22ND NATIONAL AWARD FOR EXCELLENCE IN ENERGY MANAGEMENT

HYUNDAI MOTOR INDIA

Energy Team,
Production Division

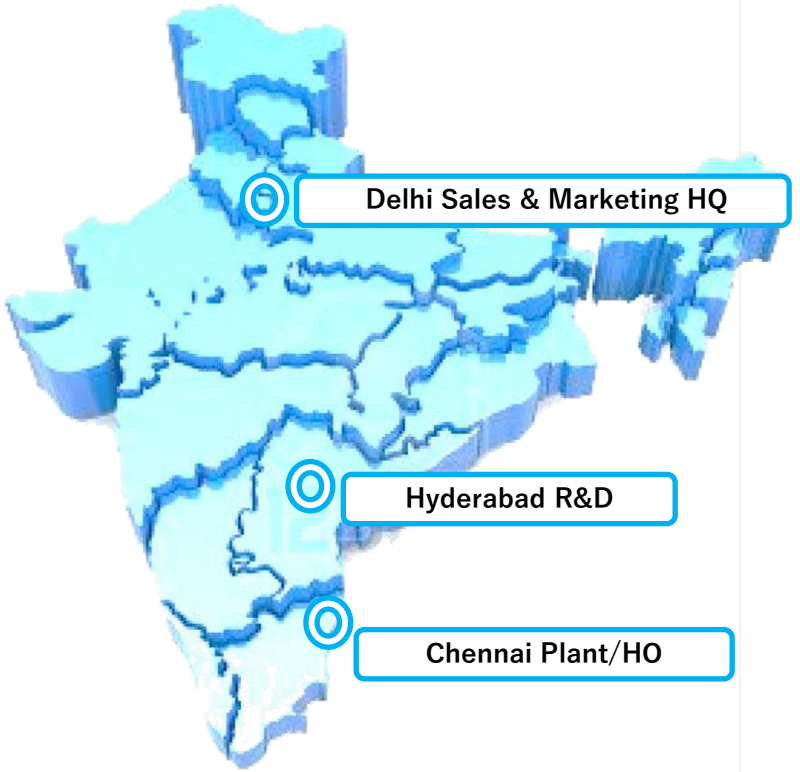
Balamurugan (Head)
Selvanathan (CEA)

About Hyundai Motor India

Foundation	6th May '96 (**Mass Production Sep '98)**
Plant/HO Location	Chennai, Tamil Nadu
Contracted demand	48,000 KW
Consumption	81,500 TOE/Year
Renewable energy	84%
Capacity	**750,000 cars/Year**
Production Model (12)	P1 (7): Elite i20, Active, Creta, Elantra, Tucson, Venue, Kona P2 (5): Santro, Grand i10, Verna , Xcent ,Grand i10 NIOS
Co-company	- 152 Vendors (Korean-43, Indian-109)
Plant operation	8.5 + 8.5 + 7 Hrs. (3 shift operation)

CELEBRATING 25 YEARS OF EXCELLENCE

CERTIFIED ISO 50001 CERTIFIED



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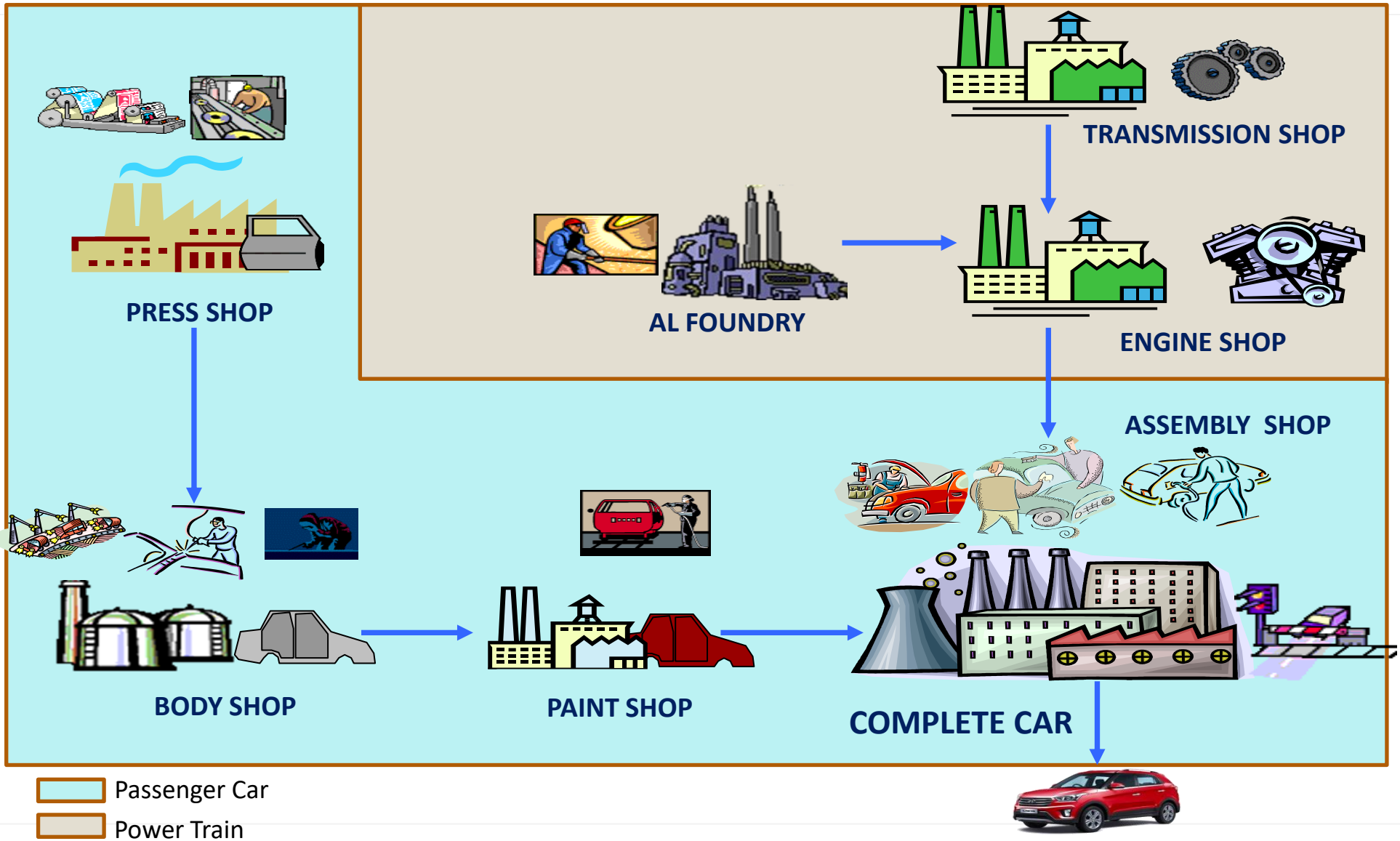
Process Flow



Company Layout

Energy Policy

Energy Policy

Date: 06-12-2018 Revision No.: 03

Hyundai Motor India Ltd (HMIL), a world class Passenger car manufacturer, firmly believes that Energy Management system is an integral part of its success and growth.

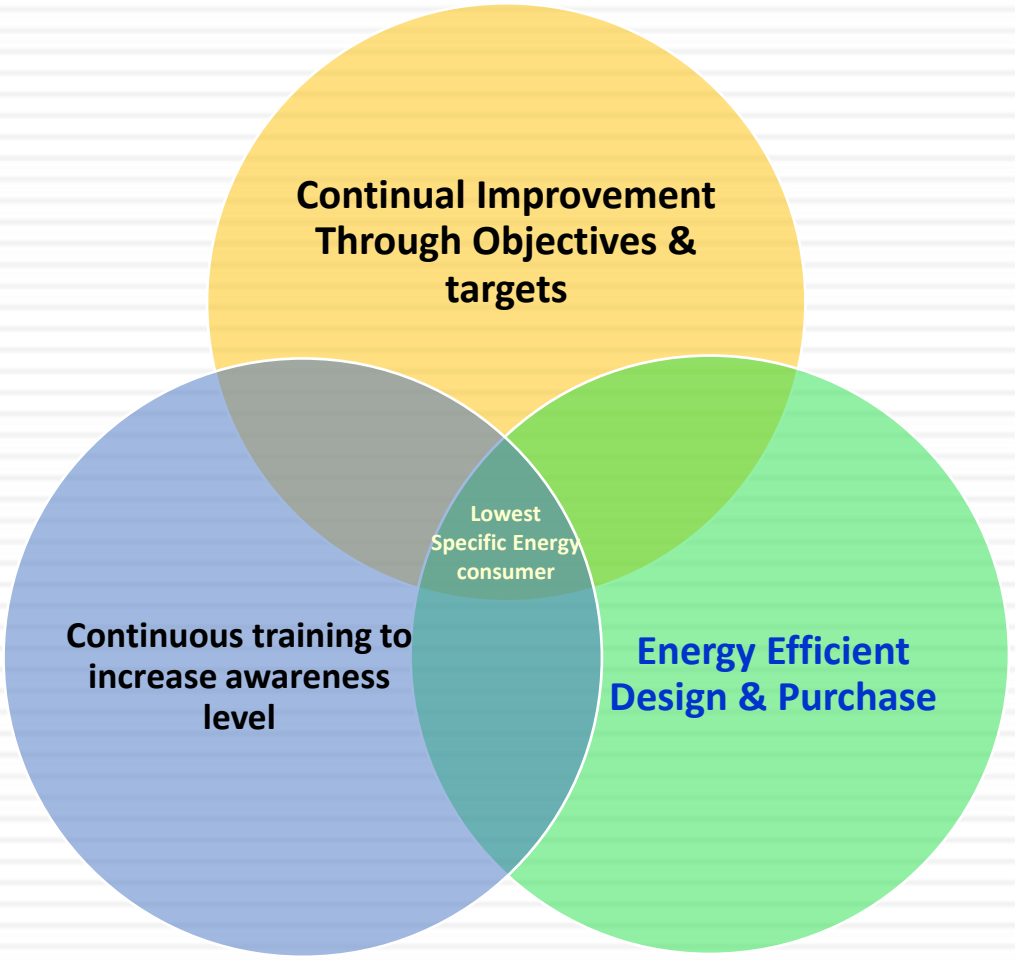
Hyundai Motor India Ltd is committed to reduce specific energy consumption through continual improvement and energy conservation measures.

To fulfil this, HMIL management shall ensure,

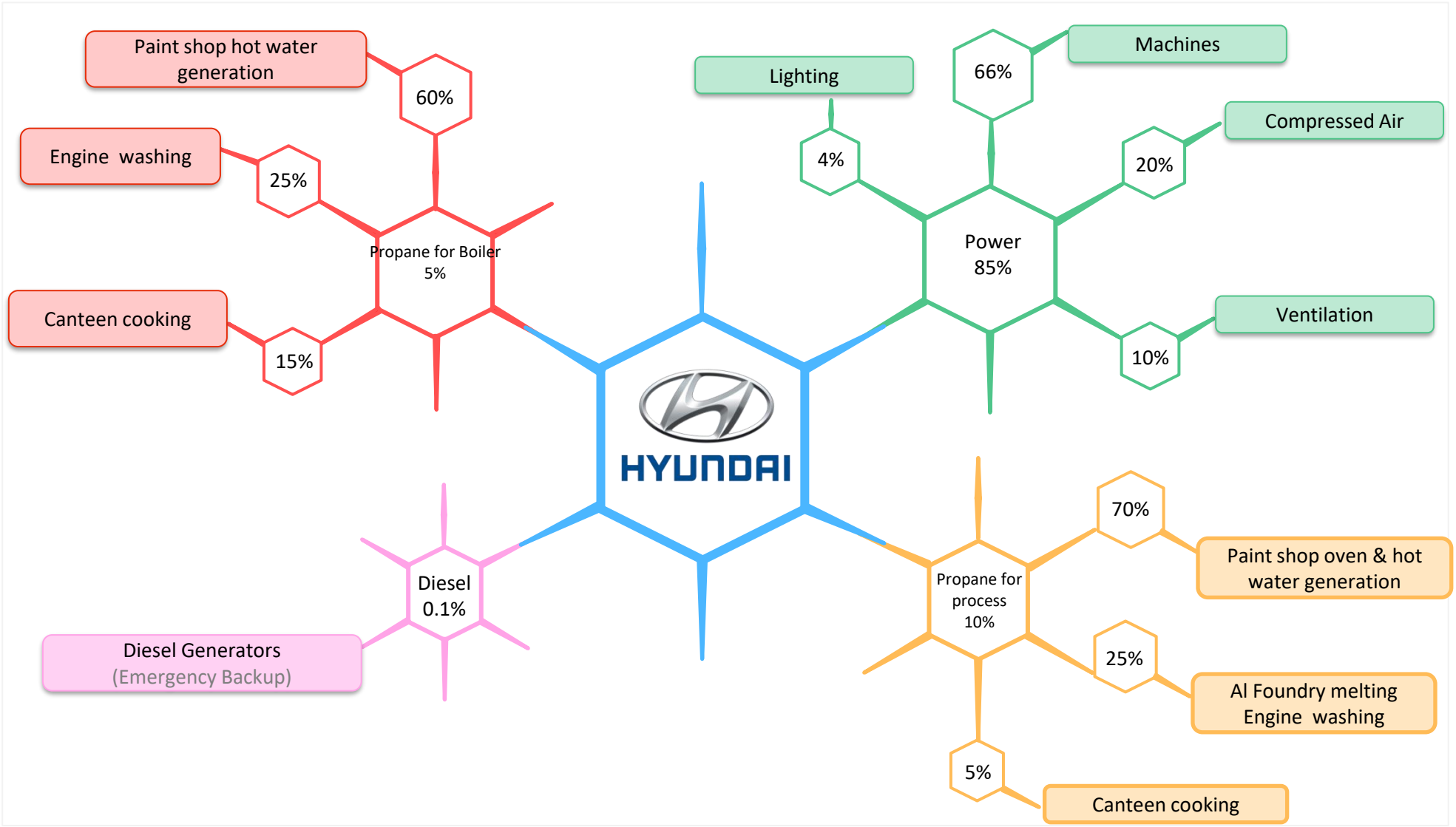
- Continual improvement through conservation of natural resources, optimization of processes and minimising energy wastages by setting goals and targets to improve Energy performance.
- Systematic framework provision for setting & reviewing energy objectives & targets.
- All essential information and resources available to achieve objectives and targets.
- Comply with all applicable legislations and other requirements identified within the scope of Energy Management system.
- Techno-commercial design and purchase of Energy, Energy Efficient products & Services to ensure carbon foot print reduction.
- Continuous training to enhance energy conservation awareness among all employees, and suppliers

S S KIM

Managing Director

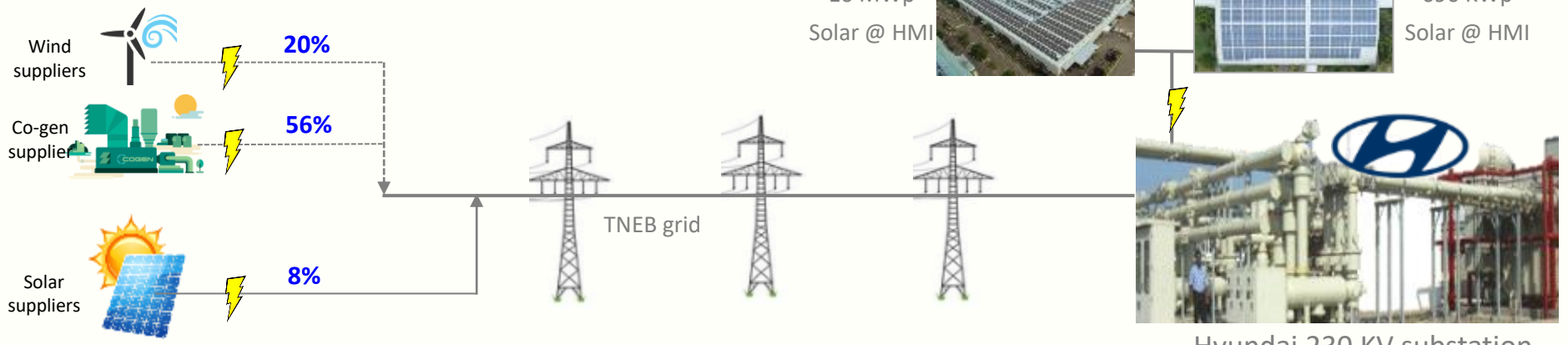


Energy consumption overview

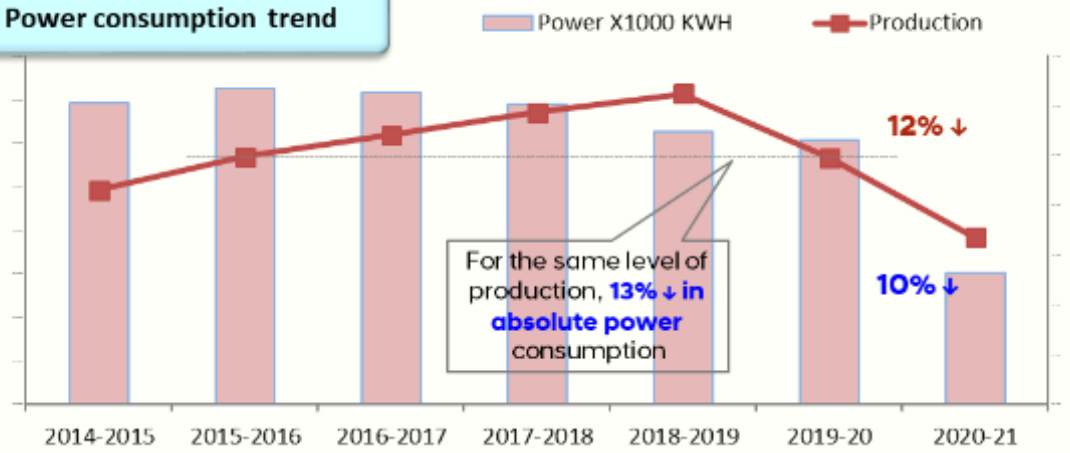


Energy consumption overview

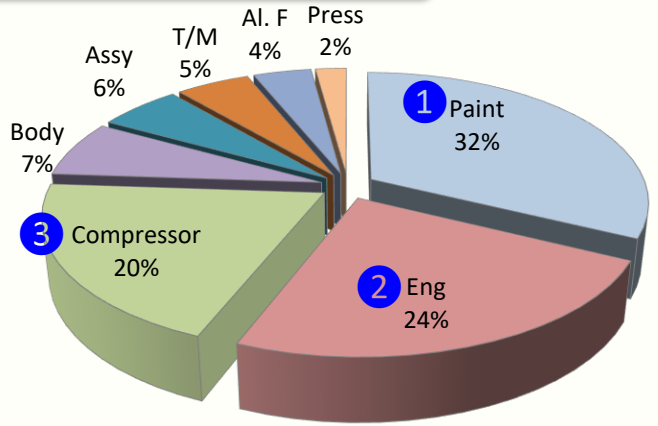
ELECTRIC ENERGY



Power consumption trend



Shop wise power Distribution



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Energy consumption overview

THERMAL ENERGY

BOILER

Propane →  → Steam supply to shops

PROPANE BULLET

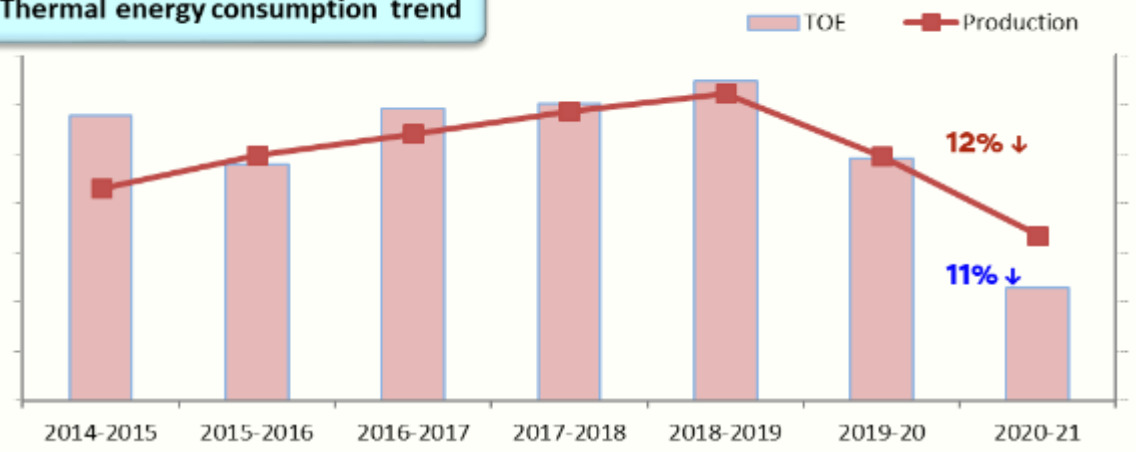
Propane → 

→ Propane for burners

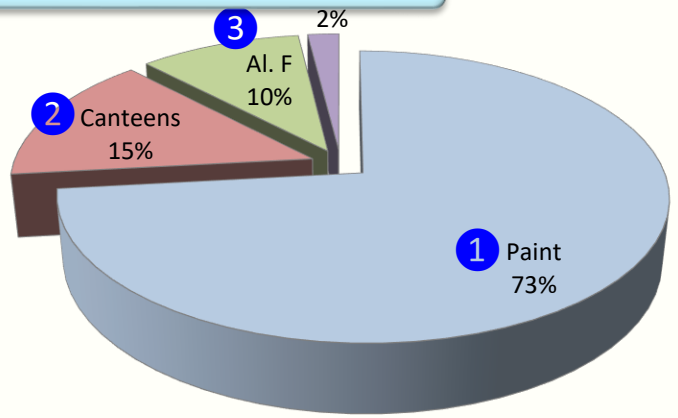
DIESEL GENERATOR

Diesel →  → Emergency Power supply to shops

Thermal energy consumption trend



Shop wise power Distribution



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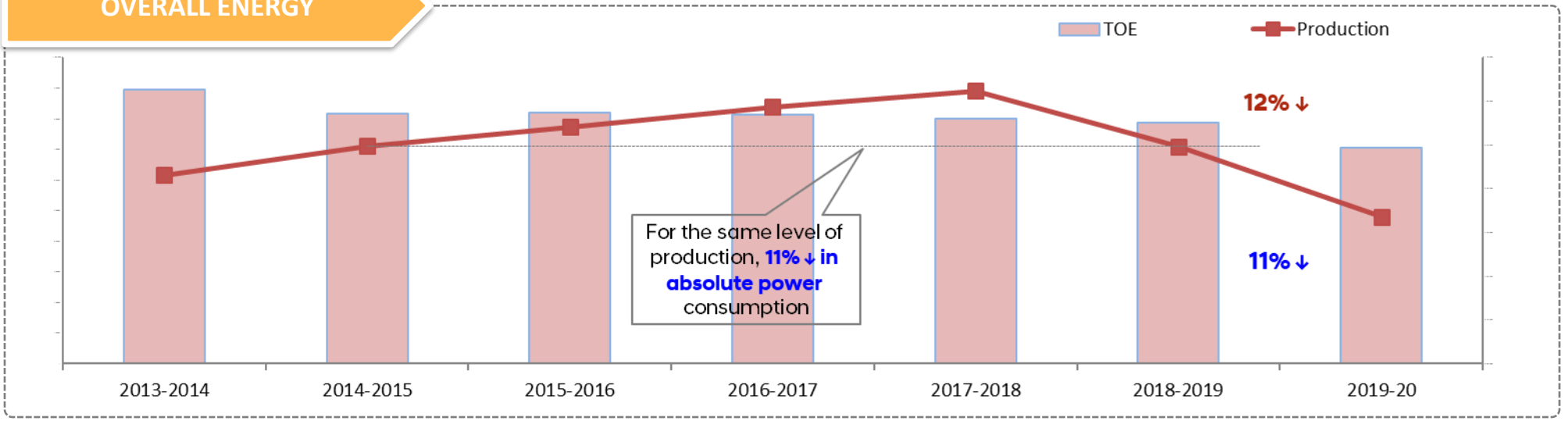
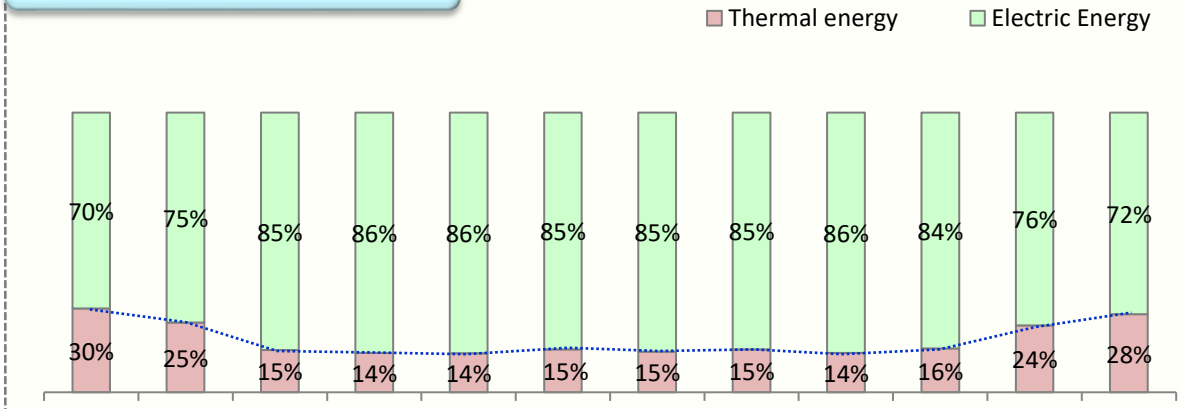
Energy consumption overview

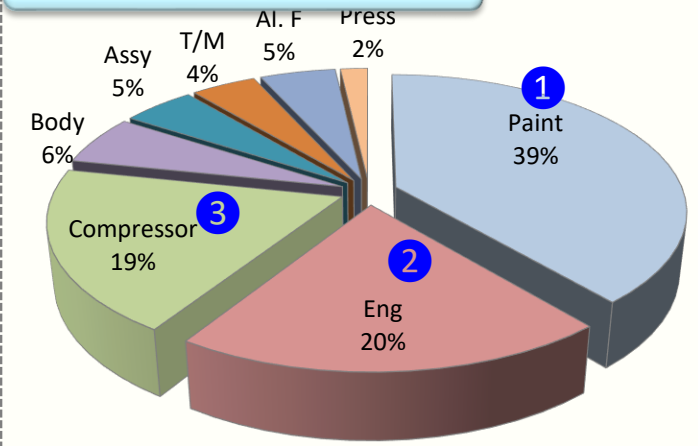
OVERALL ENERGY



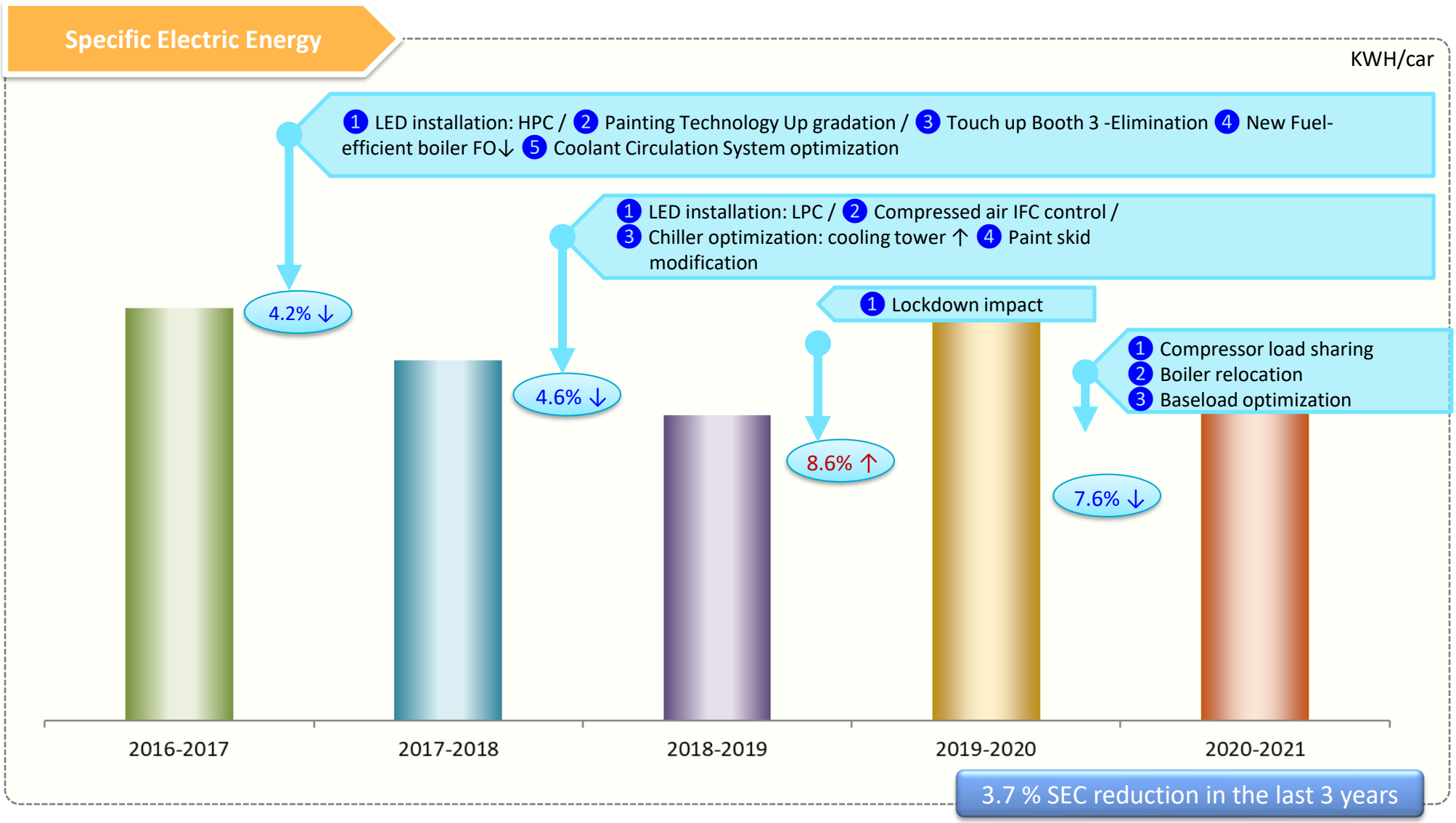
Month wise Power Distribution



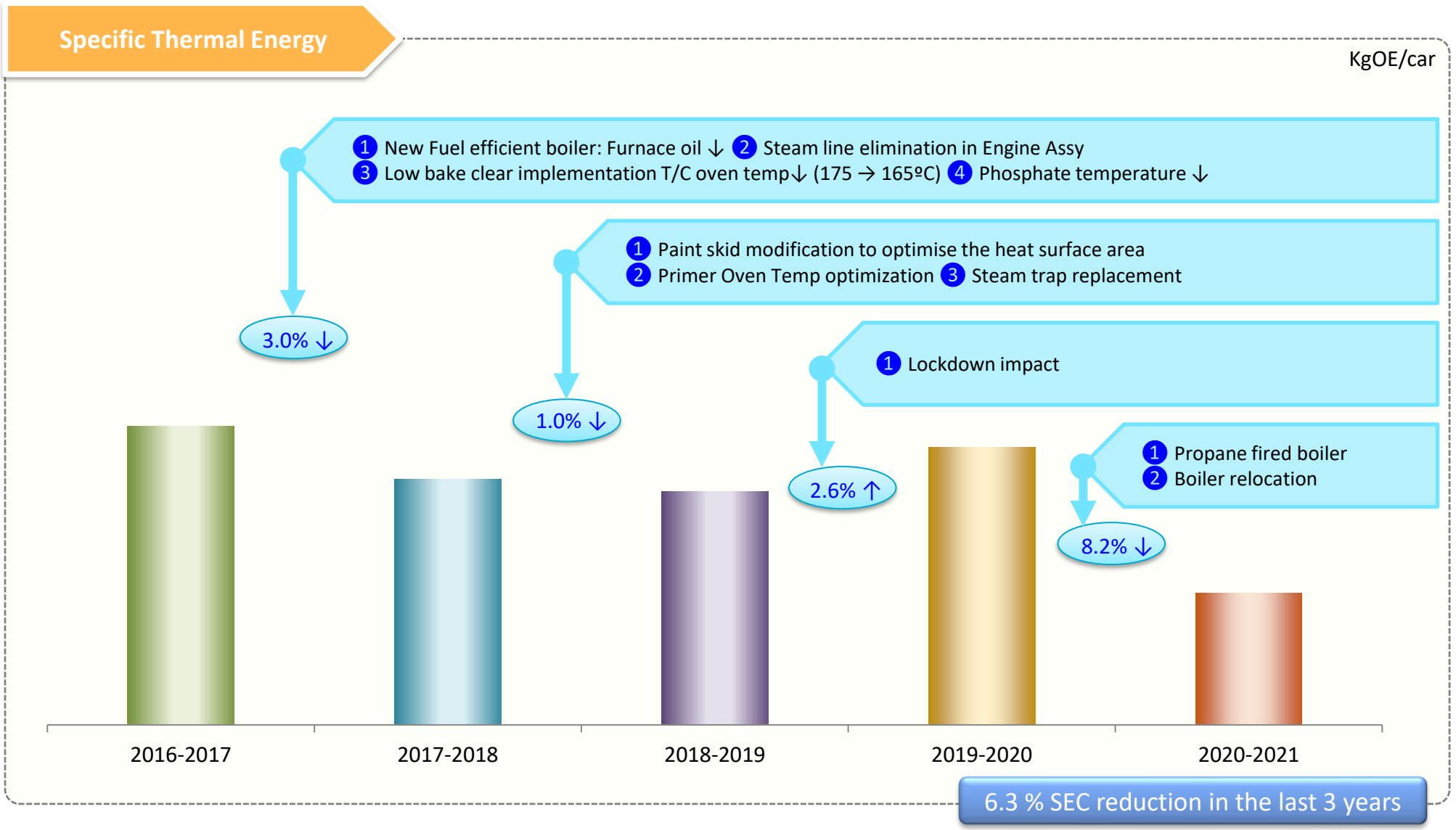
Shop wise power Distribution



Specific energy consumption in last 5 years

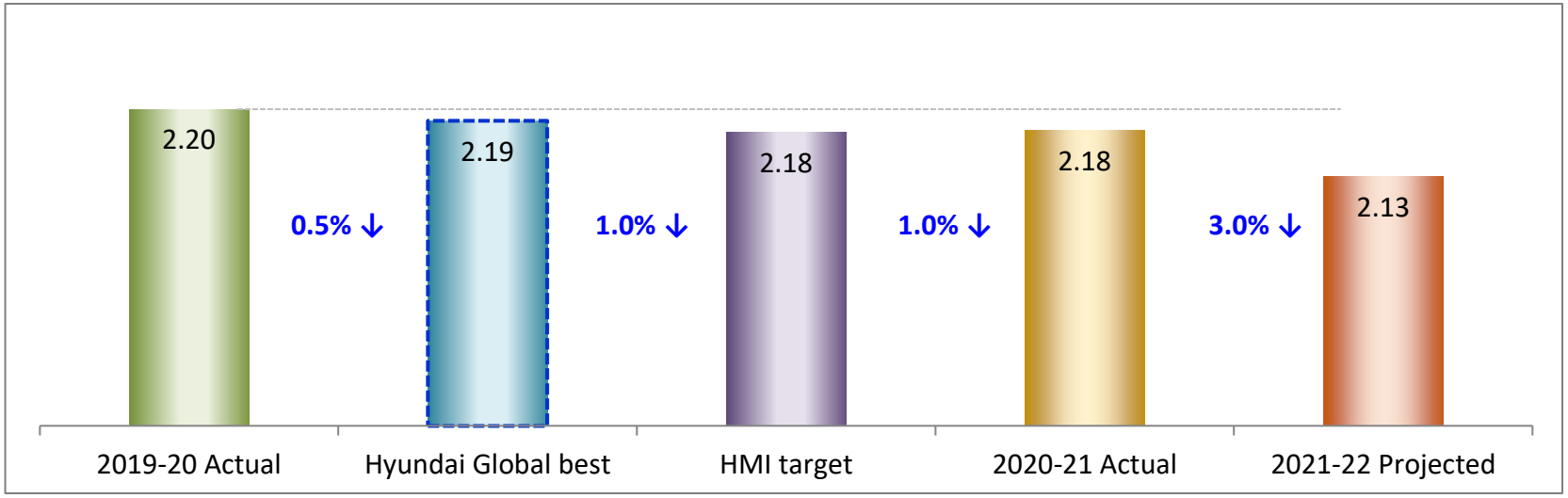


Specific energy consumption in last 5 years

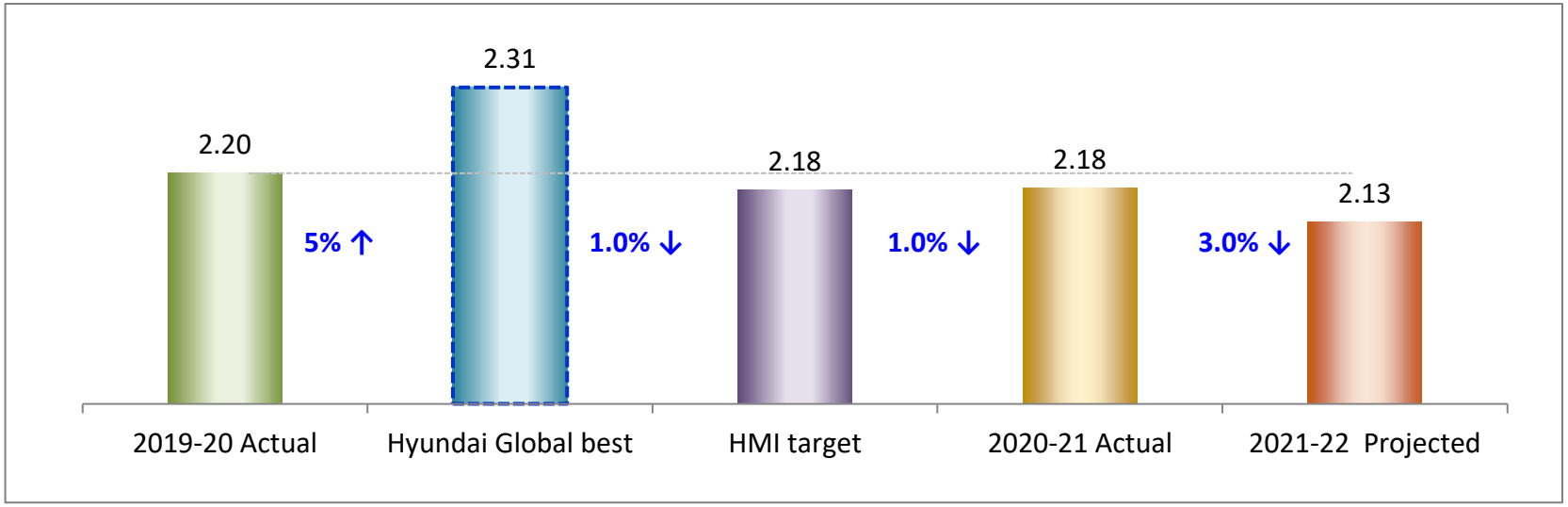


Information on Competitors, National & Global benchmark

Global
(HKMC overseas)
Benchmark
(in GJ/car)



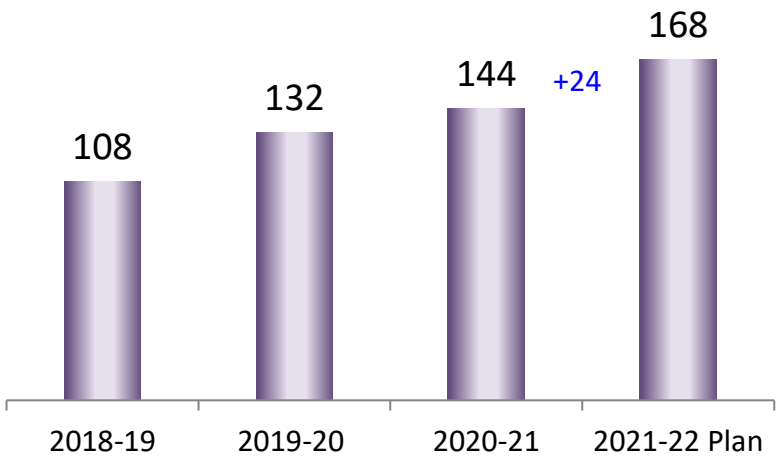
National
Benchmark
(in GJ/car)



Summary of Energy Saving projects

No of Energy Saving Activities

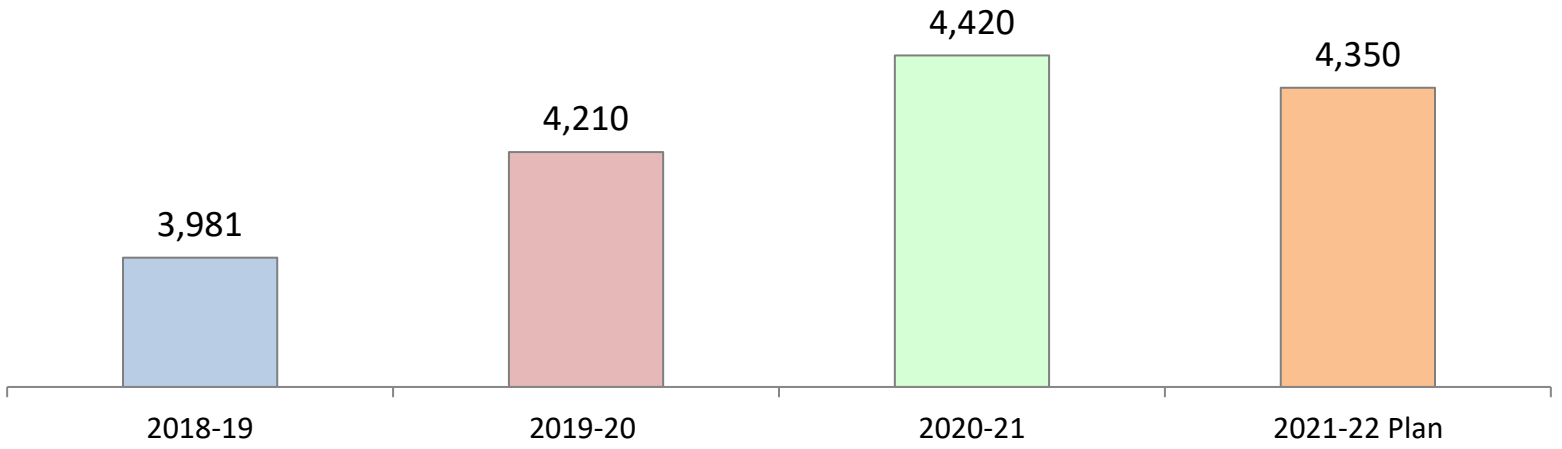
Total number of management Programs taken



Year	No of Proposal	Saving	Payback
		TOE	Months
2018-19	108	3981	23
2019-20	132	4210	28
2020-21	144	4420	32

Energy Saving In TOE/Yr.

Unit: Tons of Oil Equivalent/Yr.



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Energy Saving projects implemented in FY 2018-19

S. NO	Major Project	Energy	Investment Rs Lakhs	Annual Savings KWH / Kg of fuel
Technological Upgradation				
1	Waste heat recovery using Regenerative Thermal Oxidizer Paint #1	Propane	1100	165,000 Kg
2	High pressure deburring operation optimization	Electricity	42	269,000 KWH
3	Paint #1 IFC Pressure Optimization 9.2 bar → 8.3 bar	Electricity	9	265,000 KWH
4	Evaporative cooling system installation	Electricity	12	115,000 KWH
5	Normal ATD → High speed ATD	Electricity	28	60,000 KWH
Idle time Elimination				
1	AC optimization throughout HMI	Electricity	-	240,000 KWH
2	Metal Dust cleaning robot process elimination	Electricity	-	143,000 KWH
3	Primer FCU supply system modification	Electricity	-	202,000 KWH
4	Compressed Air Consumption Reduction with solenoid valve	Electricity	-	182,000 KWH
5	All oven cooling Zone supply & Exhaust fan switch off when PCR key switch off	Electricity	-	80,000 KWH
Energy Efficiency Improvement				
1	Booth air supply system energy management through filter optimization	Electricity	40	1338,000 KWH
2	Washing machine coolant cooling system modification	Electricity	14	265,000 KWH
3	Air Balancer to Electric hoist replacement (TM#2)	Electricity	16	41,000 KWH
4	MIP line Hydraulic power pack consumption optimization	Electricity	-	42,000 KWH

Energy Saving projects implemented in FY 2019-2020

S. NO	Major Project	Energy	Investment Rs Lakhs	Annual Savings KWH / Ton of fuel
Technological Upgradation				
1	ITMB50-130 : Washing m/c : Electric Heaters to Heat pump	Power	26	1,153,890
2	IE UK10-110 Washing pump conversion inverter type	Power	32	312,500
3	Online IFC pressure control	Power	18	265,604
4	Installation of energy efficient screw compressor	Power	84	810,092
5	Chiller efficiency improvement : Paint shop #2	Power	75	790,968
Idle time Elimination				
1	PT ENTRY-PF48 conveyor chain layout modification – Energy saving	Power	-	147,892
2	Compressed Air Consumption automation - OP Shaft	Power	2	130,428
3	Interlock Modification for Shower blowers to reduce Running time	Power	-	308,713
4	Auto stirrer running in topcoat waste thinner tank optimization	Power	-	159,362
5	Blanking line : piler no:2 energy saving valve installation	Power	5	109,190
Energy Efficiency Improvement				
1	Chip conveyor and oil skimmer energy optimization	Power	-	115,194
2	Shop ventilation blower motors up gradation (IE2 → IE3)	Power	15	106,242
3	Energy Efficient Boiler Operation	Fuel	254	274
4	Assy #1: Roll and Brake blower panel upgradation	Power	4	136,131

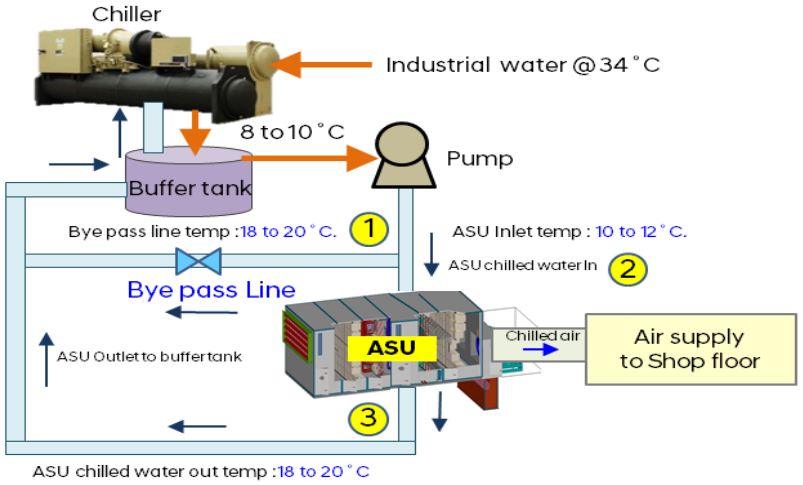
Energy Saving projects implemented in FY 2020-2021

S. NO	Major Project	Energy	Investment Rs Lakhs	Annual Savings KWH / Ton of fuel
Technological Upgradation				
1	Chiller consumption reduction by adding additive	Power	3.2	1,85,110
2	Low Temp Degrease Implementation	Propane	185	125
3	Electric Heaters → Heat Pump for washing machines	Power	53	637,580
4	Humidifier pump operation optimization during winter	Power	2.6	2,19,362
5	Thermo ceramic coting in UBS oven side walls to reduce propane consumption	Propane	3.4	26
Idle time Elimination				
1	C/BLOCK CCS Pump running quantity optimization	Power		8,06,600
2	Chiller Operation by based on seasonal (Winter/Summer)	Power		7,68,180
3	Sunday power consumption reduction compared to 2019 through audit	Power		9,23,571
4	Compressor power optimization during C shift	Power		3,37,944
5	CCS operation hours reduction during lockdown	Power		1,83,662
Energy Efficiency Improvement				
1	Energy saving through ASU Fan Motor Up Gradation to IE3	Power	18	5,90,360
2	RTO VOC feed Back Control system - Burner Temp	Fuel	1.8	55
3	C/Head: OP160 Washing pump IF washing → Grundfos pump replacement	Power	12	3,15,972
4	OPG Broaching M/C Pusher Unit Elimination	Power		1,42,029

Innovative Projects 1 : Work Deck #2 Cooling coil (3→2 Way valve type)

Before

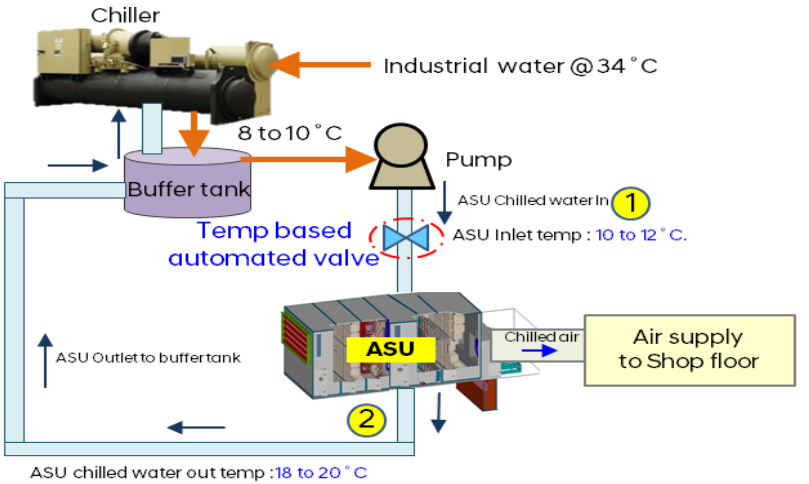
- **Before :** Cooling coil type 3 way operation.



Equipment		Detail's	Actual operation
ASU		Operation methodology	3 Way Value (Inlet ,Outlet & Bye pass)
Chiller	Winter	Load	380 TR
	Summer		420 TR
Drawback		No temperature based ASU chilled water inlet value operation	

After

- **After :** Cooling coil type 2 Way valve operation.



Equipment		Detail's	Actual operation
ASU		Operation methodology	2 Way Value (Inlet & Outlet)
Chiller	Winter	Load	304 TR (76TR↓)
	Summer		336 TR (84TR↓)
Benefit		Temperature based ASU chilled water inlet value operation	

Effect	Energy Saving : 6,08,349 KWhr /Annum	Saving	Rs 36 Lakhs/Year

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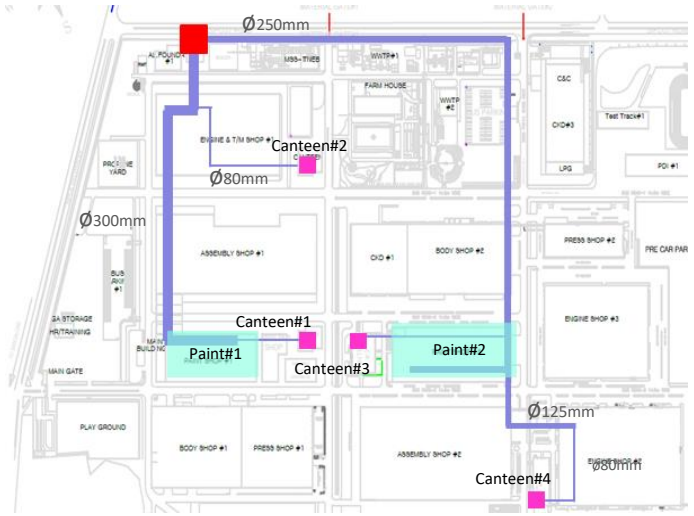
Innovative Projects 2 : Boiler relocation to reduce Transmission loss

Before

Main Steam Pipe line length : **3,925 m**

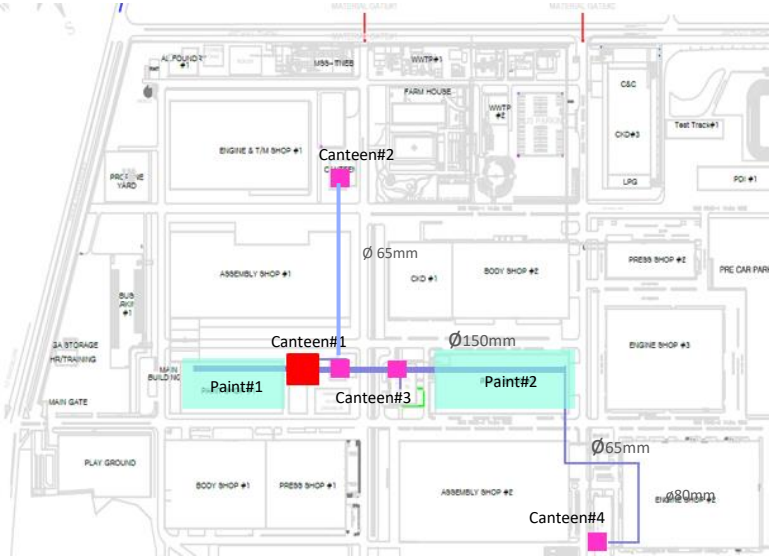


(Tons/year)

Steam Generation	Steam Usage	Steam Loss
60,000	36,000	**24,000**

After

Main Steam Pipe line length : **1,480 m** (62% reduction)



(Tons/year)

Steam Generation	Steam Usage	Steam Loss
42,000	36,000	**6,000** (75% Reduction)

Effect	Energy saving : 18,000 Tons/yr of steam	**Saving (KWH)**	Rs 503 Lakhs/Yr.

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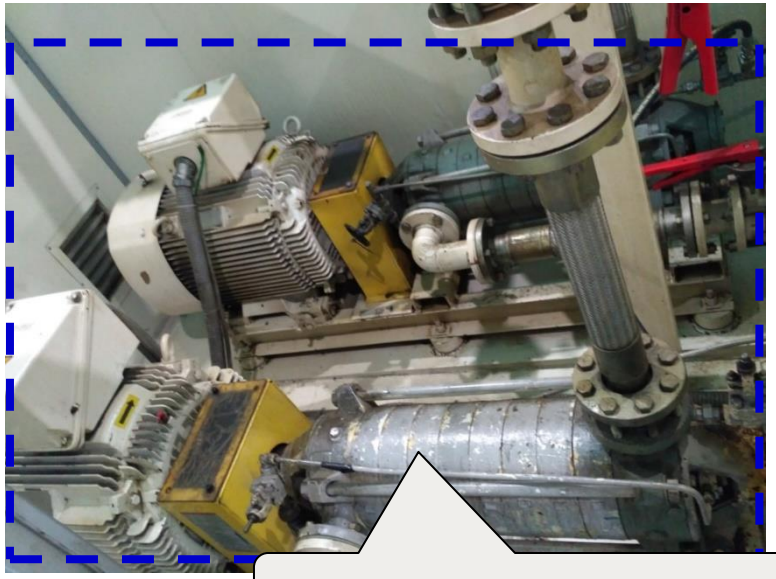
Innovative Projects 3 : WASHING- PUMP CONVERSION TO INVERTER TYPE

Before	After
 Constant speed motor- 75 Kw	 Inverter driven (Variable sp eed)motor- 45 Kw  Inverter
▪ Washing pump run by using induction motor ▪ Always running in rated energy. Pump capacity- 75 Kw ▪ Energy consumption high (56.35 Kw/Hr)	▪ Pump modified with reduced power rating (45 KW) and with inverter. ▪ Also Idle time pump operation optimized with less power consumption by using inverter- (20.7 KW/Hr)

Effect	Energy Saving : 212,551 kWh / Year	**Saving**	Rs 15 Lakhs/Year

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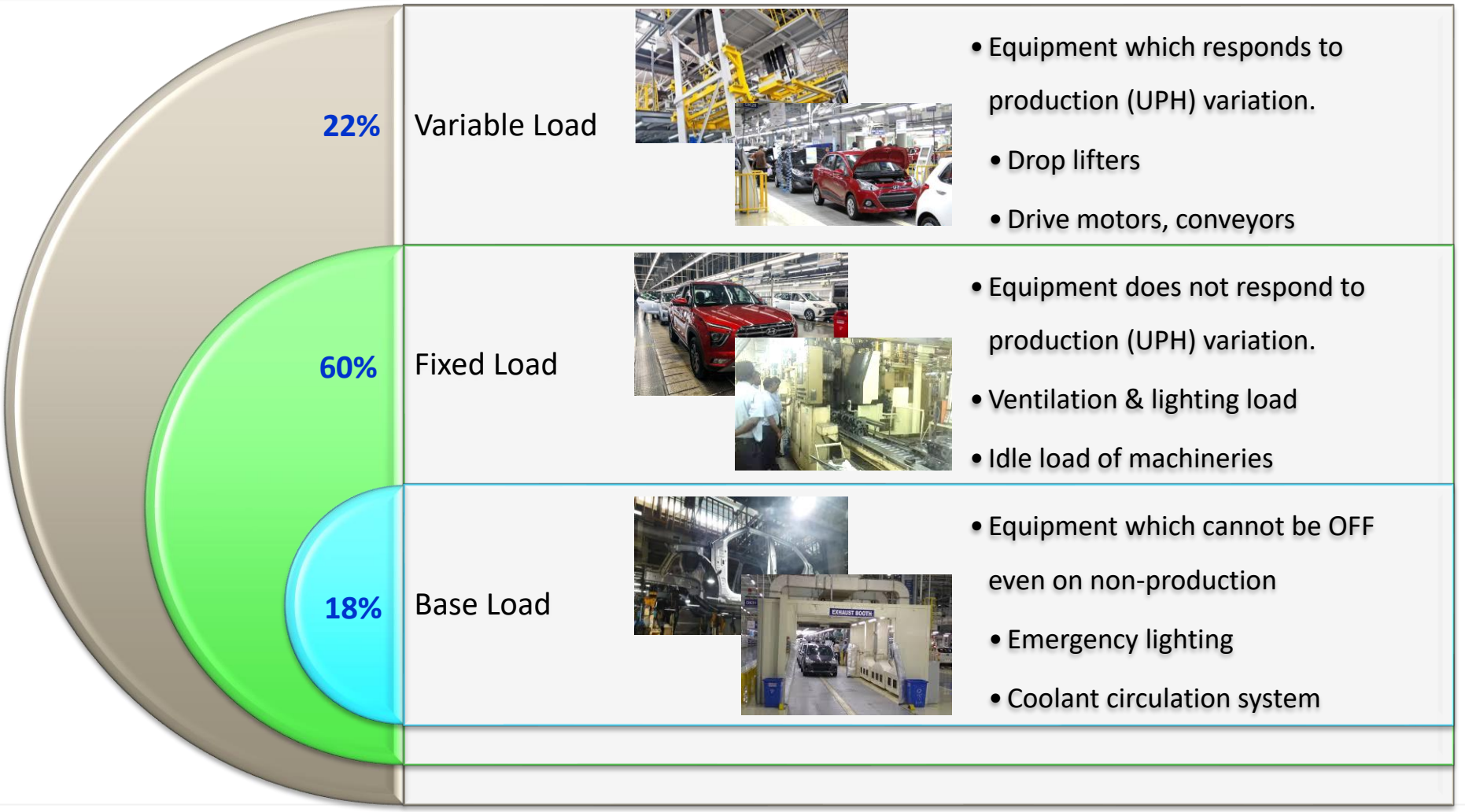
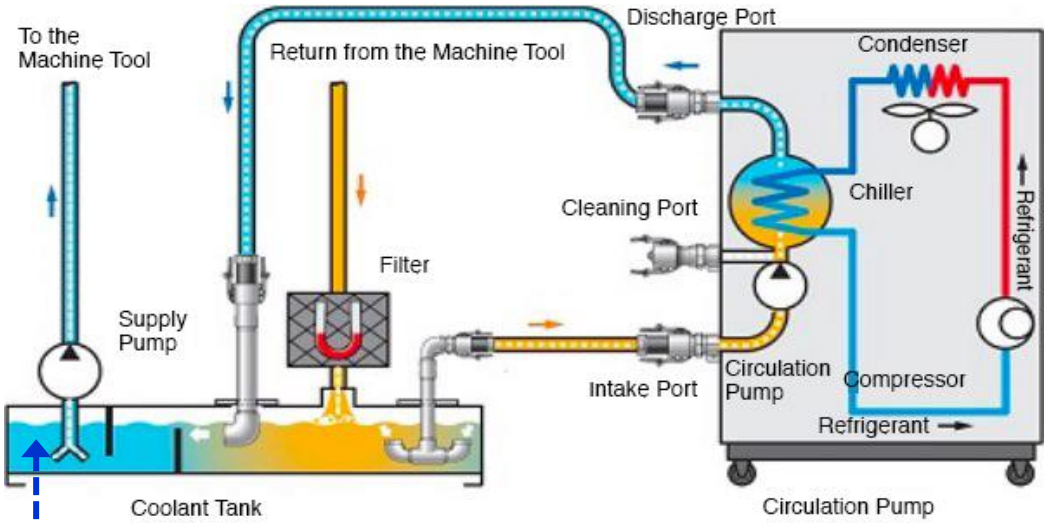
COVID Lockdown Energy Management 「Potential Identification」

❶ Base Load Identification



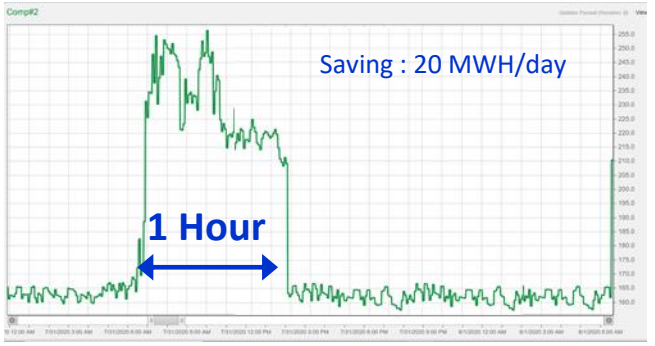
COVID Lockdown Energy Management 「Potential Identification」

❷ Coolant Circulation system optimization



Compressed air supply for agitation

Short term plan



Long term plan

Compressed Air

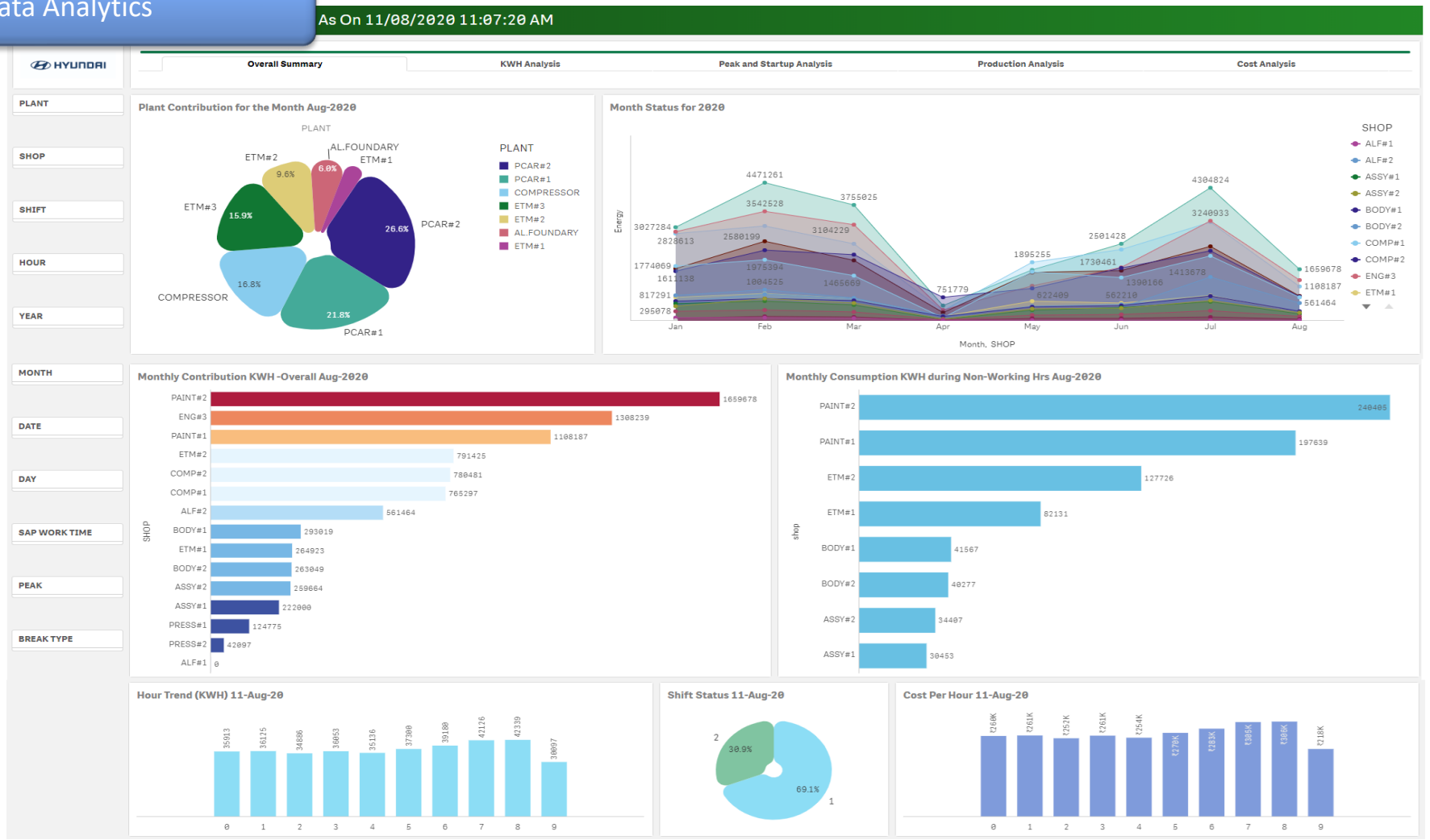
Specific ratio <1.2

Blower Air

Saving : 35 MWH/day

COVID Lockdown Energy Management 「Potential Identification」

❸ Data Analytics



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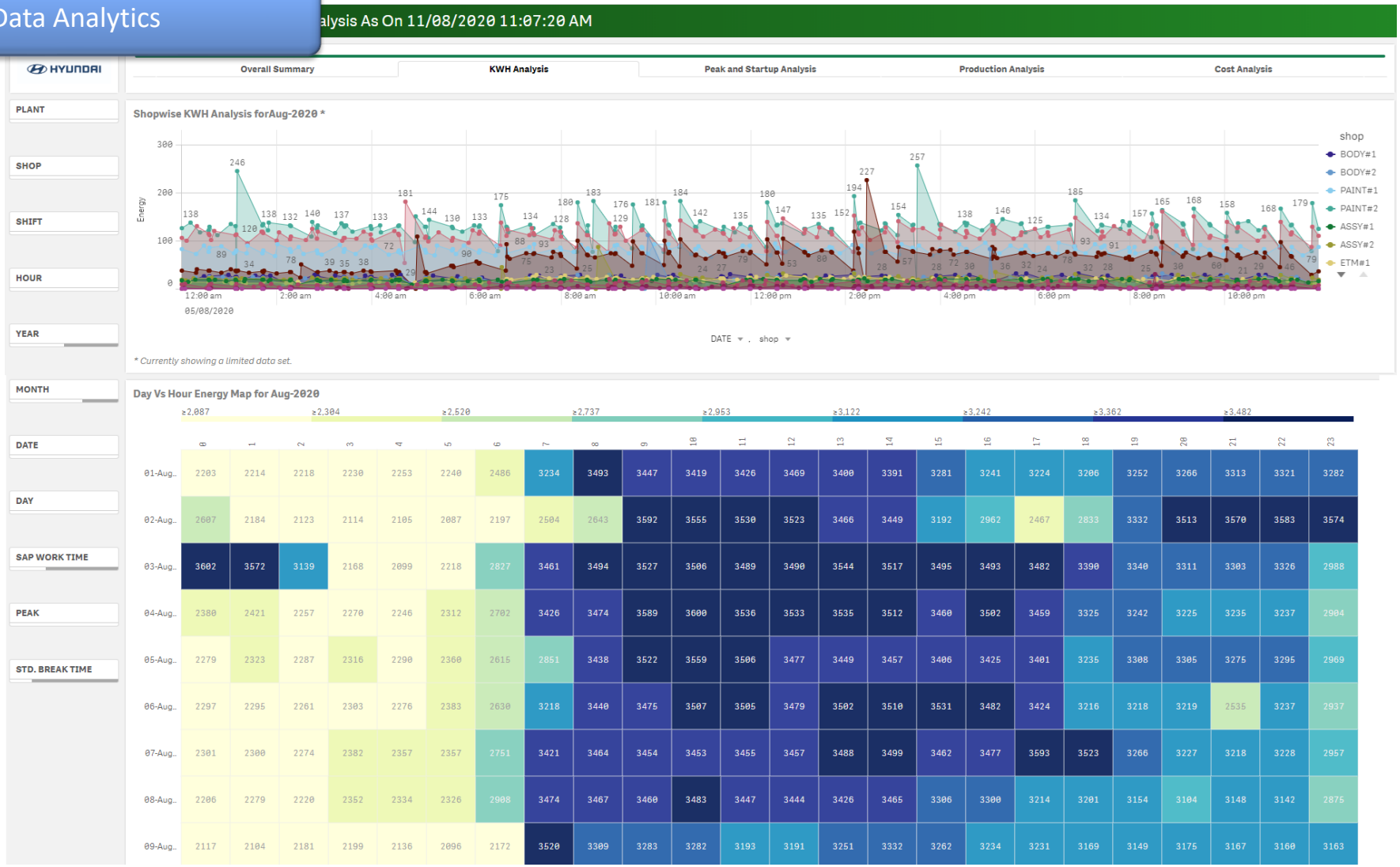
COVID Lockdown Energy Management 「Potential Identification」

❸ Data Analytics



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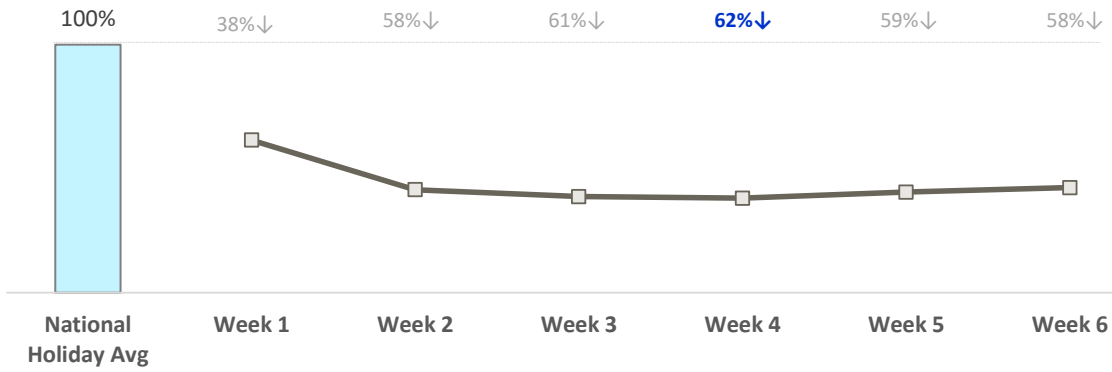
COVID Lockdown Energy Management 「Potential Identification」

❹ Performance during Lockdown

Internal Benchmarking

Energy Saving details (Benchmarked with HMI National Holiday Avg consumption KWH)

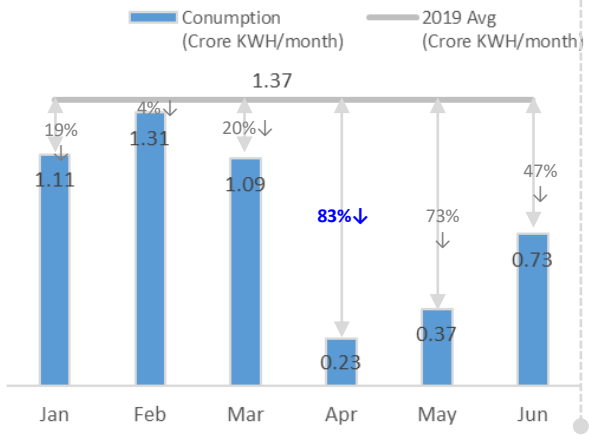


Number of activities	146
Overall Power savings KWH	62,20,690
Overall Cost savings Rs Crores	4.50

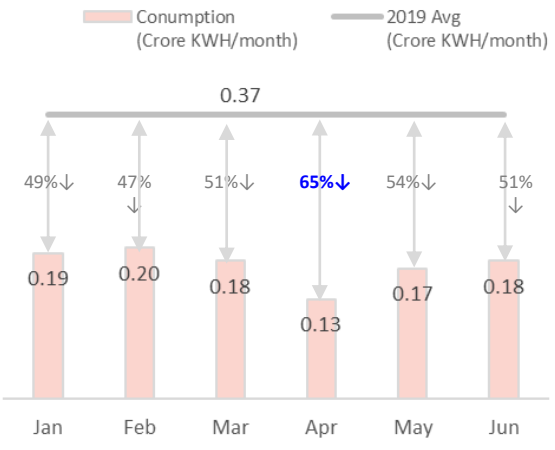
※ Benchmarked with HMI National Holiday Avg

External Benchmarking

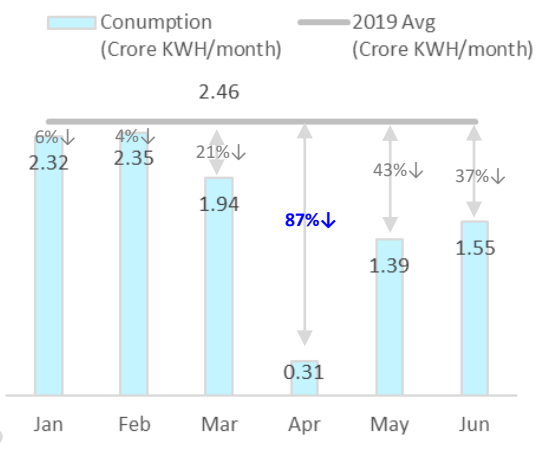
Automobile OEM #1 (In Chennai)



Automobile OEM #2 (In Chennai)



HMI



※ Highest power consumption reduction done in HMI

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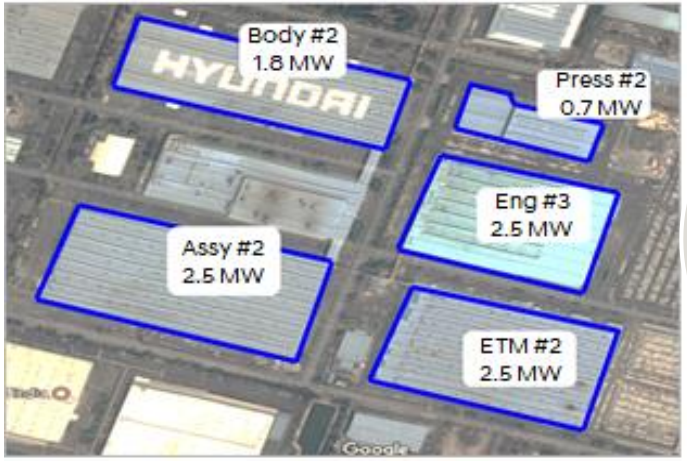
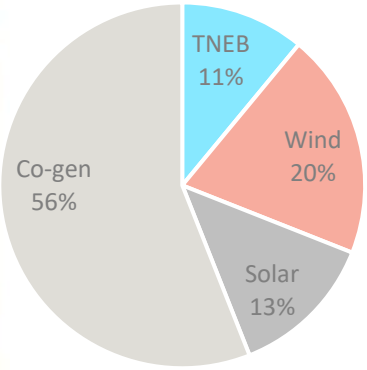
Utilisation of renewable energy sources

Technology	Type of Energy	Onsite/ Offsite	Installed Capacity (MW)	% of overall
Wind Power	Electrical	Offsite	37.5	20%
Co-Gen	Electrical	Offsite	20	56%
Solar PV	Electrical	Onsite	10	5.3%
Solar PV	Electrical	Offsite	15	7.7%
Total	**Electrical**	-	-	**84%**

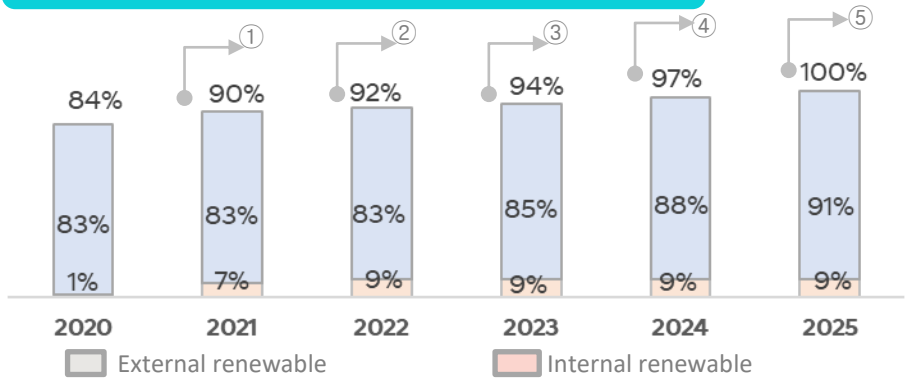
① 10 MW solar rooftop in Plant #2



RE 100



Renewable Energy Roadmap



Major Activities Planned	Year	Savings Rs Cr/Yr	% ↓
① 10 MW solar rooftop in Plant #2	2021	4.5	6%
② 6 MW solar ground mounted	2022	3.0	2%
③ Co-gen power 6MW for non peak period	2023	0.8	2%
④ Wind power allotment : non peak period	2023	0.4	3%
⑤ Bio-Gas power adjustment: available slot	2024	0.4	3%

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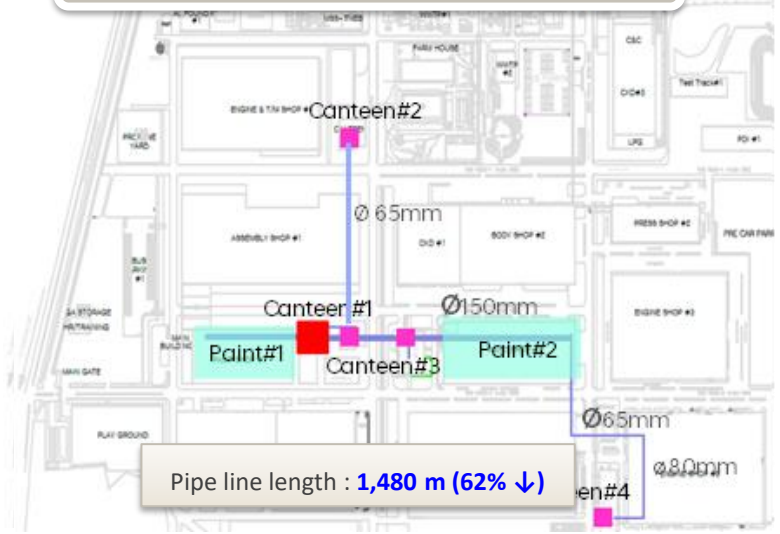
Top Management Support

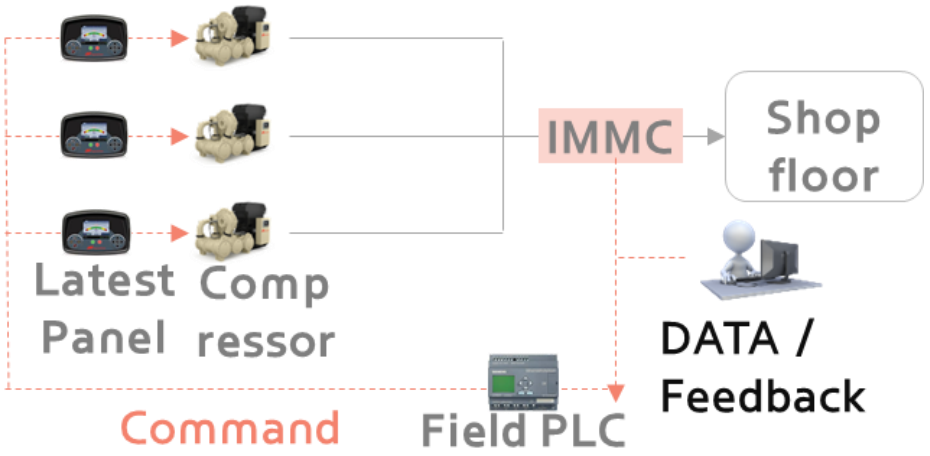
① Boiler relocation for transmission loss↓

Investment ~ 4 Crores



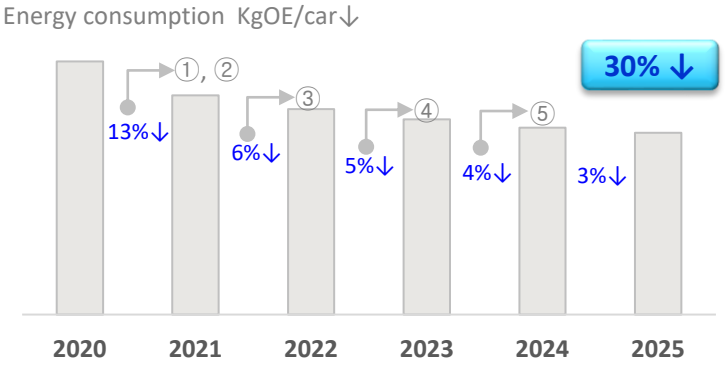
② Compressor optimization by load sharing

Investment ~ 2 Crores



Investment plan ~ 42 Crores

Specific Energy Consumption (SEC)



Major Activities Planned	Year	Savings Rs Cr/Yr	% ↓
① Boiler relocation for transmission loss↓	2021	5.2	8%
② Compressor optimization by load sharing	2021	1.8	2%
③ Significant Energy user : Efficiency audit	2022	3.2	4%
④ 100% Replacement of heater → heat pump	2023	2.4	3%
⑤ Energy Efficient preferable purchase	2024	4.0	6%

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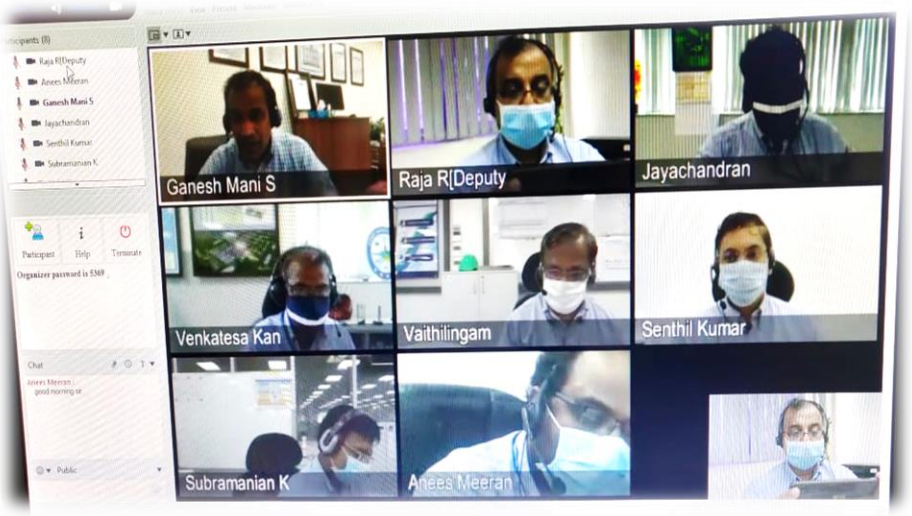
Top Management Support

Monthly Energy Review



Utilisation of waste material as fuel

HMI

Co-processing

Transport to Cement Industry

Cement Industry

Used as ARF (Alternate Resource Fuel)

S. No	Waste material	Processing method	Annual Tons / year
1	Paint sludge	Transported to Cement industries for blending with fuel.	850 Tons / Year
2	Chemical sludge	Transported to Cement industries for blending with fuel.	50 Tons / Year
3	Sealant sludge	Processed into powder form → Briquetted → Fuel for co processing in cement industry	350 Tons / year

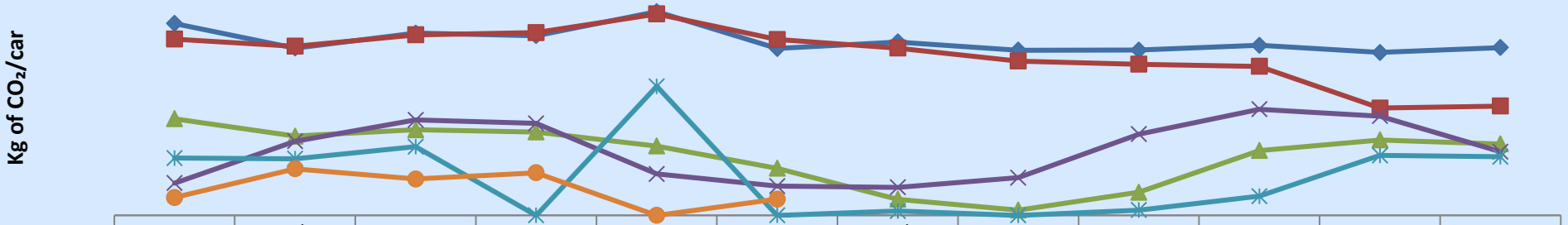
GHG Inventorisation

INDC (Indented Nationally Determined Contribution)

Nation	INDC commitment
India	33-35% reduction in emissions intensity by 2030, compared to 2005 levels
Republic of Korea	37% reduction in Green house gas emissions from the business-as-usual (BAU, 850.6MtCO2eq)level by 2030
HMI	Achieved Minimum 64% Reduction in Green house gas emissions from 2016 level through Renewable power usage  INDC korea

INDC framed by United Nation Framework on Climate Change (UNFCC) is the commitment of global countries CO_2 emission ↓

❑ **Trend of KgofCo2/car**



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	406	353	385	380	430	353	366	349	349	359	344	355
2017	372	357	381	386	426	372	353	326	319	315	227	231
2018	204	168	181	176	147	100	34	11	49	137	159	151
2019	68	157	202	194	88	62	59	80	172	224	210	134
2020	121	120	145	0	273	0	9	0	11	41	127	124
2021	38	98	77	90	0	34						

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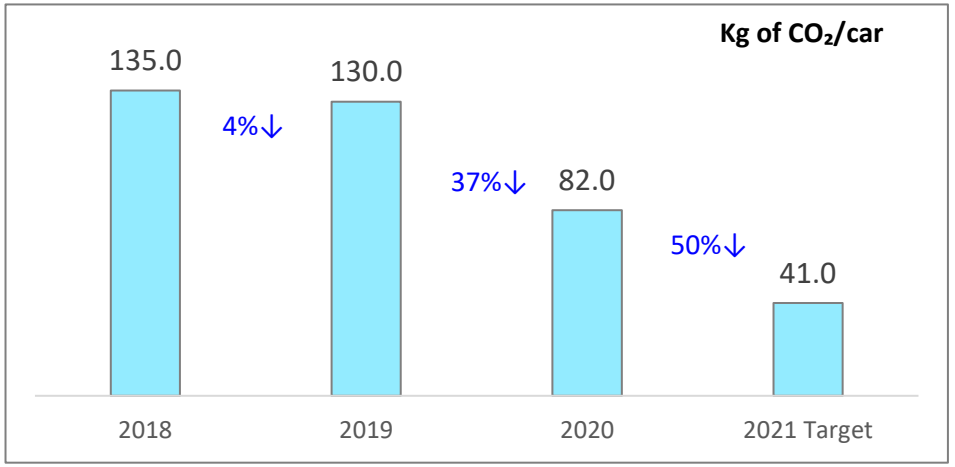
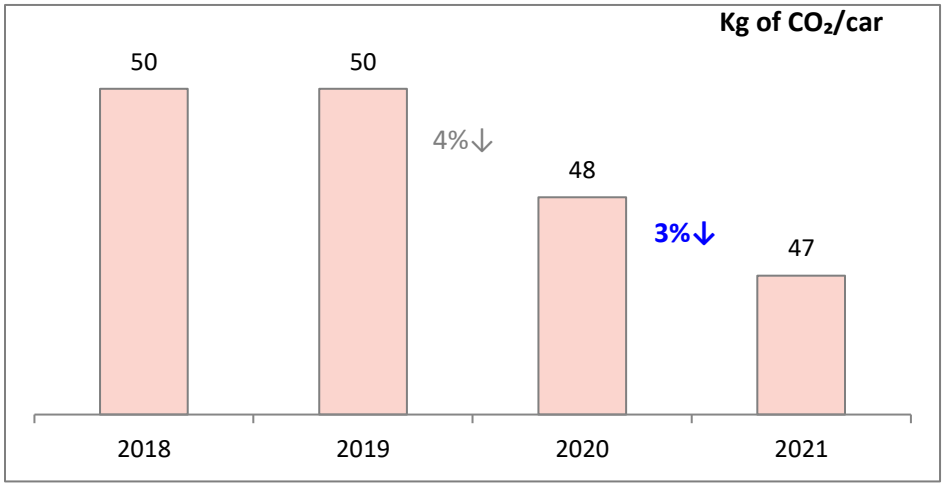
GHG Inventorisation

Scope 1



Scope 2



Scope 1 includes :

- ❑ **Emissions from sources owned or controlled by HMI**
- **Usage of propane for oven heating 7 cooking**
- **Usage of Furnace oil for generation of steam**
- **Usage of diesel in generators & internally driven vehicles**

Scope 2 includes :

- ❑ **Indirect Emissions from HMI**
- **Generation of purchased electricity consumed**
- **Excluding the renewable energy consumed (onsite/offsite)**

Green Supply Chain- In bound

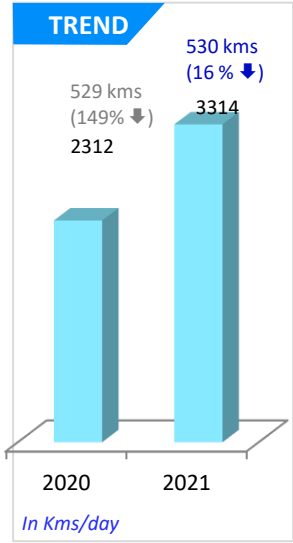
Savings Target(2019) : 408 km/day

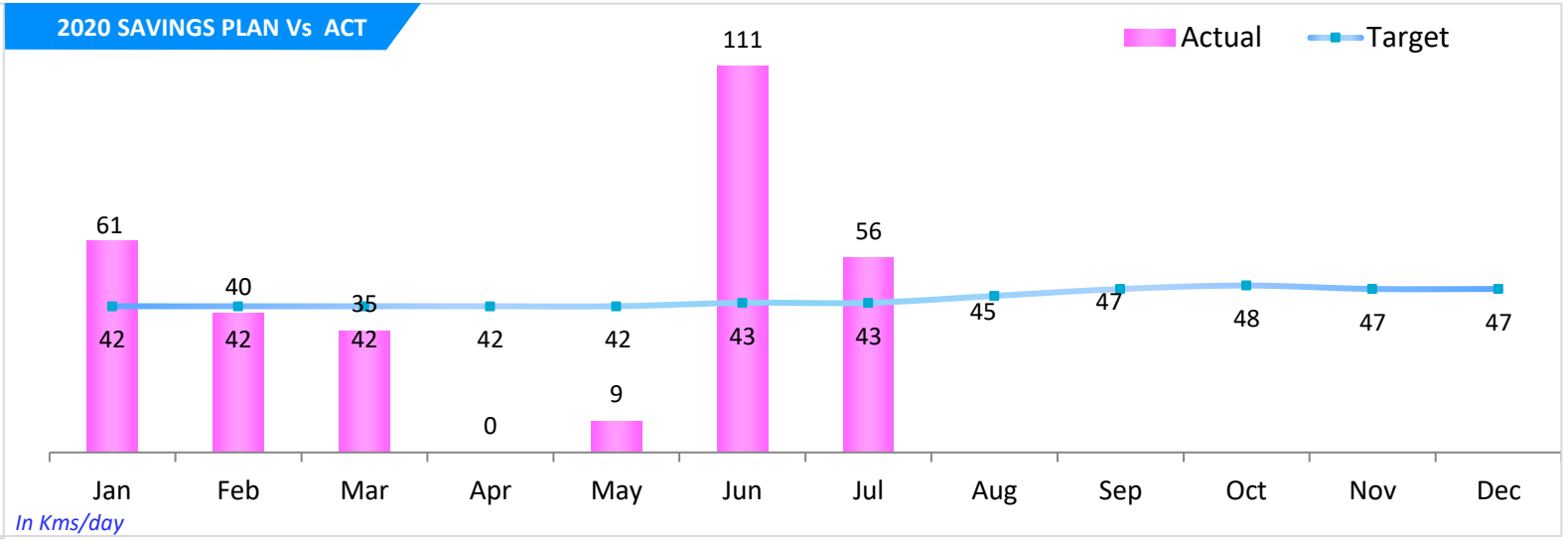
Identify Movement intensive Parts

Identify methods to reduce burden

Savings Actual(2020) : 472 km/day

Move parts closer	Increase feeding quantity	Reduce bin size for same quantity	Job reallocation
1. Remove unnecessary items on the way 2. Open additional gates	1. Enhance lineside storage • Space for more Gravity feeding Conveyor 2. Supply vs. Assy sequence synchronization	1. Optimize loose stuffing 2. Change packing material	1. Systemized feeding techniques 2. Similar job activities to be identified 3. Identifying unproductive activities





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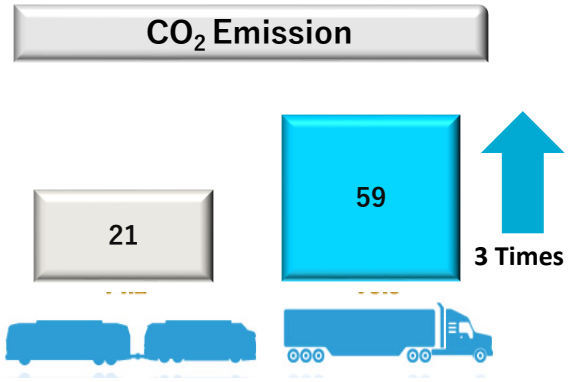
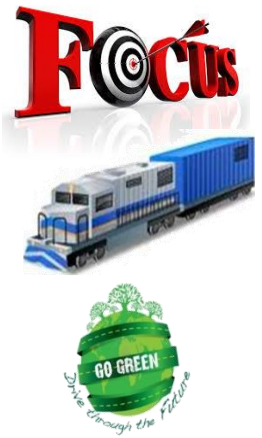
Green Supply Chain- Out bound

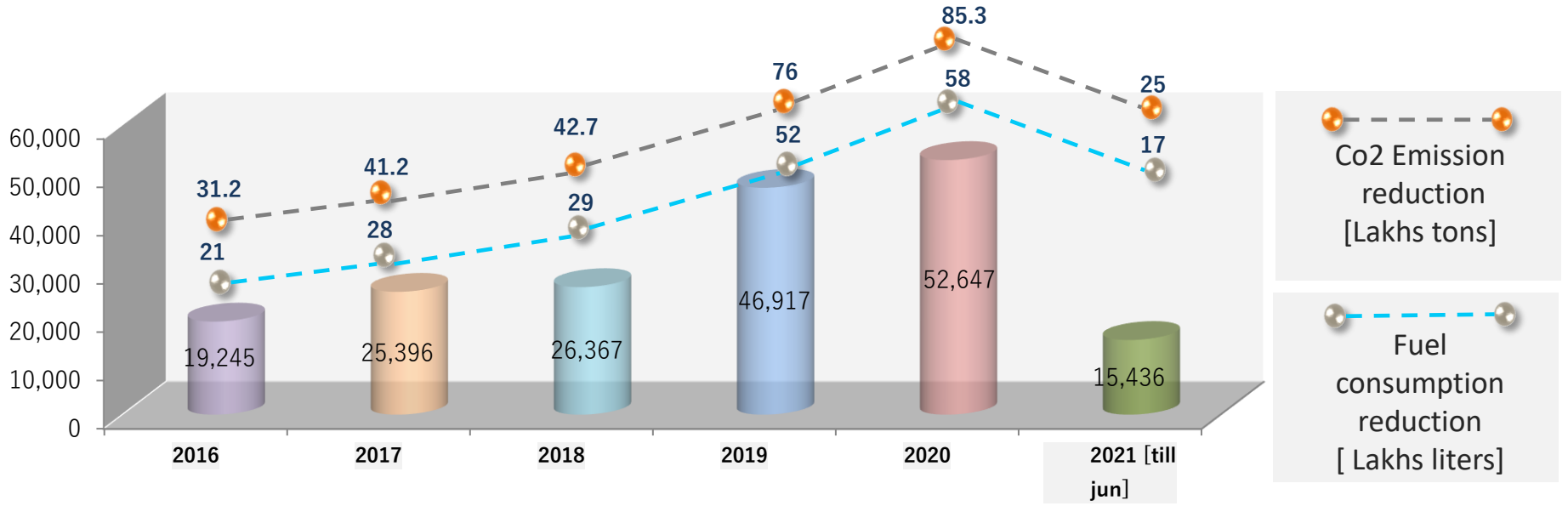


CO_2 Grams to carry 1 Ton of cargo 1 KM

Source: World Shipping Council



	2015 ~ 2021
CO_2	301 Lakh tons
FUEL	205 Lakh liters



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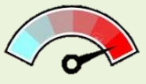
ISO 50001(EnMS) Migration plan to 2018 version

Significant Energy User

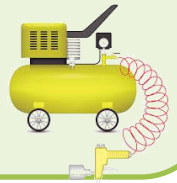
◑ Significant Energy User (SEU)

Criteria : >50% --→ >40%

(Additional 63 Equipment)



◑ 80 % of overall HMI consumption : SEU



Objectives & targets

◑ **Objectives :** Reduction of Power, Fuel consumption

◑ **Targets :**

Power : 3.0 % ↓

Fuel : 2.5 % ↓

Overall : 2.8 % ↓

EnMS Enhancement

Risk & Opportunities

◑ **Variables** affecting the performance of SEU are analyzed

◑ Parameters of the variables monitored with **check list**

Design & Procurement

◑ **Strengthening of Design & procurement**

Step 1 : Check whether Equipment is **SEU?**

Step 2 : Evaluate & **select Best Energy performance**

Step 3 : **Communication** to supplier

Step 4 : **Evaluation of actual** performance

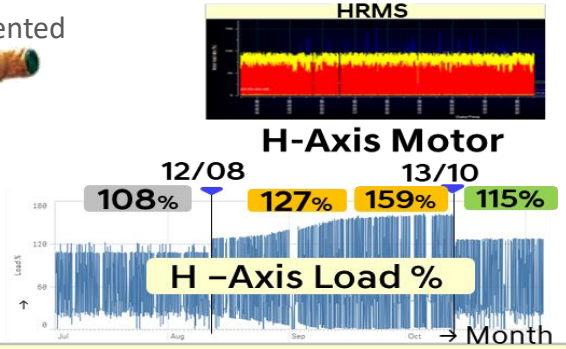
Industry 4.0 「World Class Manufacturer though Energy control」

01 Smart Solution

○ Digitisation for controlling the variables affecting the energy performance

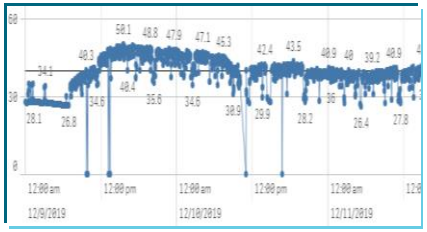
HRMS Data Analysis

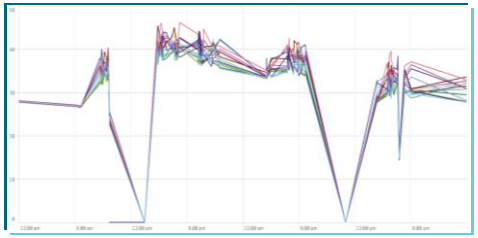
Robot **drive failure** prevented



Water flow Data Analysis

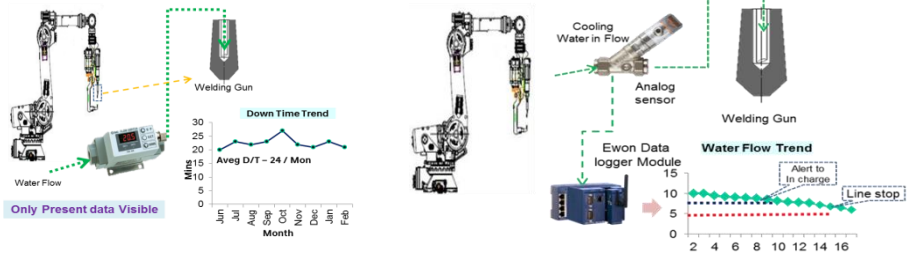
Weld water error reduction





WQMS Data Analysis

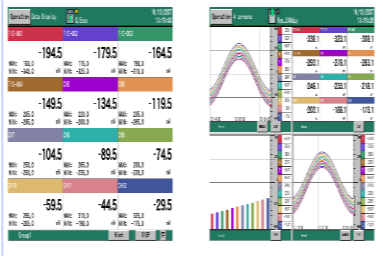
Robot **welding tip** Real time Monitoring



Effectiveness : Effective control, data logging & historical data

Real time Temperature Monitoring

Manual **Bearing Temperature** Measurement



Effectiveness : MTTR ↓, Fatigue Reduction

Smart Products & solutions	Smart Equipment	Automation & Robotics	Digital Modeling	Additive Manufacturing	IT Systems & security	Big Data analytics	Cloud computing & usage	AI/ Self learning M/Cs	Augmented Reality

Team work - 「My Place My Pride」 ®

100% Safety: Aim '5' Zero	25.00+Kgs (Feb ~ Jun)	3% Energy ↓ (3,981 TOE ↓)	Top Qualitivity 100% Efficiency	90.0%	100% Involvement

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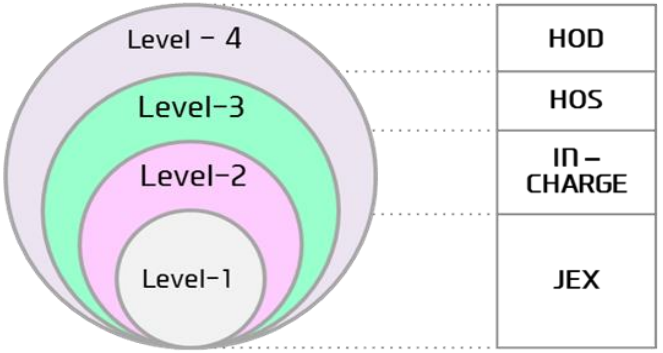
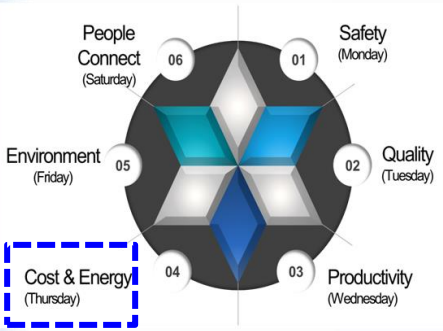
Team work - 「Daily Management System」

(Microscopic → Telescopic)

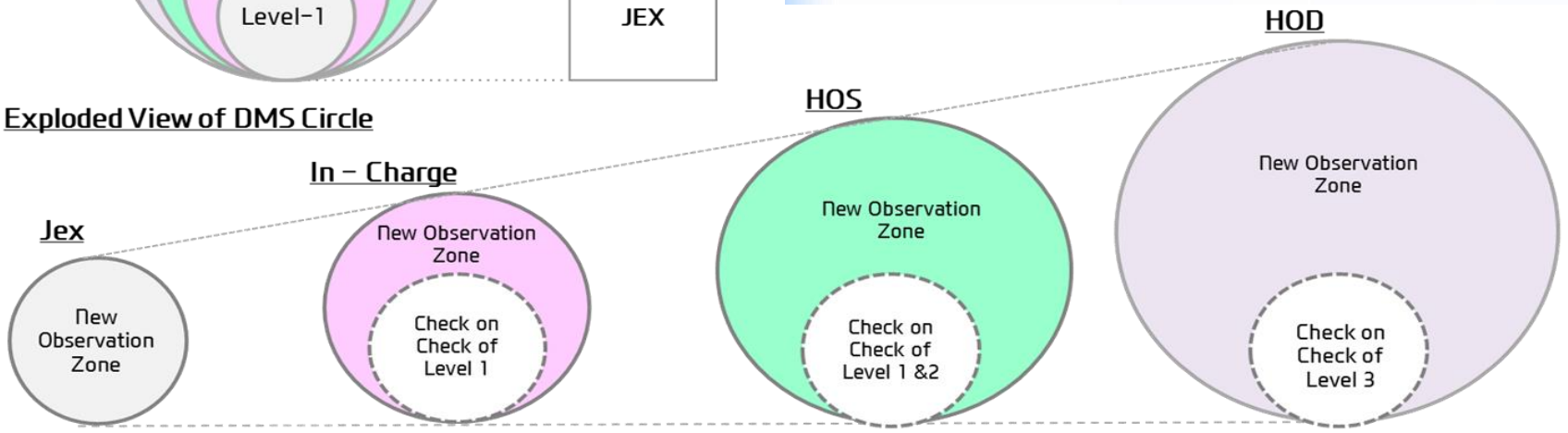




Employees Involved : 1,357 → Identified 23,800 points

Systematic Internal audit of 31 departments by 21 Auditors

Exploded View of DMS Circle



Energy wastage control	Energy optimization	Energy Technology	Motivation & Budgetary support
Check list control	Idle time optimization	Advanced & new tech implementation	HOS's Energy 360° Verification

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Employee Involvement - 「Promotion of Energy Efficient Appliances」

Products promoted			
BLDC fans	LED Bulbs	LED Tube lights	Solar panels

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Employee Involvement 「Training & Awareness」

COST INNOVATION

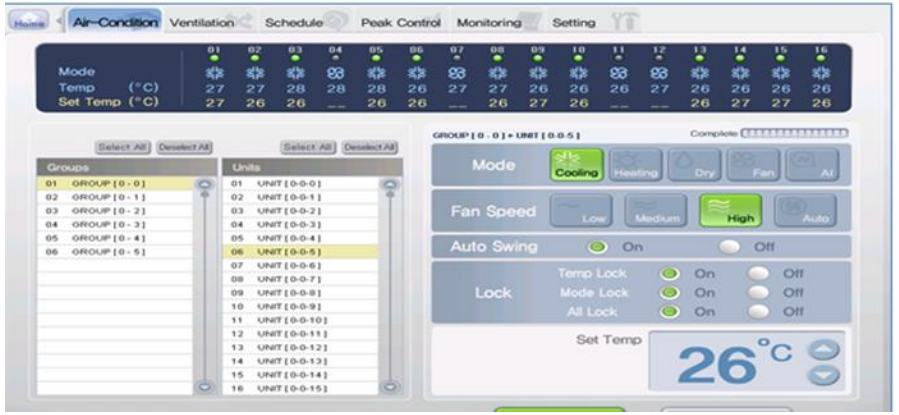
‘15,000+ TOTAL EMPLOYEE INVOLVEMENT’

Industry 4.0 「World Class Manufacturer though Energy control」

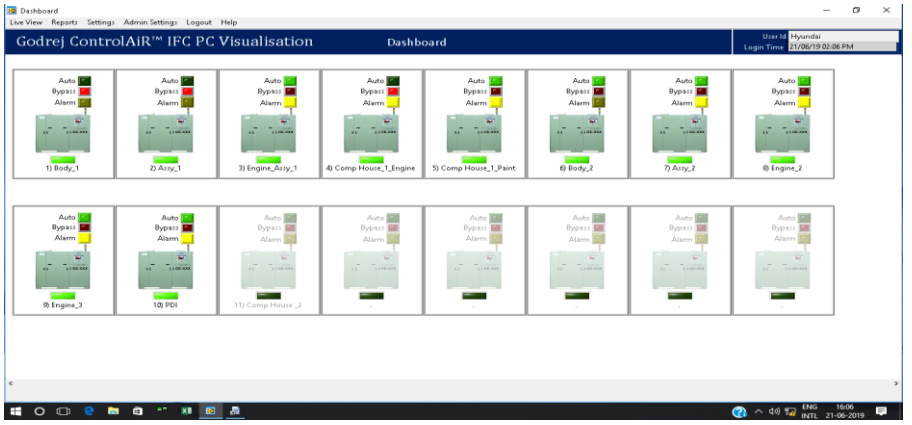
01 **Smart Solution**

○ Digitisation for controlling Direct energy consuming equipment's

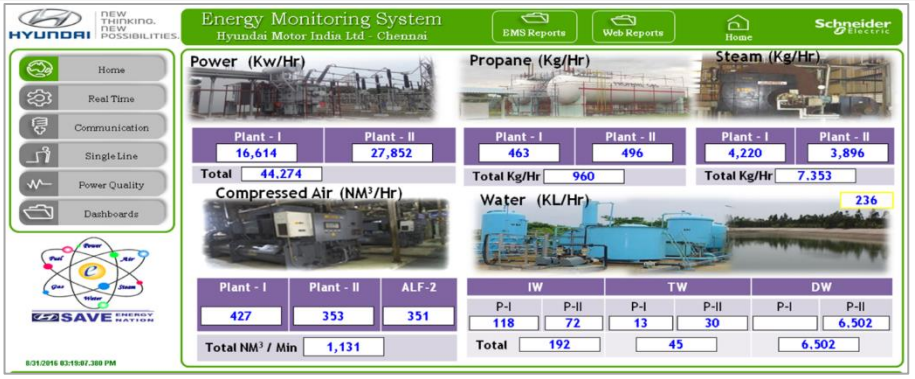
Online monitoring & control of all AC units

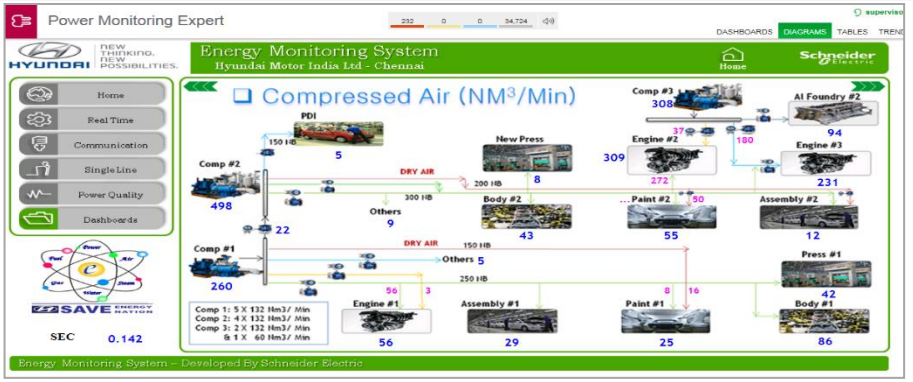


Real time monitoring & control of IFC for compressed air pressure ↓

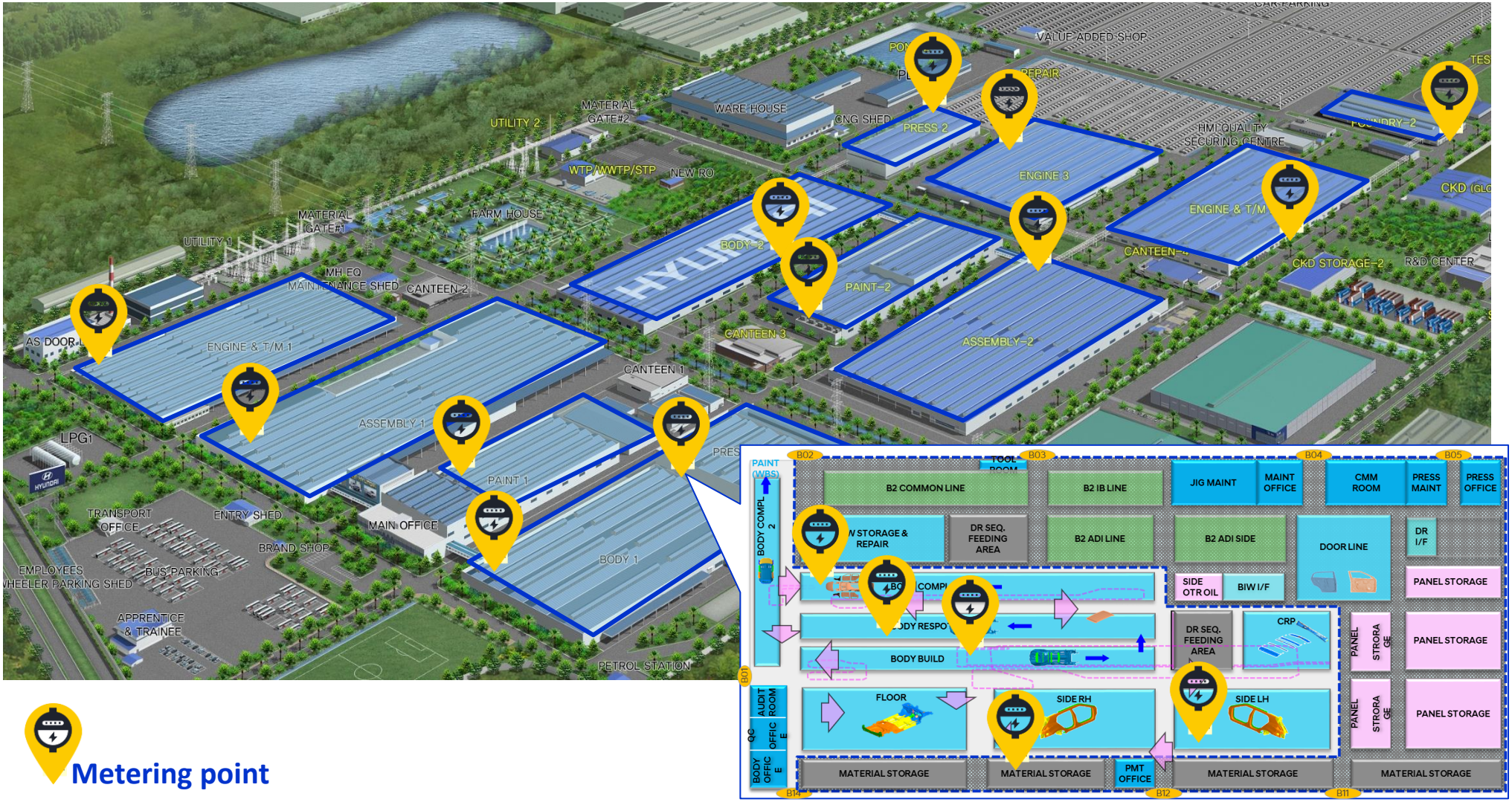


Global Energy Monitoring System (GEMS)





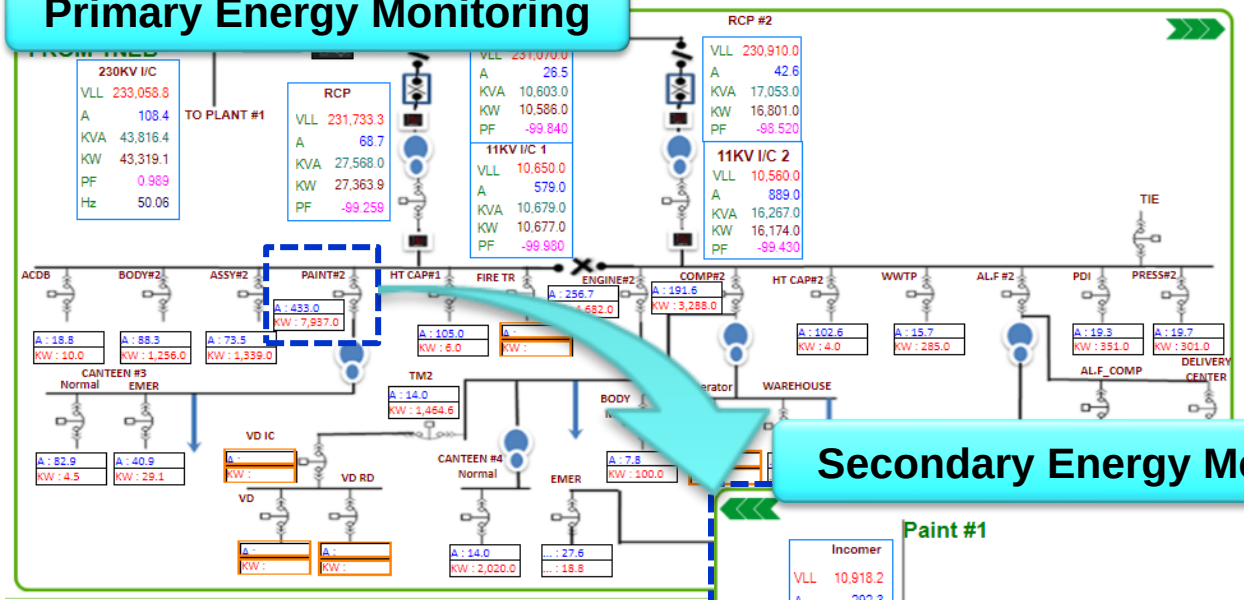
Strengthening Monitoring 「Secondary Monitoring System」



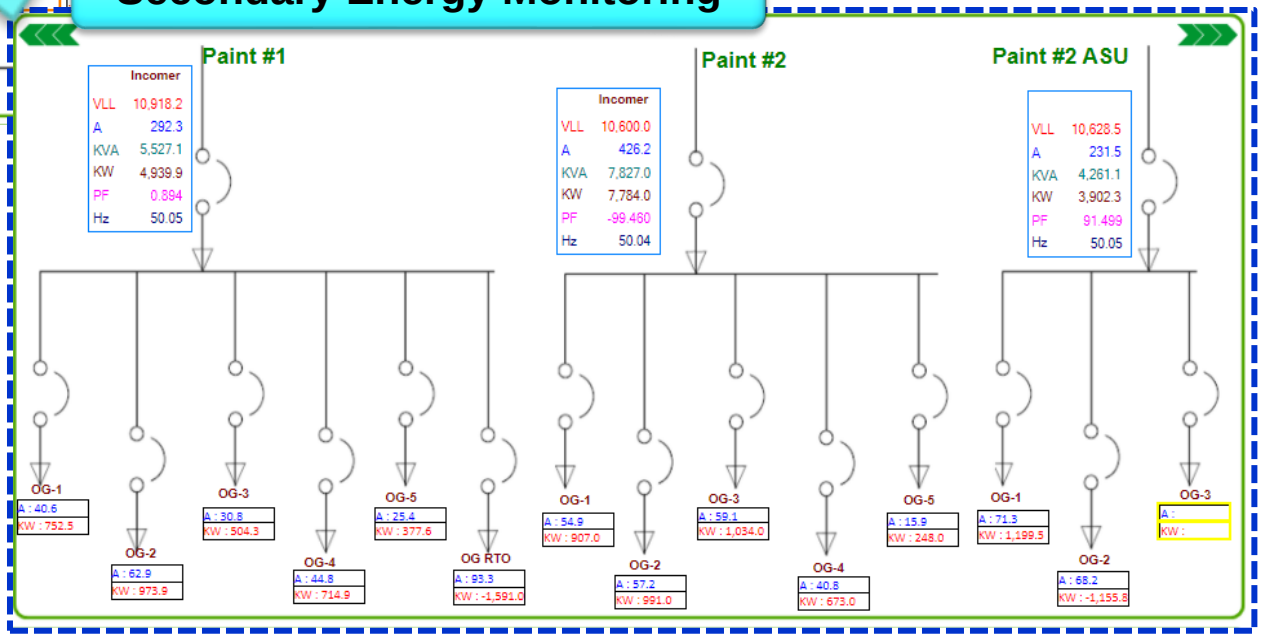
Metering point

Strengthening Monitoring 「Secondary Monitoring System」

Primary Energy Monitoring



Secondary Energy Monitoring



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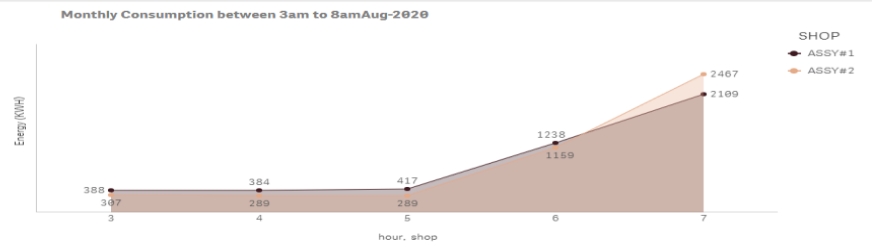
Monitoring 「Internal Benchmarking」

Start up Power consumption reduction

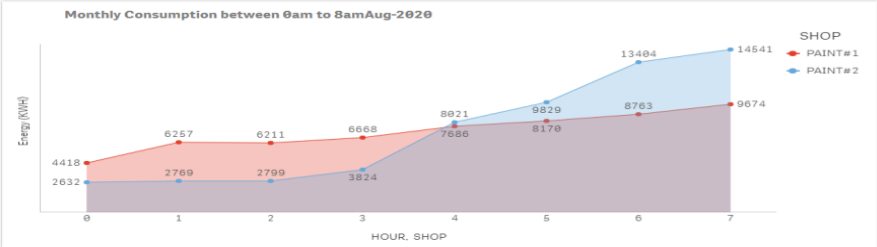
Peak and Startup Analysis | Production Analysis | Cost Analysis

PLANT
SHOP
SHIFT
HOUR
YEAR
MONTH
DATE
DAY
SAP WORK TIME
PEAK
STD. BREAK TIME

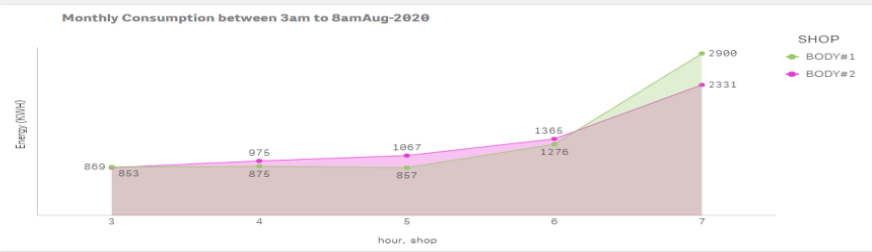
Assy#1 Vs Assy#2- Monday Morning Startup



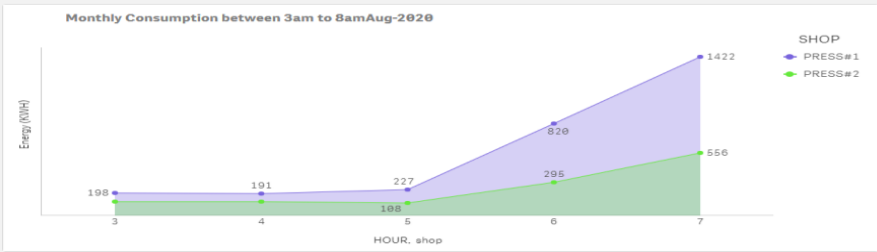
Paint#1 Vs Paint#2- Monday Morning Startup



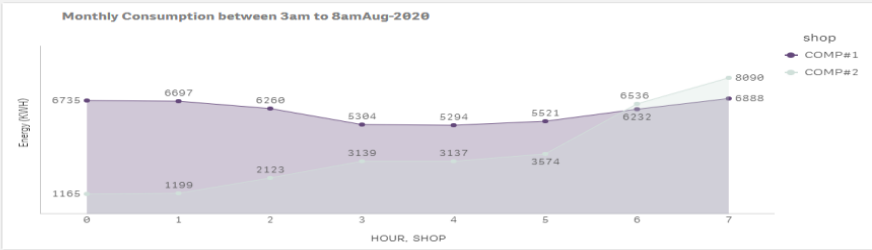
Body#1 Vs Body#2- Monday Morning Startup



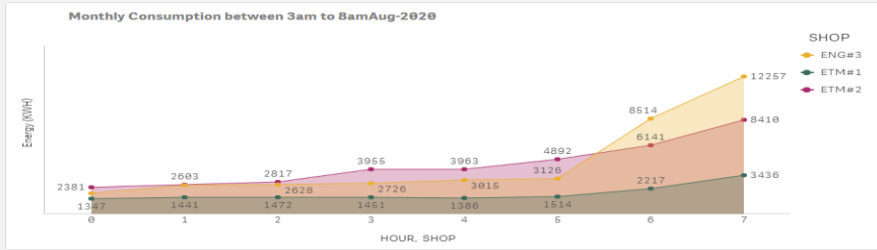
PRESS#1 Vs PRESS#2- Monday Morning Startup



Comp#1 Vs Comp#2- Monday Morning Startup



ETM#1 Vs ETM#2 vs ENG#3- Monday Morning Startup



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Hyundai Being the No. 1 & setting the benchmark indices in Automobile sector

100% LED for all type of lighting system

World No. 1 Auto OEM in Renewable energy usage

100% of SEU : VFD control & Idle time eliminated

More than 90% of AC used are efficient VRF

First Auto MNC to implement ISO 50001

World No 1 in least SEC among HKMC overseas

State of the art Waste heat recovery unit

Least compressed air leakage % (4.5 %)

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Excellence is a Journey, Not a Destination..!