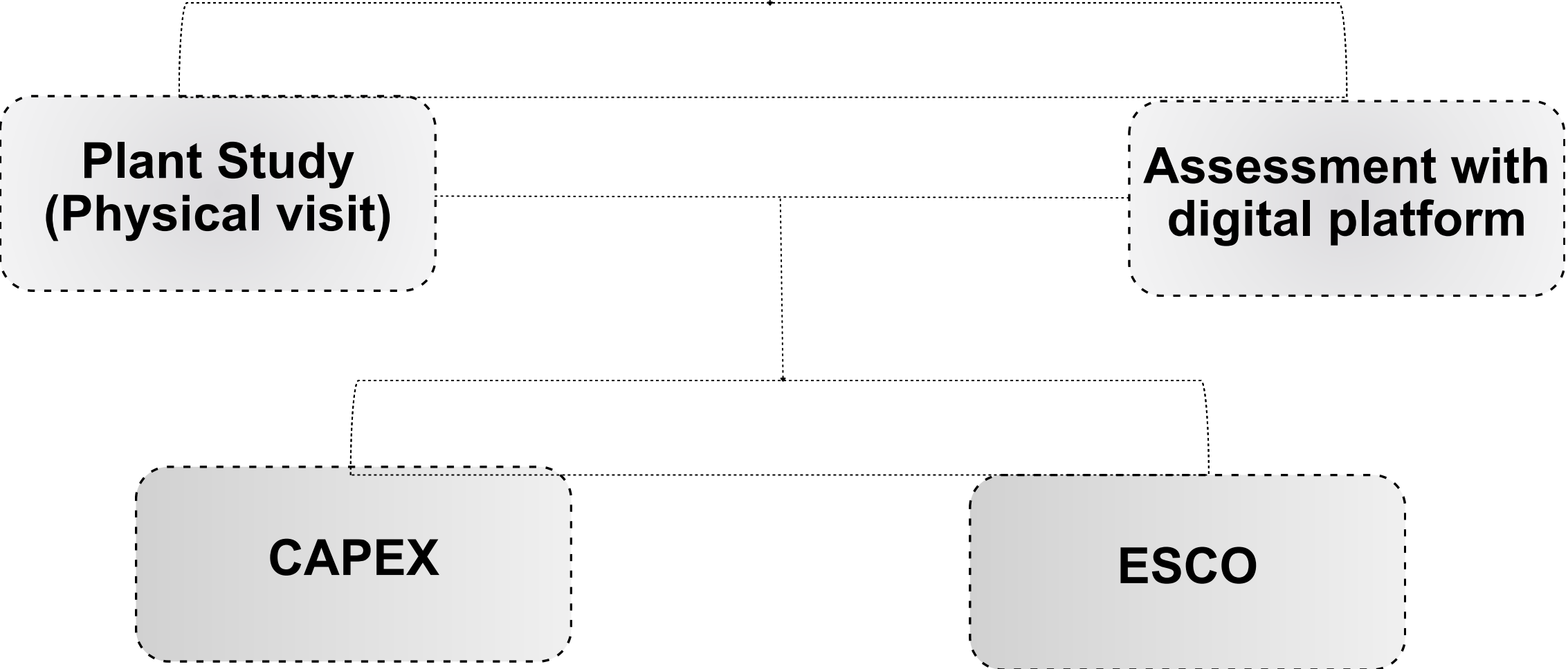
- **Part load running**
- Fluctuating market demand forces plants to run at part load condition, resulting in increase in power and utility cost.

- **De-Carbonization**
- Due to competitive market requirement corporates are focusing on de- carbonization

EMS (Energy Management Solution) Business Model



Thermax EMS Business Model

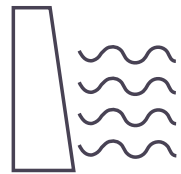


Technology Agnostic

Energy Partner - Specific Energy Consumption (SEC) Reduction by upto 10%

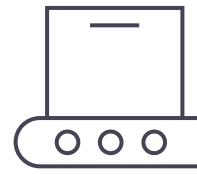
Product Agnostic

We understand all aspects of Various Industrial sector ...



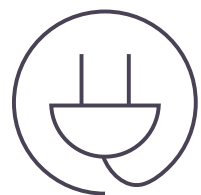
Generation Side

- Capacity enhancement of steam generators
- Optimized fuel consumption (power plant and kiln)
- Co2 emission reduction
- Integration of Solar energy with existing energy sources.



Distribution Side

- Compressed air system analysis & optimization
- Draft/Pressure drop optimization
- Electrical load Management
- Electrical System Fault Analysis to reduce nuisance tripping



Consumption Side

- Optimal utilization of alternate fuel.
- Optimized utility consumption (air & water)
- Optimization of Aux. Power Consumption.



Digital Platform

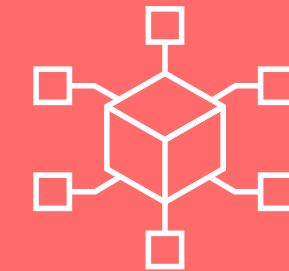
- Real time measurement and analysis through one platform

Thermax is Grade-II ESCO

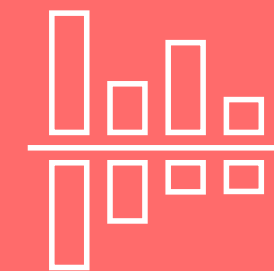
- ... and we help you deliver maximum value



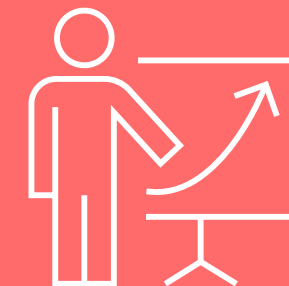
- **10% guaranteed savings**



- **Integrated solutions**

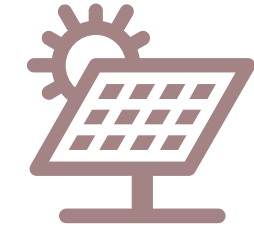
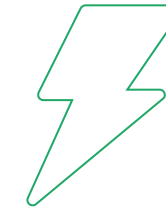
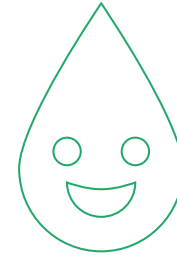
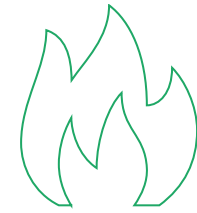


- **Flexible commercial models**



- **Strong understanding of value drivers**

Integrated End to End Solutions through Utilities Thematics



• Power

- Station Heat Rate Improvement
- Increasing Power o/p
- Fuel Cost Saving
- Maximizing on WHR.
- Turbine Upgradation.

• Process Heat

- Heat Recovery Unit
- Micro-turbine
- Fuel Shift
- Heat Pump

• Process Cooling & HVAC

- CLCT
- Evaporative Condenser
- Modernization of refrigeration plant
- Vapour Absorption Machine

• Compressed Air

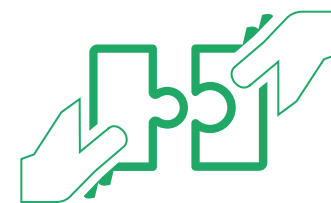
- Inlet air cooling for PAC / GT / Ring Main
- Heat Recovery Unit
- Inter stage Cooling

• Electrical System

- IE-1, IE-2 Motor Replacement
- Co-ordinated master control



Clear Baseline Establishment



Measurement & Verification

- Digital IPF

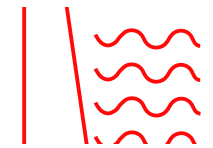
solution

Gross Heat Rate Improvisation for the Captive / Cogen. Power Plant



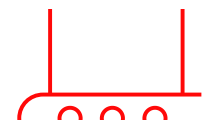
- Increasing Boiler heat transfer area
- Turbine modernization
- Fuel Shift
- Condenser modernization
- HP/LP- Heater / SCAPH Introduction
- Cinder Heat Recovery
- Heat Pump
- Aux. Power consumption reduction

Reduction In Auxiliary Power Consumption



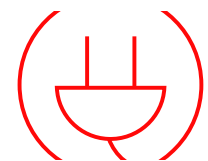
Plant Information

- Leading Cement Manufacturing Unit in Rajasthan (J K Cement Nimbada)
- 21 MW CPP & 13 MW WHR Power Projects
- Boilers, 89 TPH AFBC & 72 TPH WHR (5 Nos)



Problem Statement & Approach

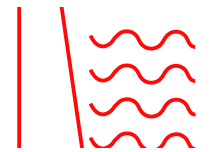
- High Auxiliary Power Consumption
- Detailed Analysis to understand Possible Levers
- Implemented levers like Control Logic Optimizations, Electrical up-gradations (VFDs) etc.



Results & Benefits

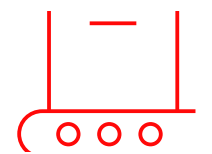
- Aux. Power Consumption reduced by 1 % in CPP & 2.2 % in WHR Power Plants
- **More than INR 100 Lacs of Savings**
- Carbon Footprint Reduction by 2500 t Co2e /year

Regenerative Heaters in Existing Power Cycle



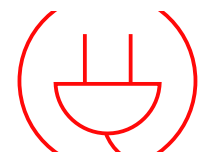
Plant Information

- Leading Color Pigment Manufacturer in Maharashtra (Sudarshan Chemical)
- 8 MW Power Plant
- 67 TPH AFBC Boiler



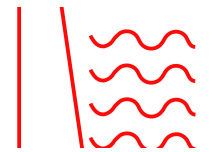
Problem Statement & Approach

- Higher Fuel Consumption
- High Heat Rates
- Installation of Heaters in Power Cycle to raise Feed Temp
- Steam availed from MP Steam from Turbine Extraction



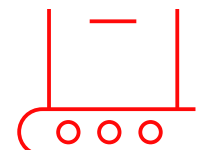
Results & Benefits

- Feed Water Temp increased from 130 Deg to 160 Deg
- Station Heat Rate Improved by 86 Kcal/KWh
- Fuel Savings by 5 to 6 TPD
- Annual Cost Saving of **65 Lacs**



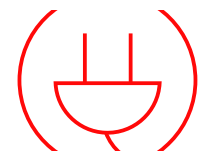
Plant Information

- Leading Cement Manufacturer in Karnataka (J K Cement Muddapur)
- 2 X 25 MW Captive Power Plant
- 2 X 110 TPH AFBC Boiler



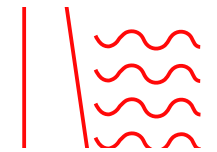
Problem Statement & Approach

- High Loss of Ignition (LOI)
- Restricted use of Ash in Cement plant due to higher LOI
- Lower Boiler Efficiency & Higher Specific Fuel Consumption
- Changes in Fuel Properties Leading LOI issues
- Problem Identified As Insufficient Burning Of Fuel In Upper Part of Boiler
- Design & Supply of Cinder Recovery System (Re-firing of Ash in Boiler)



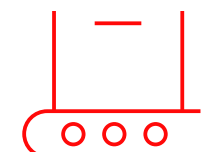
Results & Benefits

- LOI of Boiler reduced from 15 -17 % to 6 - 8 %
- Boiler efficiency was improved by 0.5%
- Heat rate reduced by **45-50 kcal/kwh**
- Fuel saving of approximate 2250 tons/year.
- Overall fuel saving resulted in reduction of Carbon Foot print by 7321 tCO₂e/year.



Plant Information

- Leading Cement Manufacturer in AP (TRCL MCL 2 - Jayantipuram)
- 2 X 18, 1X 6 Captive Power Plant and 3X 9MW WHRB Power Plant
- 2 X 76 TPH AFBC Boiler, 3X 12 TPH WHRB Boiler



Problem Statement & Approach

- No load sharing between machines.
- Unwarranted Plant Blackouts.
- Fixed Load Shedding (Non availability of frequency based and Load based Load shedding)
- Underutilization of Power Generation Capacity.



Results & Benefits

- Reduced plant reserved capacity, increasing reliability & effective capacity, economic operation.
- Reduced Capital costs and Reduced Operating costs.
- To reduce non-essential load , safe guard op of Plant.
- Reduction in Operating cost due to unwarranted tripping's/ blackouts, Reduced Operating Costs.

- **Increasing Boiler / TFH / HWG heat transfer area**
- **Condensing Economiser in Liquid & Gases fuel retrofits**
- **Fuel Shift**
- **Heat Pump**
- **Micro Turbine against PRV station**
- **Converting indirect heating applications on heat recovery HW as much as possible.**

- **EVC based condensing solutions**
- **VAM vs Electrical Chiller feasibility**
- **Chiller / Chiller Heater / Chiller Heat Pump / Heat Pump feasibility**
- **Hybrid Chiller instead of std. electrical chiller**
- **Debottlenecking with VAM in IAC, PAC, Syn Gas and CO2 compressor inlet mass cooling**
- **CLCT applicability as against std. chiller application**

- Ring-main system
- Heat Recovery between interstage compression
- Oil heat recovery
- Centralisation vs decentralisation feasibility
- IAC system in bigger capacity units

UNIQUE APPLICATION BASED SOLUTIONS

CLCT (CLOSE LOOP COOLING TOWER) in Series with Chiller Unit.



Application

- Packaging film chilled roll application
- Aluminium Foil Caster application

Plant Information

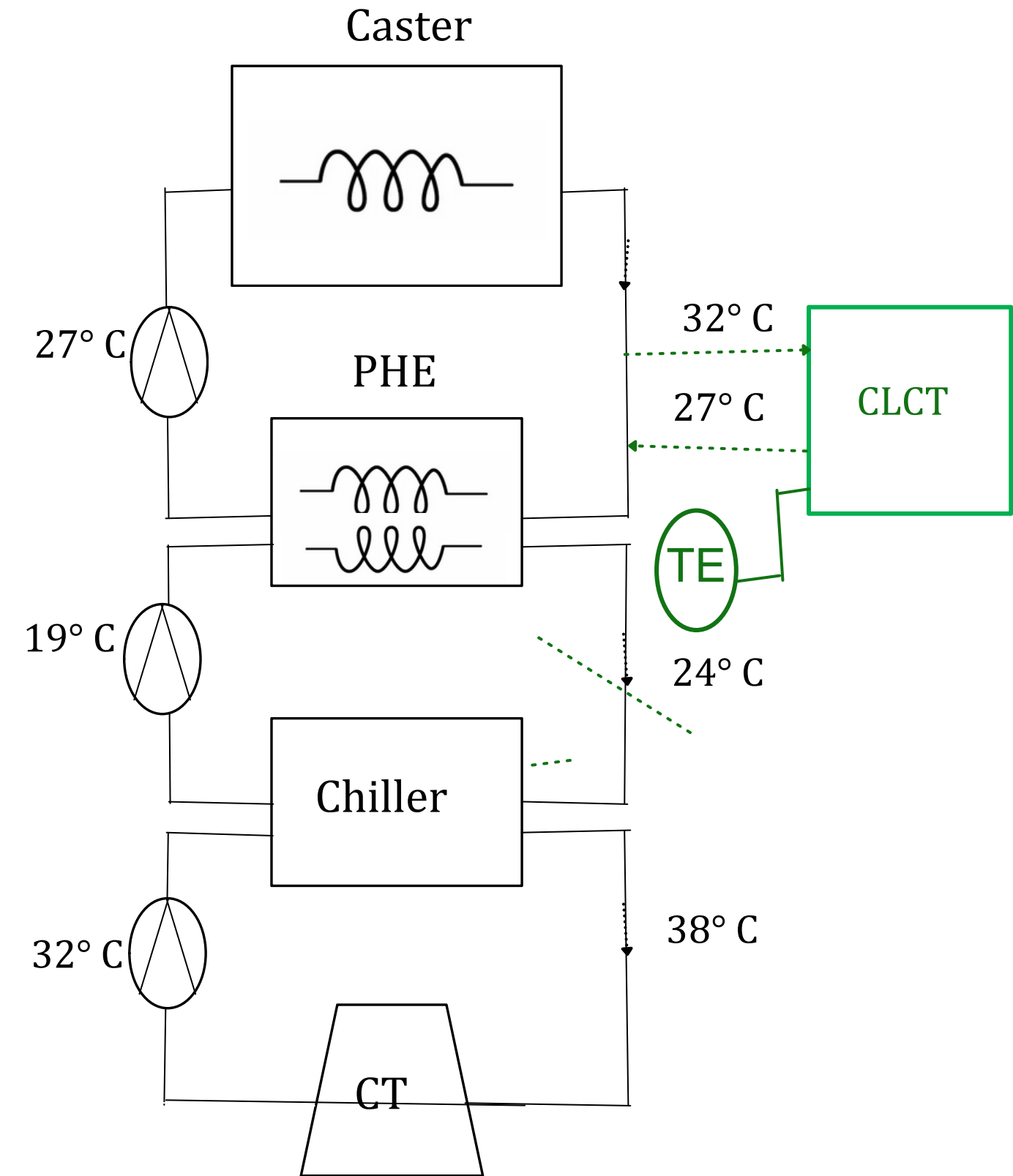
- Downstream Plant
- Electric Chiller of 300 TR of 2 Nos. used for CASTER Application

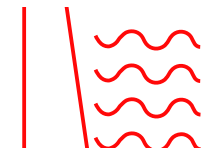
Problem Statement & Approach

- Electric Chiller used for cooling application
- Introduction of CLCT in series with electric chiller.

Results & Benefits

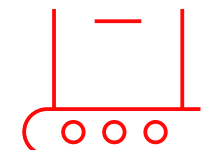
- Saving of **Rs.48 Lac /Yr**
- CO₂ Reduction will be 800 Tonnes/Yr





Plant Information

- Leading O & G Plant
- Utilization of natural gas for meeting power & steam demand
- 12 MW X 5 Nos. of Steam Turbine



Problem Statement & Approach

- Self Power Cost of Rs.10/unit against available grid cost of Rs. 7/unit.
- Out of 5 Blower, 2 will be running with SCAPH
- Introduction of Micro turbine for process waste heat conversion to power.

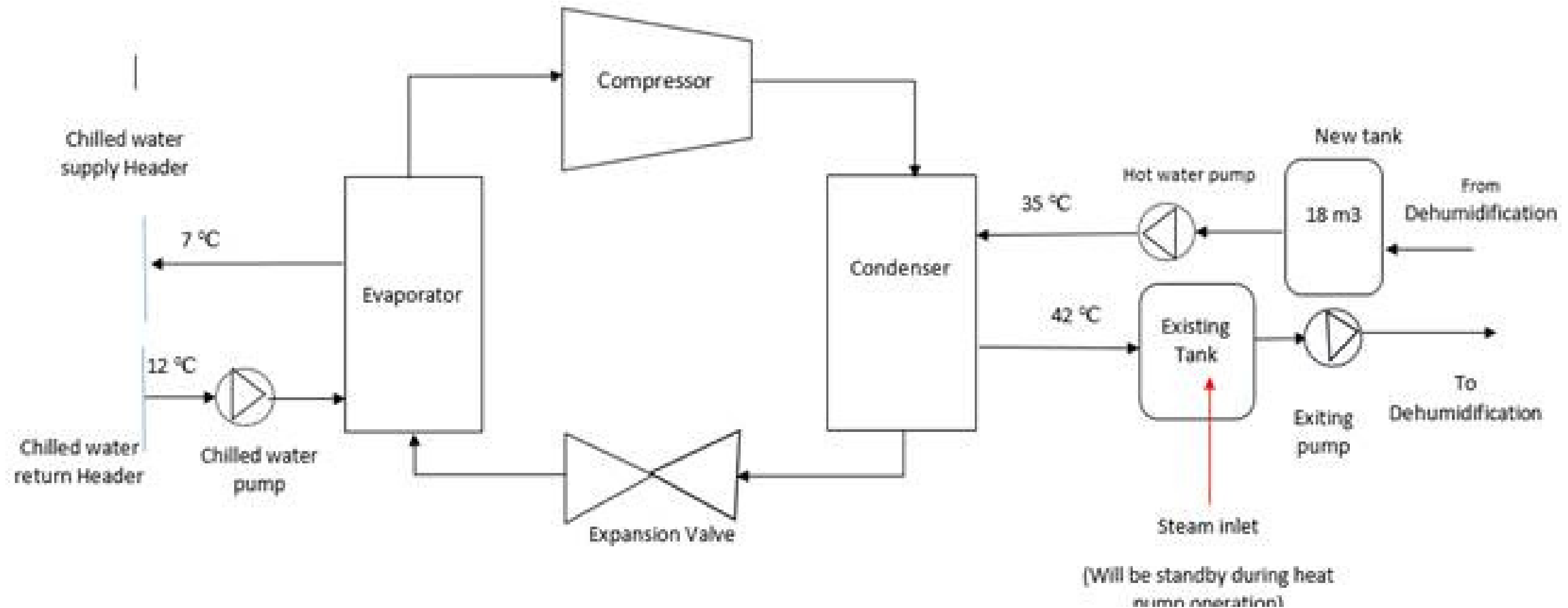


Results & Benefits

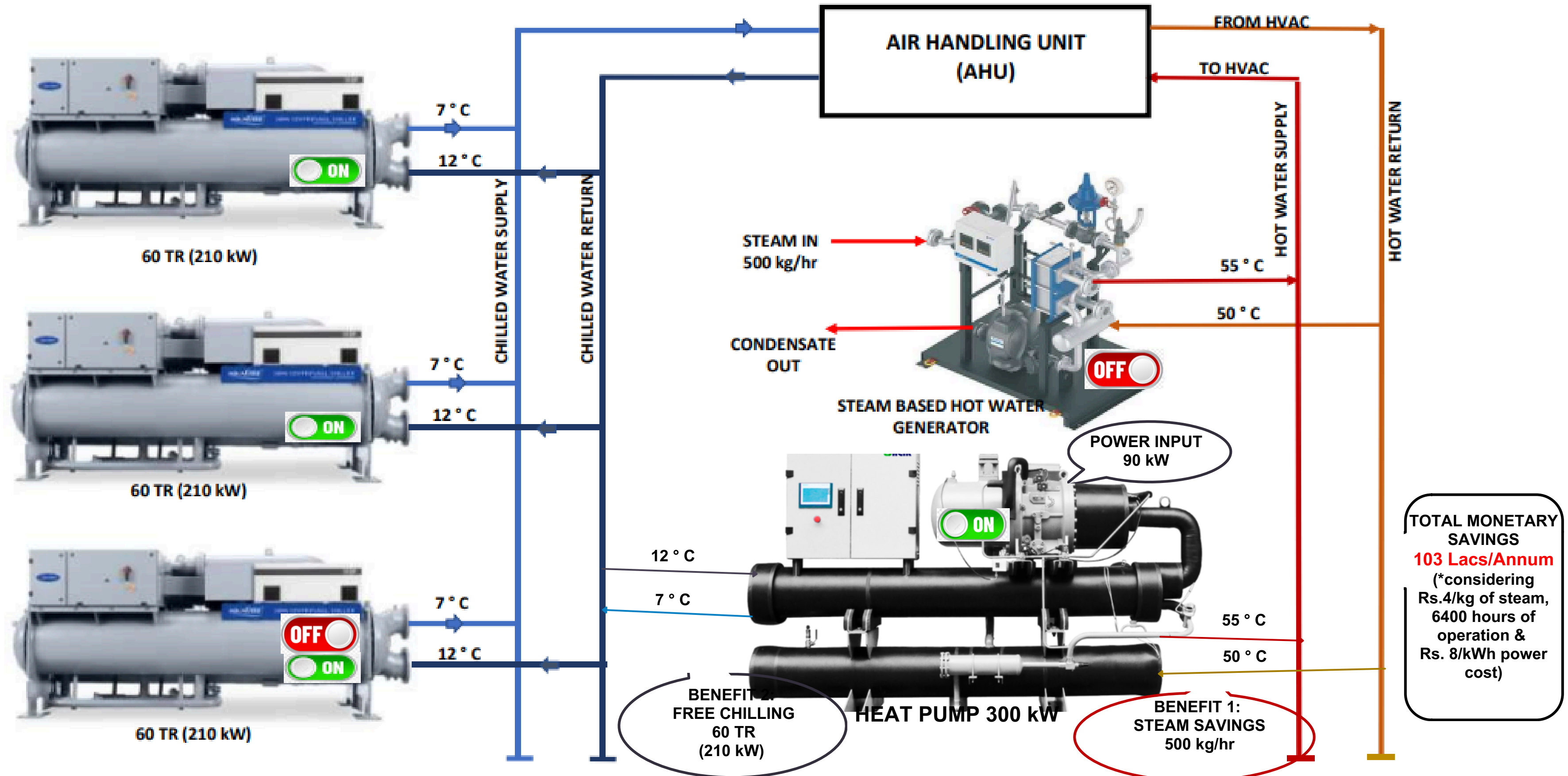
- Saving of **Rs.12 Cr/Yr**
- CO₂ Reduction will be 7000 Tonnes/Yr

Heat Pump in Pharma & Integrated Pulp Paper Industry

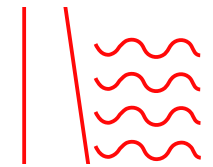
- De-humidification of air
- Boiler feed water heating
- Industrial process where lower than 90°C temperature to be maintained.



Heat Pump Installation Hook-up Overview with Existing System

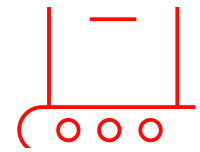


Heat Pump (Pharma Major)



Plant Information

- Pharma Industry
- Chilling of 1000 TR used for dehumidification application of 600 KW (35°C - 42°C).



Problem Statement & Approach

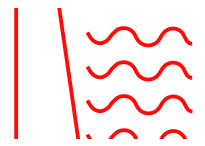
- Use of costly steam (Rs.5.65/Kg) for dehumidification.
- 800 KW electric air cooled heat pump with 130 TR free chilling



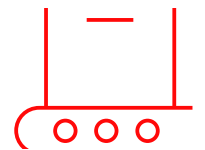
Results & Benefits

- Saving of Rs. **2Cr /Yr**
- CO₂ Reduction will be 1800 Tonnes/Yr

Motor Replacement – Any Industry

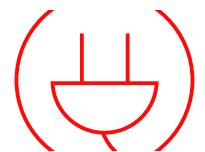


Plant Information ○ Any Industry



Problem Statement & Approach

- Converting IE-1 , IE-2 motor efficiency to IE-5
- Motor running more than 15 hrs
- Electricity cost is equal or more than Rs.8/unit
- Non-flameproof



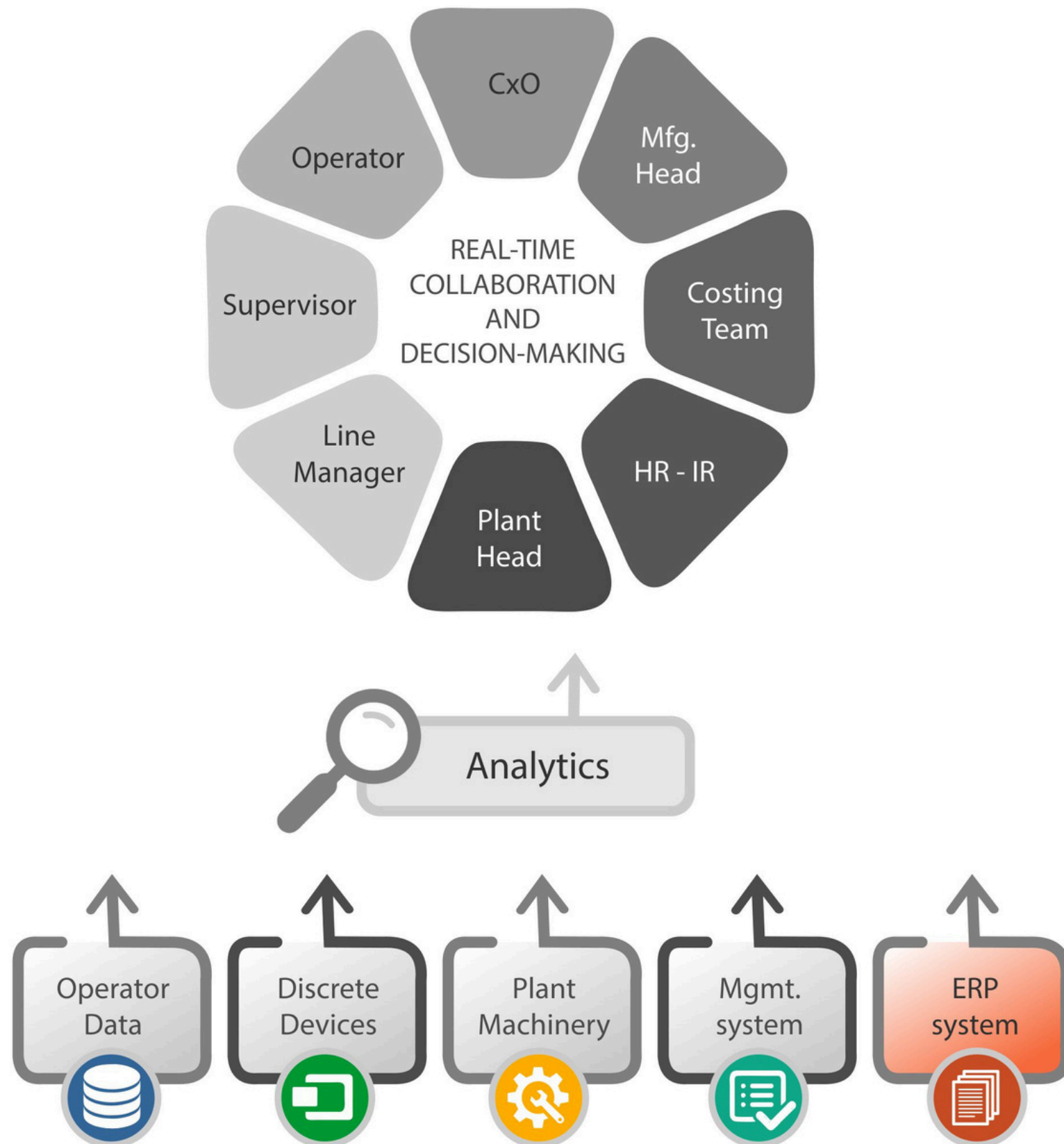
Results & Benefits

- Saving of **Rs.30 Lacs/Yr**
- CO₂ Reduction will be 270Tonnes/Yr

Savings Sharing by Thermax & Client



Real Time Data Acquisition Sources



Operator Data

- Batch Entries
- Manual stoppages
- Process variables



Discrete Devices

Meters, VFD, PID, Sensors

- Power consumption
- Chemical consumption
 - Consumables



Plant Machinery

PLC / DCS / SCADA

- Technical downtime
- Run-time and cycle time
- Process parameters
- Machine performance



Management system

- BOn-line QA check
- Grade realization
- Energy systems



ERP system

- Planning Data
- Production
- WIP inventory
- Conversion Cost

Digital IPF solution



Existing Utility

Process OEE

IPF provides end-to-end integrated solution

REAL TIME DATA ACQUISITION

Covacsis' LIU eliminates the need of Historian, automation homogeneity and PLC as an essential data source.

- First company after Kepware & Metricon to have readymade software library of drivers
- Covacsis has indigenous library of more than '100' drivers covering more than 97% of Industrial control systems
- Covacsis data acquisition capabilities covers non-standard controllers and protocols
- Semi-automated & Analogue signal capability to capture data from
- 100% drivers are plug & play
- Less than 2 hours to acquire data from a machine
- Sector and machine agnostic

REAL TIME ANALYTICS

Operational and Financial analytical dashboard providing key performance indicators of factories across value streams, assets, operations, products in **real time**.

- Industry wise **pre-boxed analysis** & KPI readily available
- Most comprehensive plug & play KPI & analysis around Productivity, Quality and Cost
- **Less than 5 mins** to configure a new KPI
- Real time batch performance/WIP
- Exception driven management
- Sector and machine agnostic
- Notification and Alerts
- On demand and scheduled reports

AI & ML

Manufacturing algorithms for **Factory Operation management in real time and predictive**, quality, cost of assets, processes in factories.

- **Chemical**
 - Golden batch modeling and predictive analytics
 - Yield forecasting
 - Rolled throughput yield
- **Metal**
 - Caster Quality Prediction
 - SSA & Slide Prediction
 - Furnace Efficiency Prediction
- **Cement**
 - Kiln Efficiency prediction
 - Kiln breakdown Forecasting
 - Coal Mix Optimizer
- **Textile**
 - CS2 recovery
 - Shade variation prediction
 - Specific energy consumption forecasting
 - Boiler demand forecast

Key Deliverables or KPIs

Productivity

- Asset utilisation
- OEE (All six major losses of TPM)
- Performance
- TAT
- Yield
- Batch Cycle Time
- Quality Index
- Downtime analysis

Batch Genealogy & Tracking

- Batch trace and tracking
- Batch performance at every operation/machine
- Batch cost
- Batch Quality

Plant Reliability

- Asset wise
- MTBF & MTTR
- Reason wise
 - Breakdown cost
- Tool life analysis
- Sensor
 - calibration tracking and notification

Process Capabilities

- Process control
- Cp, Cpk computation
- Six Sigma analysis
- Cost impact of process deviation
- Multiple parameters comparison
- Dependencies amongst parameters

Golden Batch Analysis

- Real time graphical analysis of current batch performance against the golden batch
- Comparison of all historical batches against golden batch

Benchmarking

- Dynamic computation of LCL/UCL for any process parameter or KPIs
- Computation of standards like TAT, Cycle time, Consumption etc.

Conversion Cost

- Specific energy consumption
- Specific utilities consumption
- Relative utilities consumptions by machines, Batches, shifts, plants etc.
- Excessive WIP tracking
- Cost impact due to downtime, scrap, deviations etc.

Manufacturing Yield Improvisation at Chemical Plant - Dahej



Thermax chemical plant was using two VAM of 300 TR installed capacity, catering the process cooling with its 7Deg.C chilled water.

Intervention proposed by (EMS) revealed VAM is running at part load i.e 105 TR. and shifting the cooling load to Electrical chillers would be more economical.

Also to gain cooling efficacy with positive head, entire chilled water system was installed on 5th floor and cooling towers system on Terrace. The CHW outlet is designed for 5Deg.C instead of 7Deg.C VAM design parameter.

New electrical chiller System has been in operation since Sept 2022. Initial analytics basis on observations on saving calculations for electric screw chiller system can be seen below.

	Sept	Oct	Nov
Total Operational Benefits (INR)	₹ 7,80,355	₹ 11,80,764	₹ 11,79,166
Non Tangible Benefits	2. Reduction in CSA addition phase of R5201 reactor in Anion stream by 5.6 Hrs as against avg. cycle time 3. Potential exists for further cycle time reduction if we can reduce the chilled water outlet temp. below current design temp. of 5Deg.C This approach of further reduced CHW we are working for Paud plant.		

Month	Avg Hrs	Hrs
May-22	25	19.6
Jun-22	18	
Jul-22	20	
Aug-22	15.5	14.0
Sep-22	14.5	
Oct-22	13.75	
Nov-22	13.8	
Average reduction in CSA addition phase		5.6

	CPF in tCO2e/Year
Estimated contribution due to VAM operation	1033.4
Estimated contribution due to Electric Chiller operation	896.8
	136.6

Thank You!
(9810019236)

Sachin.d.mane@thermaxglobal.com

