Amara Raja Batteries Limited, Chittoor

WELCOME

22nd National Award for Excellence in Energy Management 2021

24 - 27 August 2021

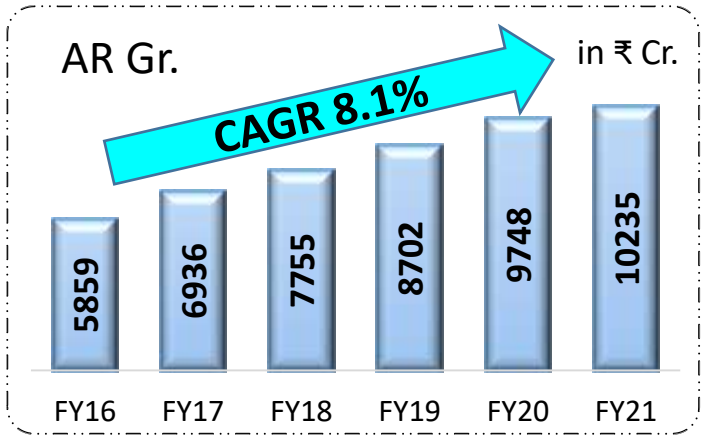
Team members:

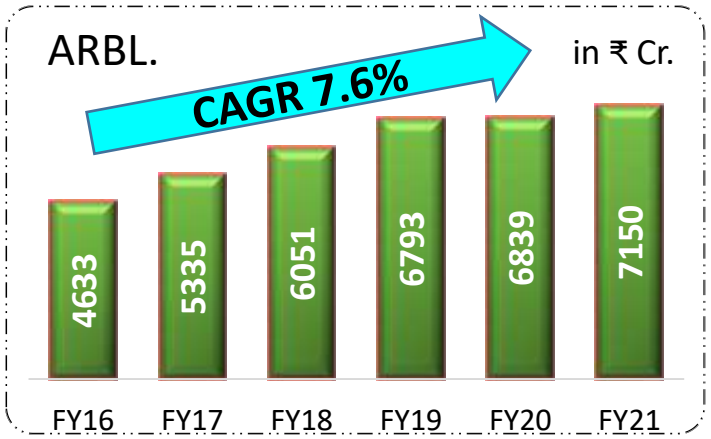
Subhash M, General Manager & HOD - Centre Of Excellence

Vinaya Sagar K.B., Head - Energy management

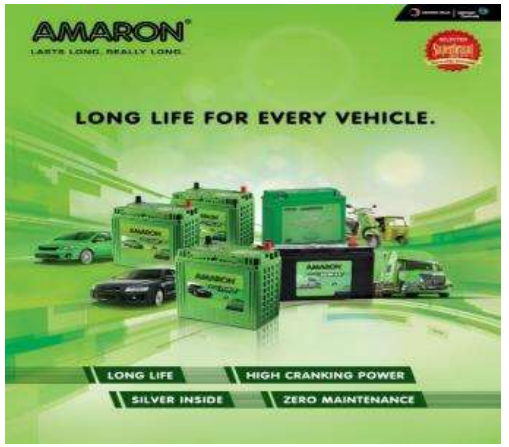
Kumara Swamy K – DGM, Power Distribution

Amara Raja- A Clear differentiator





Product Brands



Amara Raja Batteries Limited

Ownership:

- Incorporated in 1985 & Public Limited Company Est. in 1991

Manufacturing Locations:

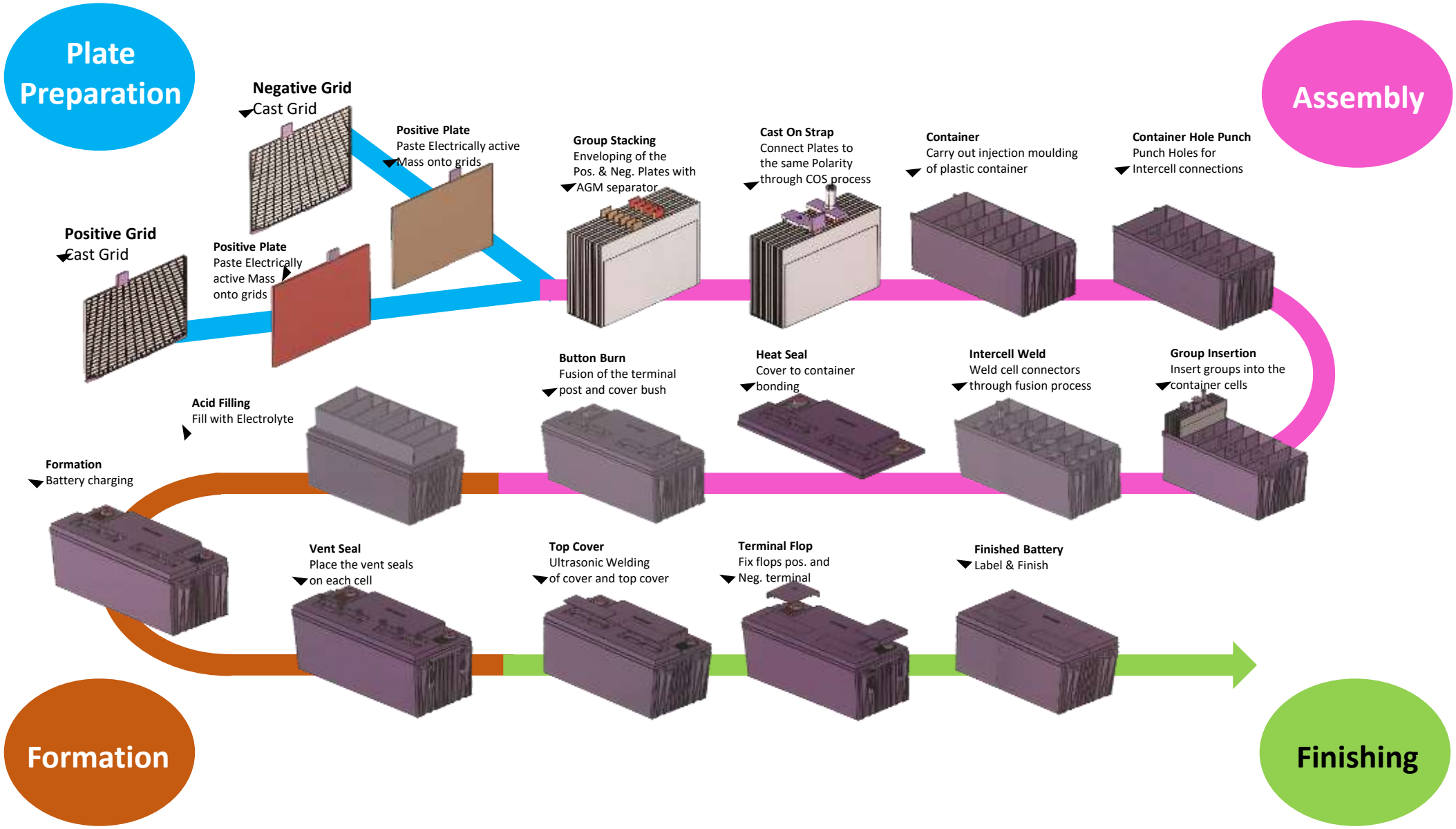
- 6 Plants in 200 Acres at Tirupati, Rural place in INDIA
- **Amara Raja Growth Corridor with 5 plants in 500Acres at Chittoor, AP**
- Providing Employment to nearly 15000 people directly
- The largest single manufacturing facility in Indian ocean rim

Our Innovative dynamism:

- Brought VRLA technology in two wheeler to India
- Exclusive Vendor to OE premium segment Vehicles

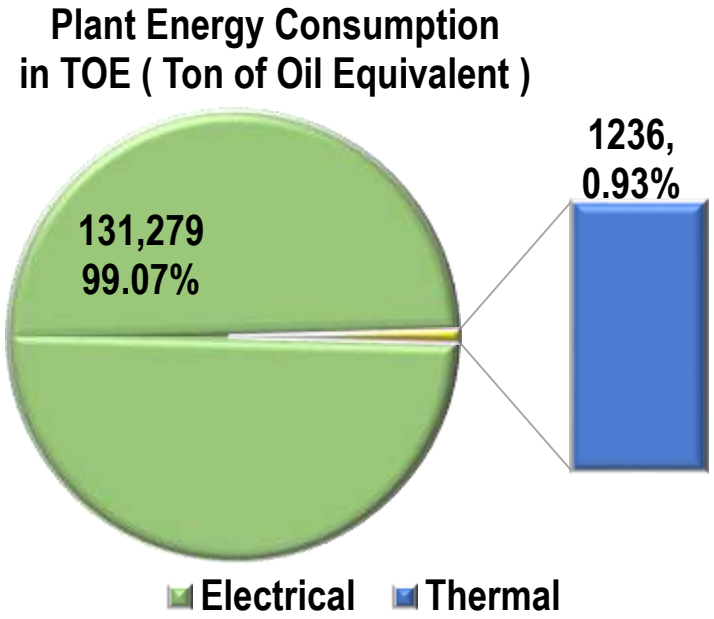
Amaron Sleek

Battery Manufacturing Flow Diagram



Energy Consumption Overview

Energy Sources



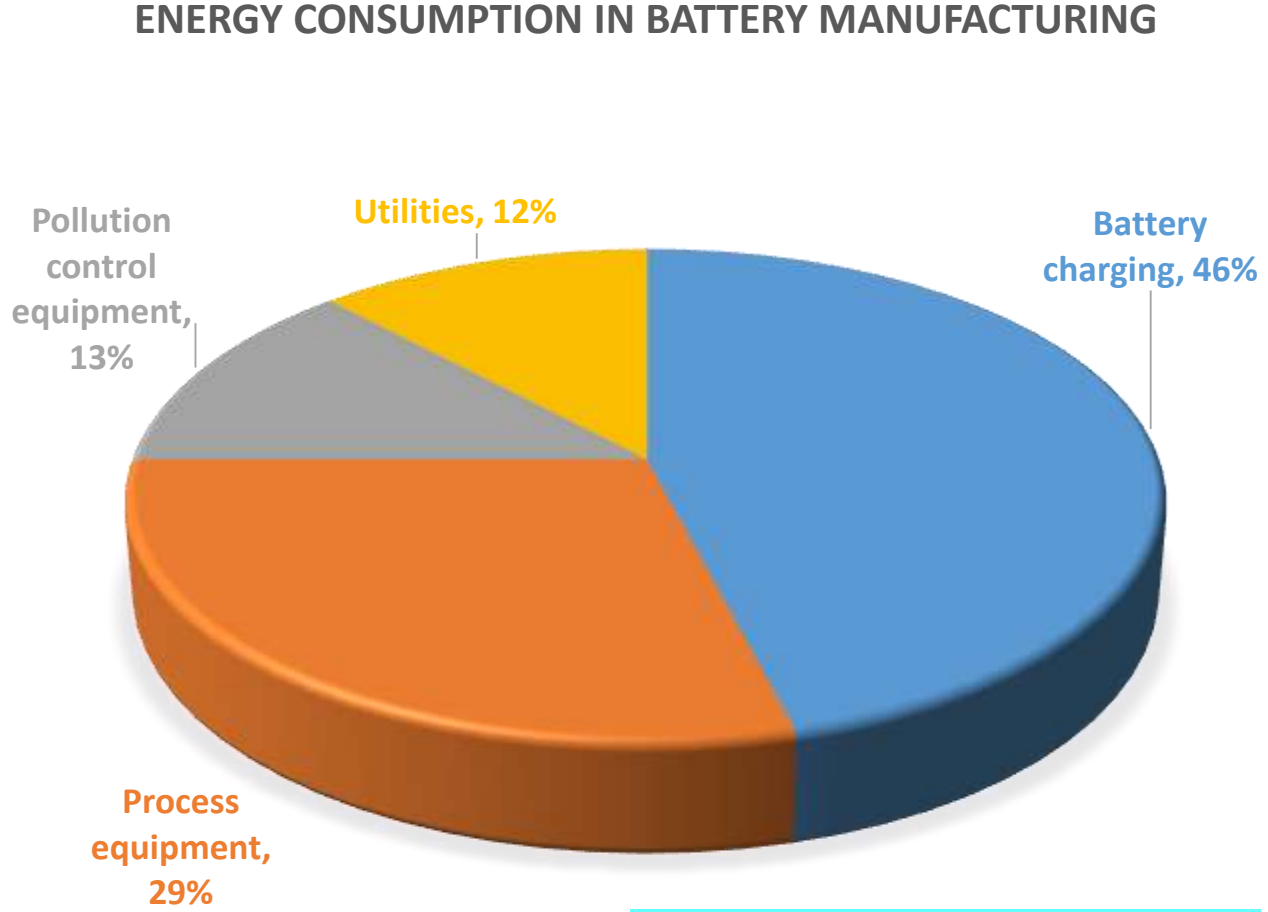
Electrical

- 152.7Mn Units
- 1,31,279 TOE

Thermal

- 1,236TOE (HSD, LPG, Acetylene)

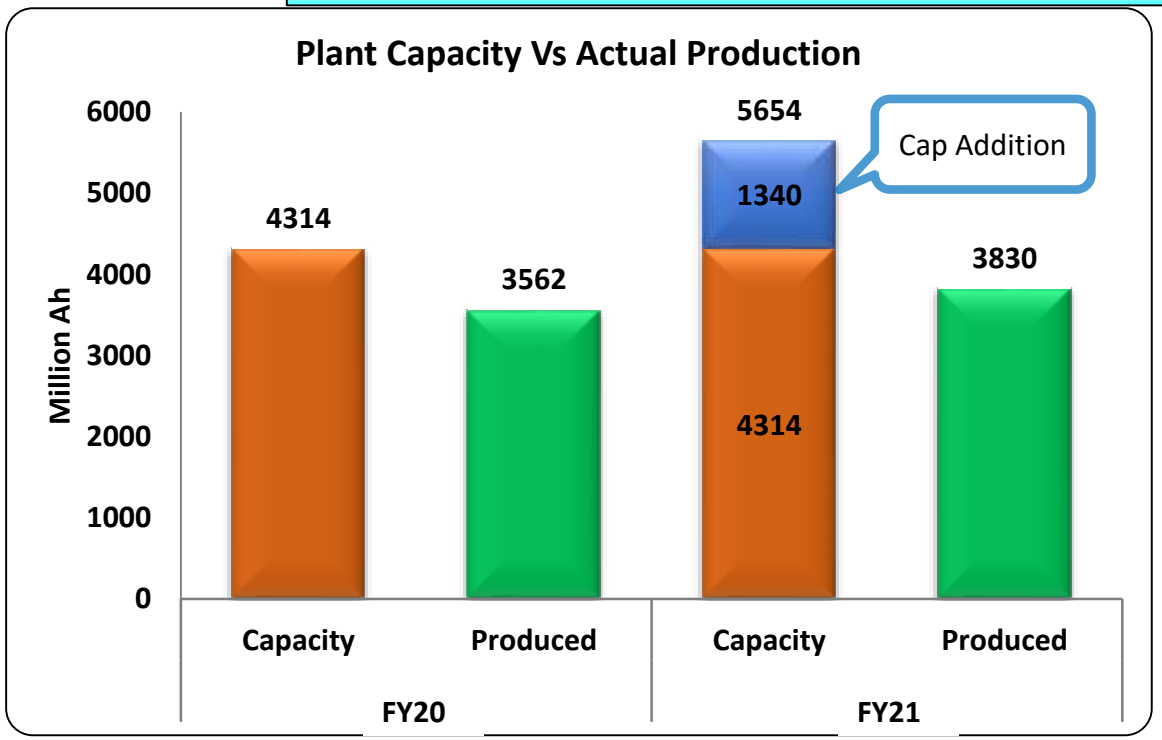
Energy Consumption in Battery Manufacturing

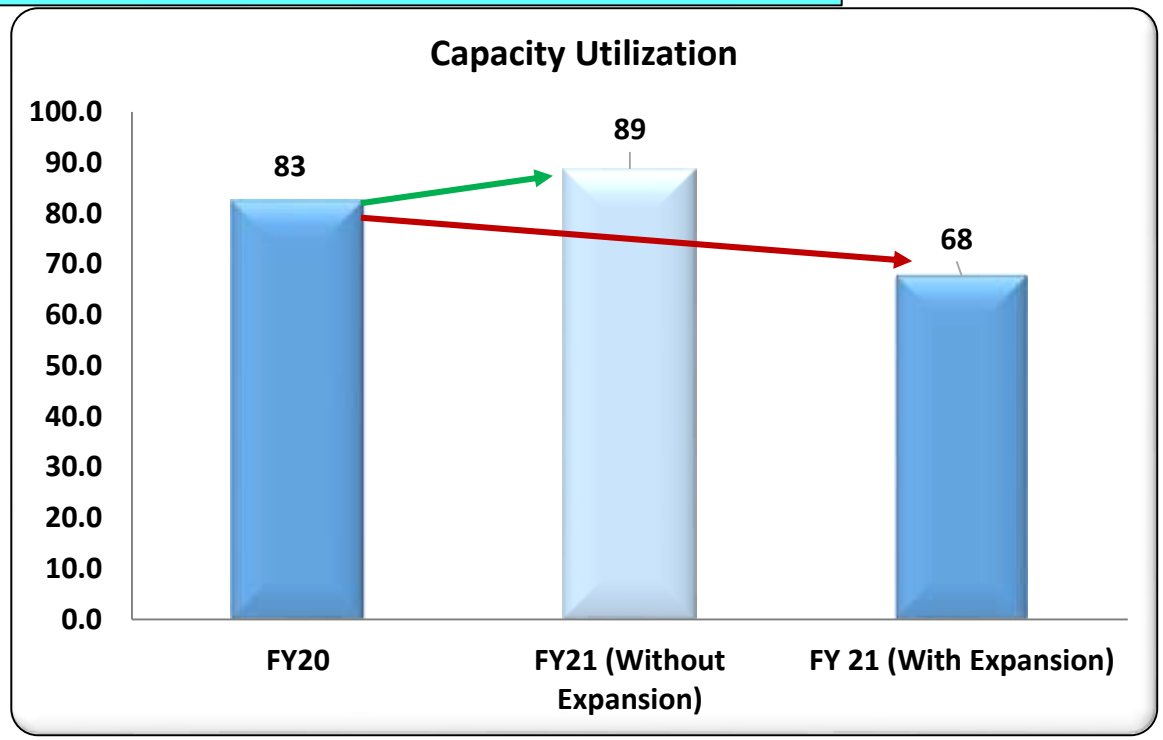


100% Fully charged in Factory

Impact of Covid-19

Impact of annual production performance : Reduced by 15%





1. Plant capacity increased by 31% due to expansions
2. Production increased by 7.5% over FY 20
3. Capacity utilization increased from 83 % to 89 % without expansion
4. With expansions capacity utilization reduced from 83% to 68% due to Covid 19 related issues.

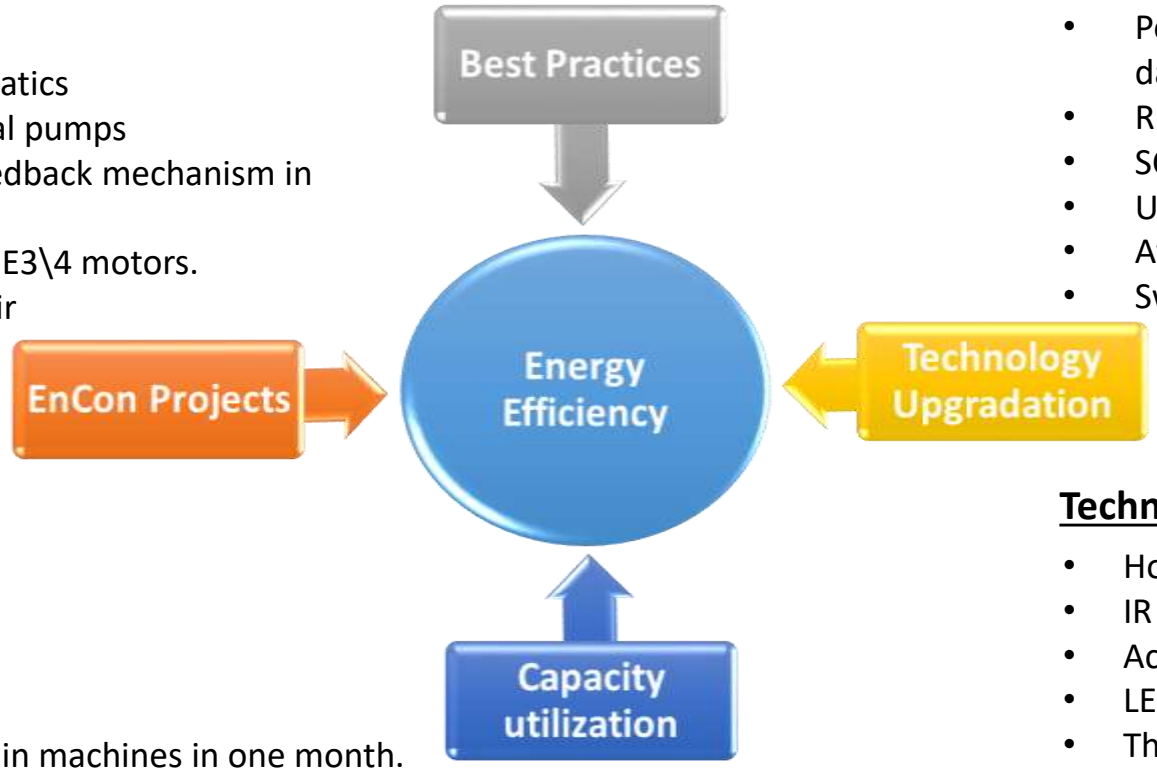
Amara Raja Model of Energy Conservation

EnCon projects:

- Lead pot size Optimization
- Improved Heater Controls
- Roof top solar systems
- LED Lighting across the plants
- Electrical Vibrators in place of Pneumatics
- Replacing AODD pumps with Electrical pumps
- High efficiency Water pumps with feedback mechanism in WRS and Cooling towers
- Replacement of normal motors with IE3\4 motors.
- Optimum utilization of Compressor air
- Reduction of Skin temperature.
- Heat recovery from Compressors
- Auto descaling of chillers.
- IR Heaters for Flash dryers.

Off Peak load scheduling :

- Operate the Acid Chillers during OFF peak hrs and store for Peak hour consumption.
- Operate the water pumps to fill the overhead tanks.
- Formation Rework process in OFF Peak hours



Best Practices:

- Always run both reactors connected to single lead pot
- Switch off Flash dryer during pasting machine stoppages.
- Periodical checking of healthiness of damper controls
- Run lead pots at lower band of specification.
- SCR Parameters fine tuning in COS lead pot.
- Use all circuits in a charger.
- Avoid manual bypassing of WRS water.
- Switch off lights when not required..

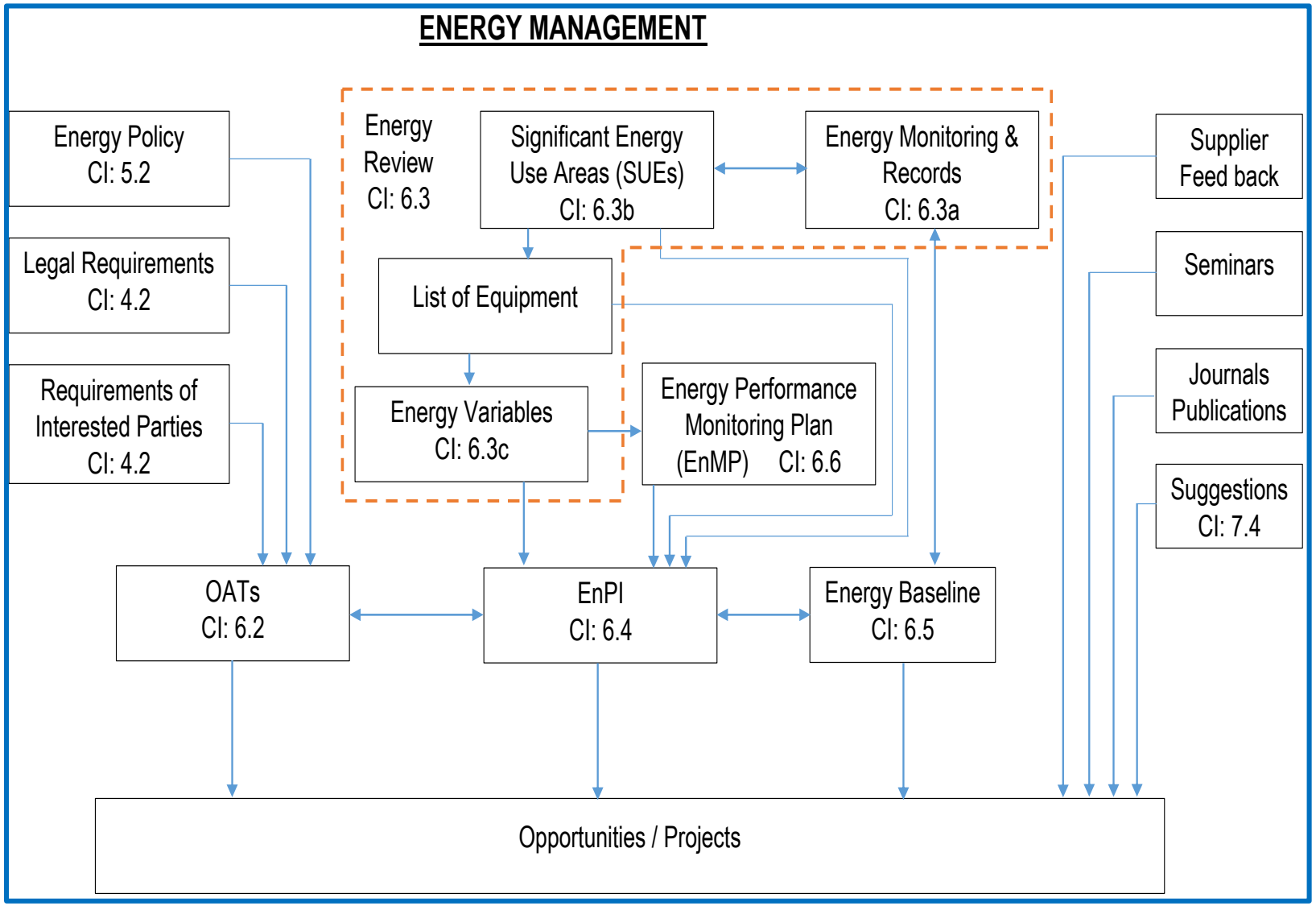
Capacity Utilization:

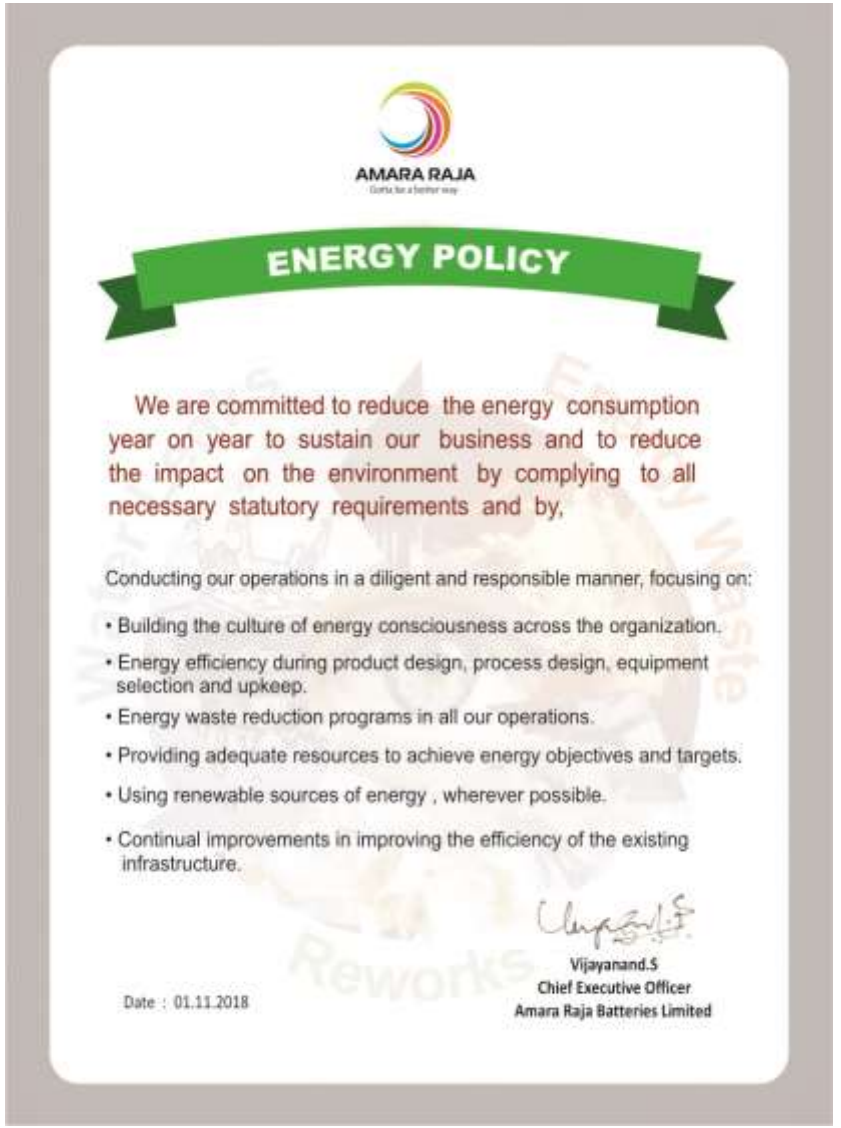
- Reduce number of Restarts in machines in one month.
- Trail run energy to be capitalized till 50% capacity is achieved.

Technology Upgradation:

- Hot Water Based Heating system for Ovens
- IR heaters For Flash Driers
- Active Harmonic Filters
- LED Lighting across the plants
- Thermal Energy Storage
- Brush Less DC Fans for AHUs & FA systems
- Auto Descaling systems of Chillers

ISO 50001:2018 Methodology for Energy Efficiency





AMARA RAJA

ENERGY POLICY

We are committed to reduce the energy consumption year on year to sustain our business and to reduce the impact on the environment by complying to all necessary statutory requirements and by,

Conducting our operations in a diligent and responsible manner, focusing on:

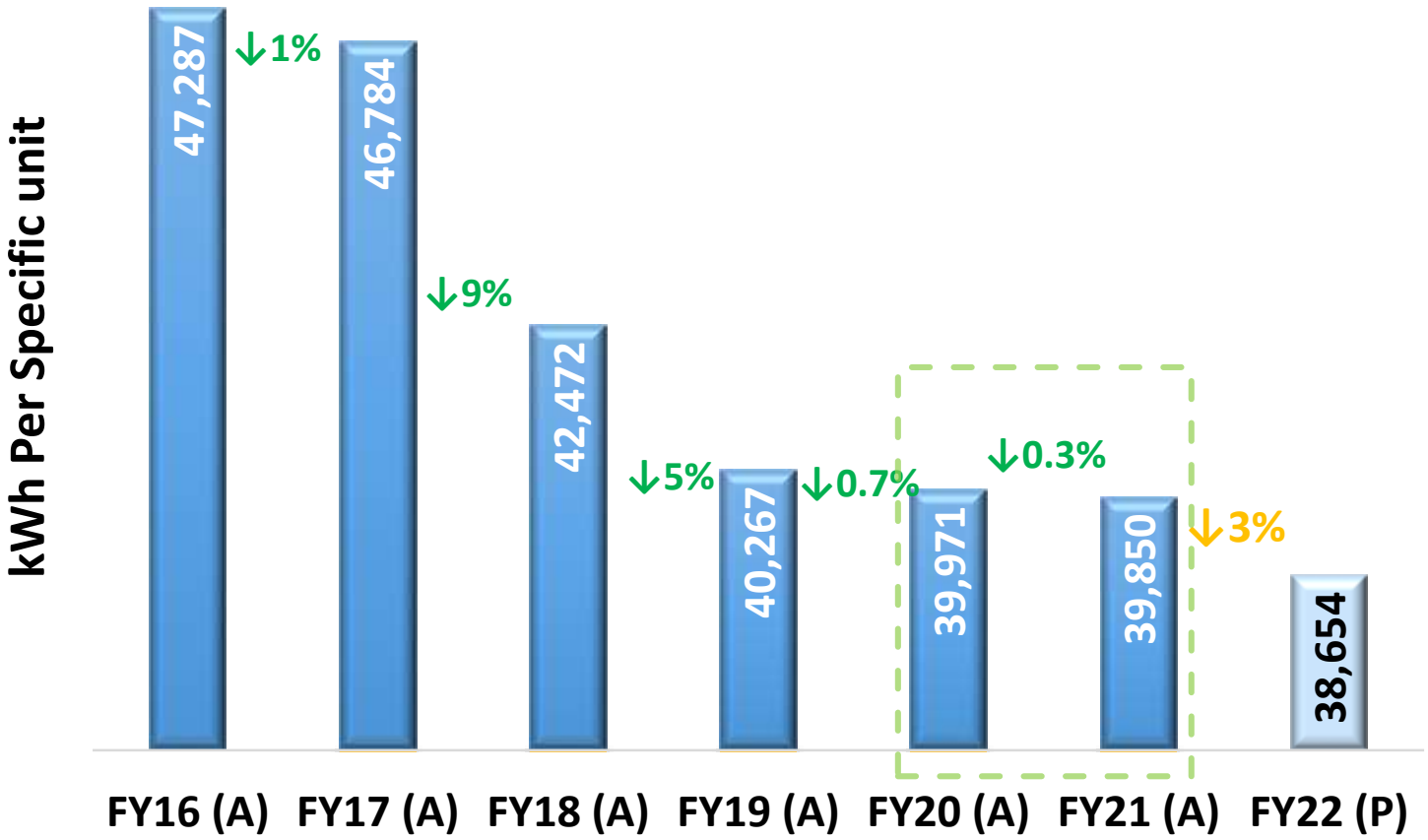
- Building the culture of energy consciousness across the organization.
- Energy efficiency during product design, process design, equipment selection and upkeep.
- Energy waste reduction programs in all our operations.
- Providing adequate resources to achieve energy objectives and targets.
- Using renewable sources of energy , wherever possible.
- Continual improvements in improving the efficiency of the existing infrastructure.

Vijayanand.S
Chief Executive Officer
Amara Raja Batteries Limited

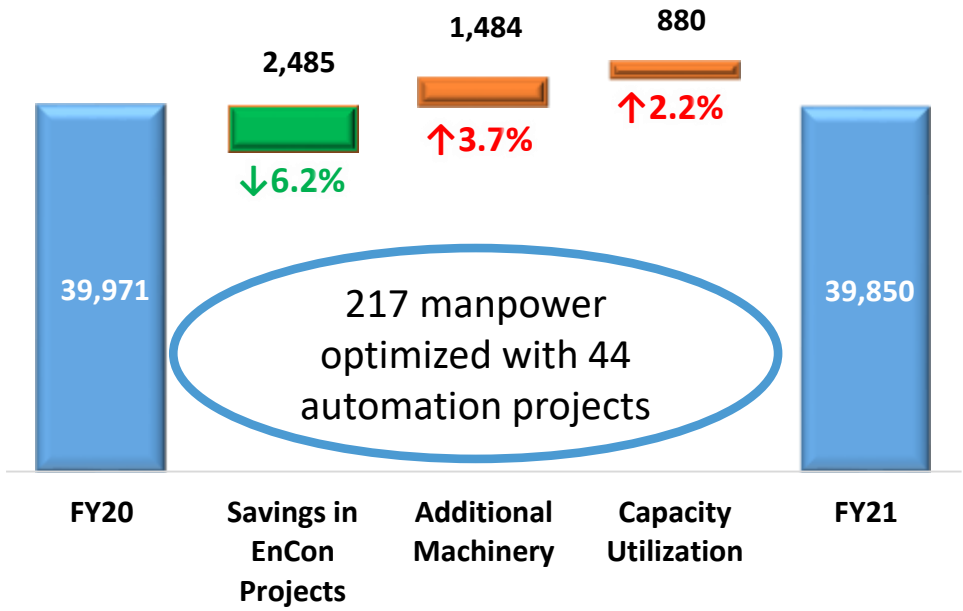
Date : 01.11.2018

Specific Energy Consumption

Sp. Energy Consumption per Specific unit



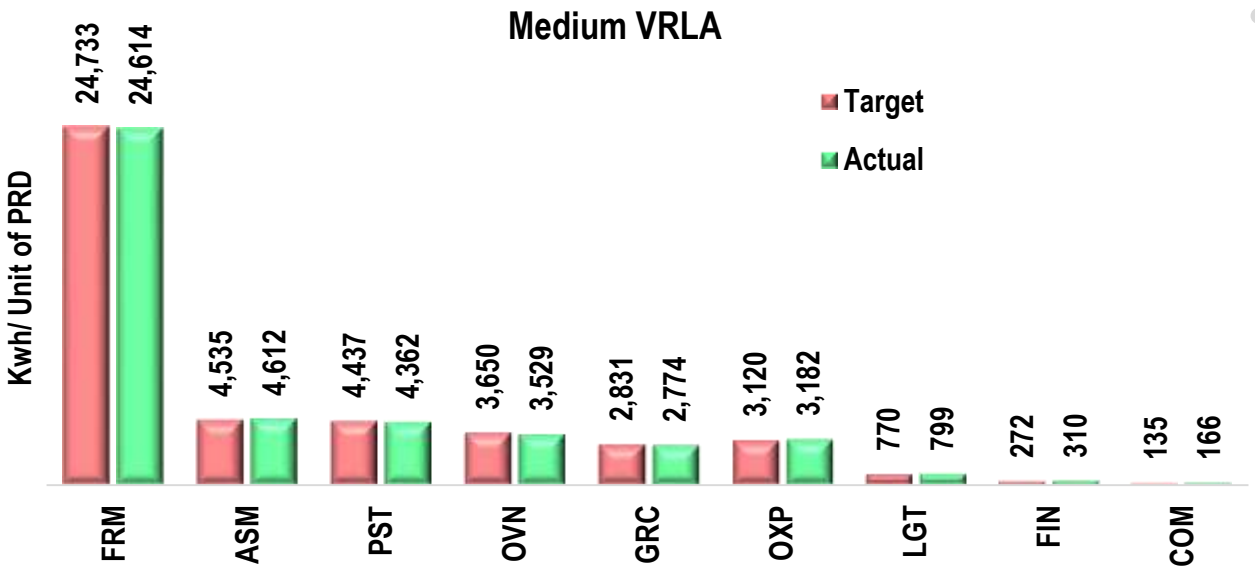
SEC Contribution

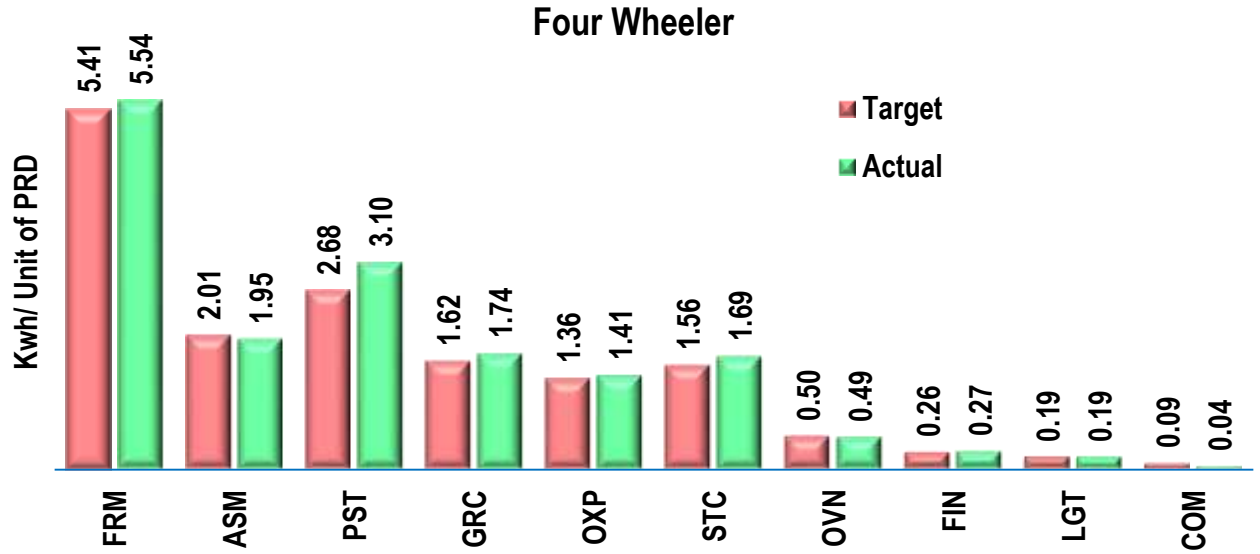


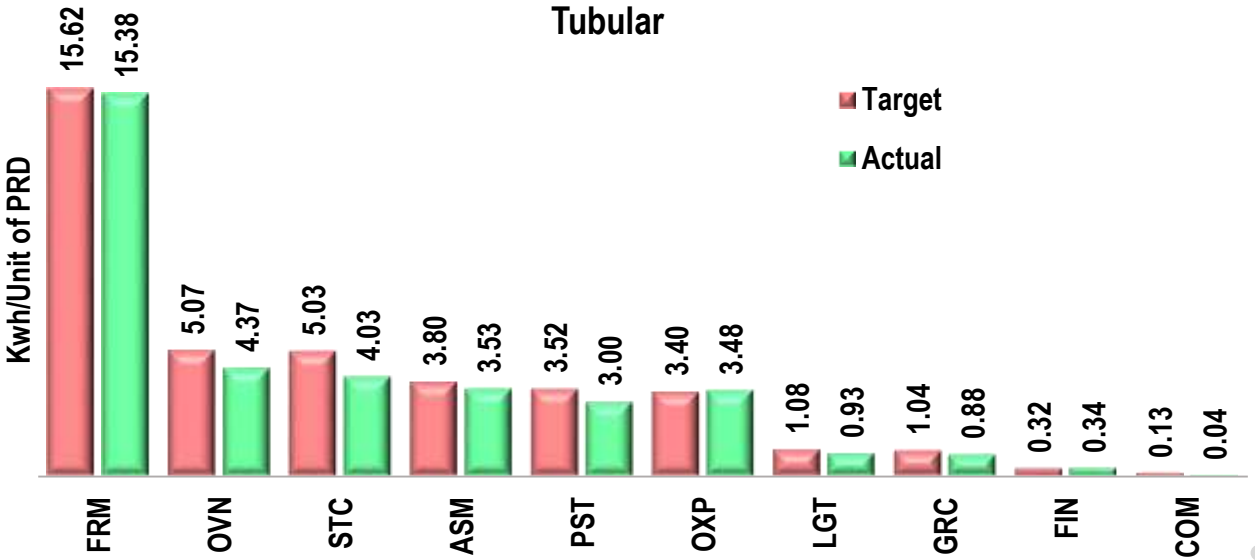
SP. Energy Reduction

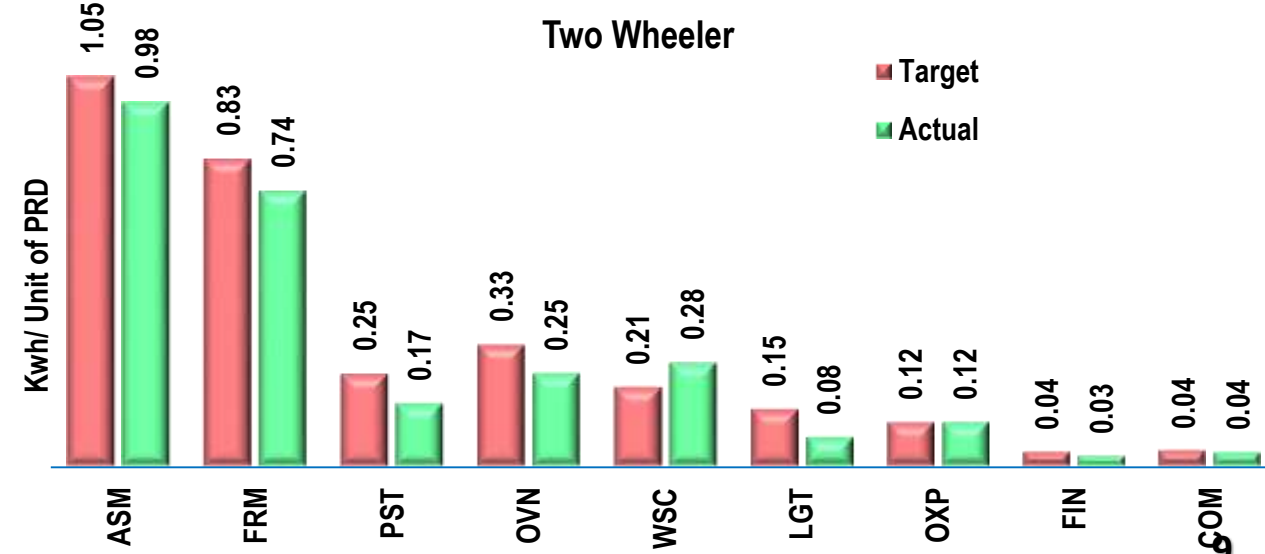
FY 16-21 :- 15.7 %

SEC of Significant Energy Use Areas



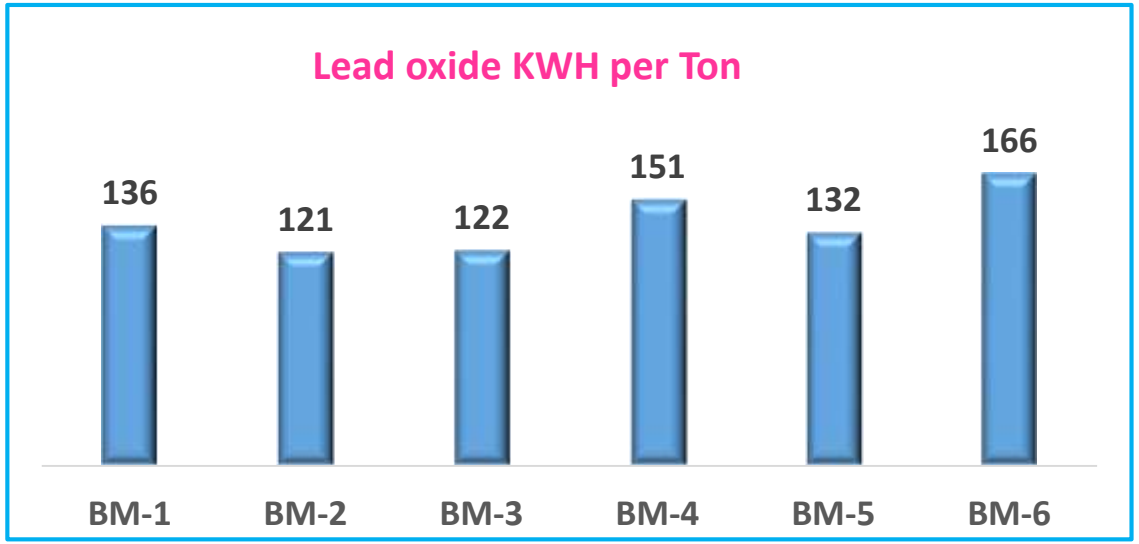




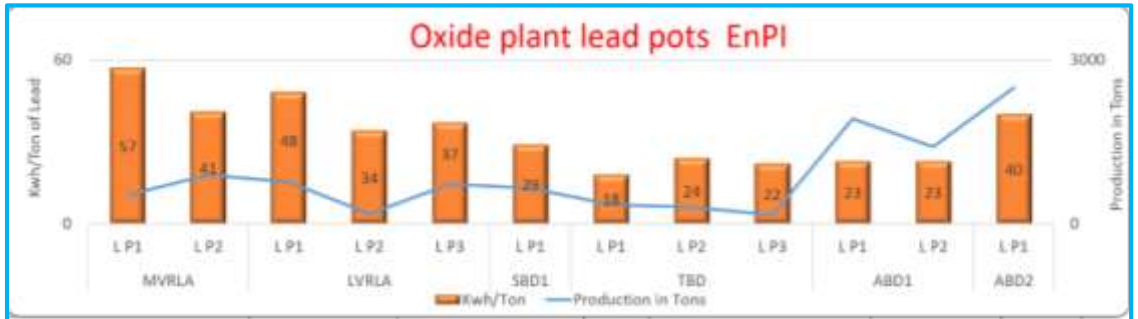


ISO 50001:2018 Methodology for Energy Monitoring

ENPI Monitoring

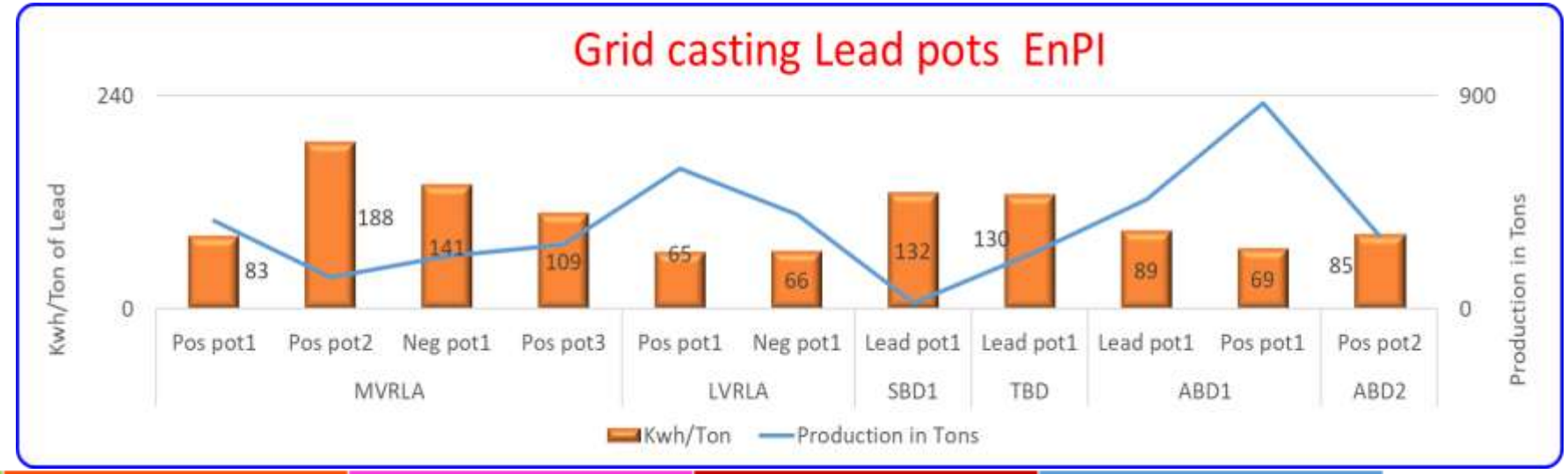


Variables Monitoring



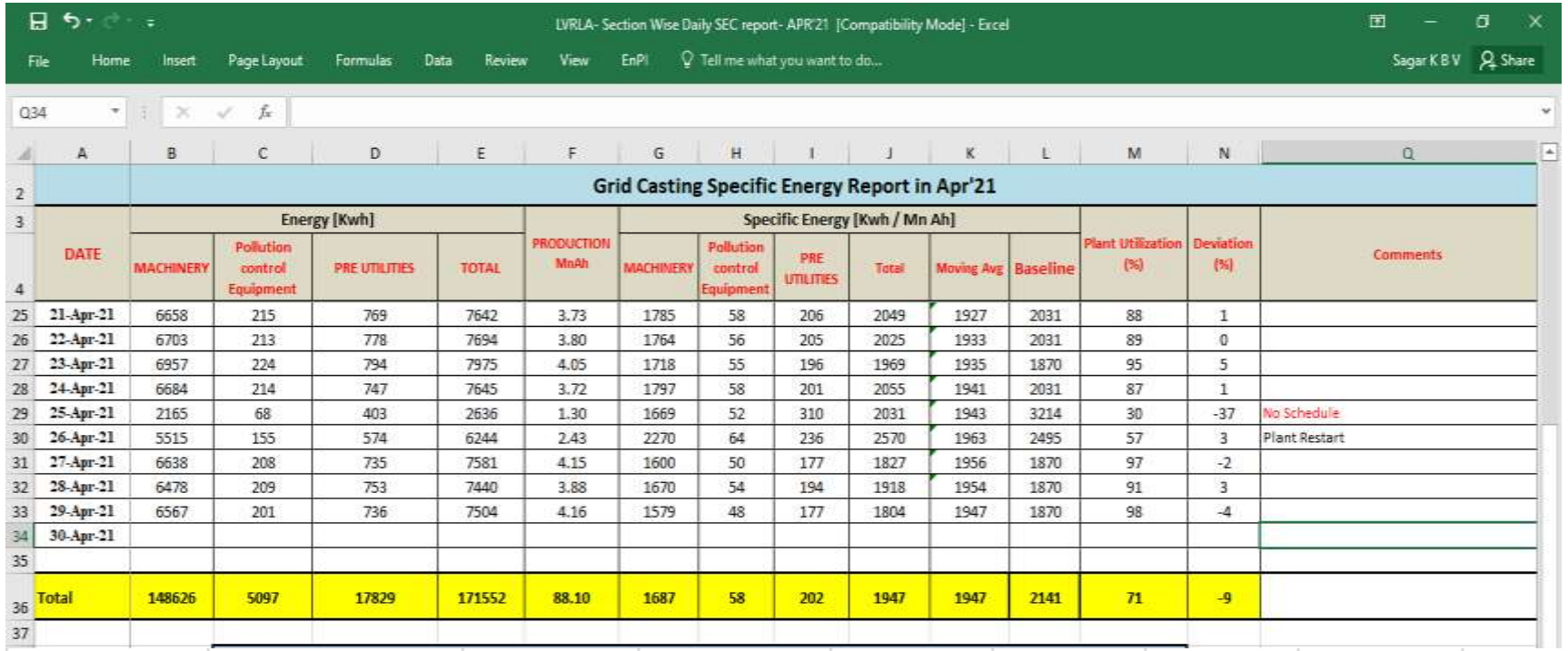
Variables of lead pots	MVRLA		LVRLA			SBD1	TBD			ABD1		ABD2
	LP1	LP2	LP1	LP2	LP3	LP1	LP1	LP2	LP3	LP1	LP2	LP1
Lead melting Temperature	430	430	475	475	475	425	430	430	430	400	400	400
Capacity consumption Ratio	5	5	5	5	5	4	5	5	5	2.7	2.7	6.7
Skin temperature	90	95	65	74	55	60	45	50	45	47	46	75
Hood design (Old \ New)	Old	Old	Old	Old	Old	New	Old	Old	Old	New	New	Old
Heater controller	SCR	SCR	SCR	SCR	SCR	SCR	SCR	SCR	SCR	SCR	SCR	SCR

Interplant Comparison of SEC of Equipment



ISO 50001:2018 Methodology for Energy Monitoring

Daily SEC Reporting comparing with baseline



Grid Casting Specific Energy Report in Apr'21

DATE	Energy [Kwh]				PRODUCTION MnAh	Specific Energy [Kwh / Mn Ah]						Plant Utilization (%)	Deviation (%)	Comments
	MACHINERY	Pollution control Equipment	PRE UTILITIES	TOTAL		MACHINERY	Pollution control Equipment	PRE UTILITIES	Total	Moving Avg	Baseline			
21-Apr-21	6658	215	769	7642	3.73	1785	58	206	2049	1927	2031	88	1	
22-Apr-21	6703	213	778	7694	3.80	1764	56	205	2025	1933	2031	89	0	
23-Apr-21	6957	224	794	7975	4.05	1718	55	196	1969	1935	1870	95	5	
24-Apr-21	6684	214	747	7645	3.72	1797	58	201	2055	1941	2031	87	1	
25-Apr-21	2165	68	403	2636	1.30	1669	52	310	2031	1943	3214	30	-37	No Schedule
26-Apr-21	5515	155	574	6244	2.43	2270	64	236	2570	1963	2495	57	3	Plant Restart
27-Apr-21	6638	208	735	7581	4.15	1600	50	177	1827	1956	1870	97	-2	
28-Apr-21	6478	209	753	7440	3.88	1670	54	194	1918	1954	1870	91	3	
29-Apr-21	6567	201	736	7504	4.16	1579	48	177	1804	1947	1870	98	-4	
30-Apr-21														
Total	148626	5097	17829	171552	88.10	1687	58	202	1947	1947	2141	71	-9	

Base Line Energy values for different Capacity utilization

Sl. No.	Rev Date	(Section) Production Capacity	Kwh/MnAh							
			90-100 %	80-89 %	70-79 %	60-69 %	50-59 %	40-49 %	30-39 %	< 30 %
1	Rev-0(01.05.19)	4.44	2363	2498	2695	2974	3116	3560	3728	3959
2	Rev-1(01.04.20)	4.44	1962	2102	2242	2403	2606	2741	2930	3024
3	Rev-2(01.04.21)	4.44	1870	2031	2141	2342	2495	2954	3214	3569

Energy Benchmarking

National Benchmarking

International Benchmarking

Data Source: Annual reports of 2018-19

Further Focusing on..

- Efficient Curing profile
- Solar PV Panels
- Heat Recovery system
- IIOT
- Quick Recharge system
- Punched Grid Technology
- Optimized Formation process
- Lead Pot design modification

Ongoing Energy saving projects for FY'22

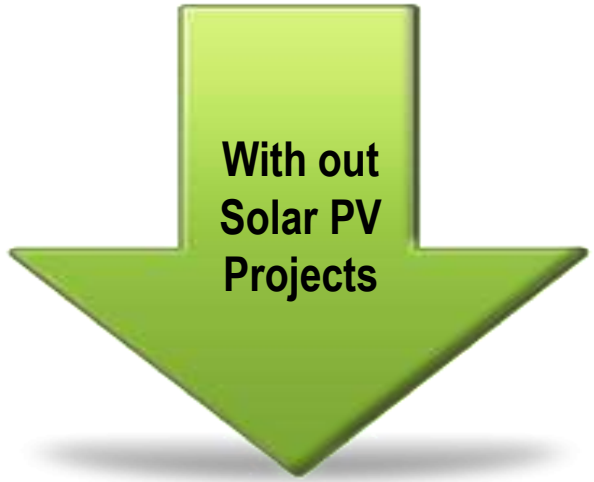
List of Ongoing Energy saving projects - FY' 22 Amara Raja Batteries Ltd - Chittoor					
S No	Title of project	Annual savings in Kwh	Annual savings in Mn Rs	Investment in Mn Rs	Pay back in months
1	Solar installation in ASG & ARGC PV panels skylights 3.93 MW	5,733,728	34.40	186.50	65
2	Replacement of Centrifugal blower with BLDC fans in Fresh Air systems	1,201,472	7.21	13.40	22
3	Replace AODD pumps with energy efficient centrifugal pumps	126,000	0.76	1.18	19
4	Improved heater controls for lead pots	229,800	1.38	1.21	11
5	Install direct driven EC motors for charger room AHU's (BLDC)	917,390	5.50	10.72	23
6	IR Heaters for pasting flash dryer	212,000	1.27	0.94	9
7	Install Auto descaling system for water chillers	177,650	1.07	2.18	25
8	Skin temperature reduction in lead Pot	123,400	0.74	0.95	15
9	Replace existing conventional lamps with LED	218,140	1.31	3.10	28
10	Replace with direct coupling in place of blower belts	341,512	2.05	2.46	14
11	Elimination of washing tunnel blowers & provide pneumatic dampers in DE sys.	129,709	0.78	0.33	5
12	Provide Occupancy sensors for central maintenance lighting	6,300	0.04	0.02	6

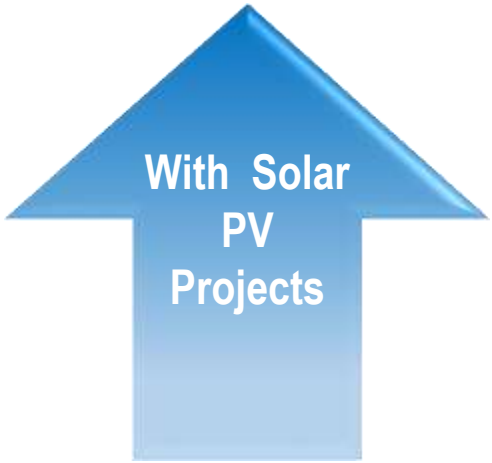
Ongoing Energy saving projects for FY'22

List of Ongoing Energy saving projects - FY' 22 Amara Raja Batteries Ltd - Chittoor					
S No	Title of project	Annual savings in Kwh	Annual savings in Mn Rs	Investment in Mn Rs	Pay back in months
13	Install Compressor Air Consumption monitoring Kit	180,000	1.08	0.61	7
14	Replace trans vector nozzle in place of compressor air cleaning applications	12,240	0.07	0.06	10
15	Replacement of cooling tower fan blades with Epoxy glass coated FRP blades	33,480	0.20	0.125	7
16	Install Fan less cooling tower in MVRLA Grid casting cooling tower	84,000	0.50	0.50	12
17	Ah input reduction in MVRAL formation chargers	618,400	3.71	0	-
18	Formation Chargers replacement with IGBT chargers (60 No's.) in MVRLA	588,400	3.53	13.9	47
19	Provide IFC control system for Air compressors in TBD	210,000	1.26	1.1	11
20	Capacitor banks added in SDB level for Maintain Power factor unity in TBD	90,000	0.54	0.9	21
21	Provide Exhaust for compressor room in TBD	70,000	0.42	0.4	10
22	Replacement of Air compressor screw element with Energy Efficient motor in TBD	231,250	1.39	2.4	20
Total for 2021-22		**1,04,28,453**	**63**	**406**	**78**

Statistics on EnCon Projects

Year	No of Projects	Investment (in Mn)	Savings (in Mn)	Payback (in Years)
FY19	28	173.5	39.8	4.4
FY20	47	256.65	62.01	4.1
FY21	37	341.85	57.10	6.0

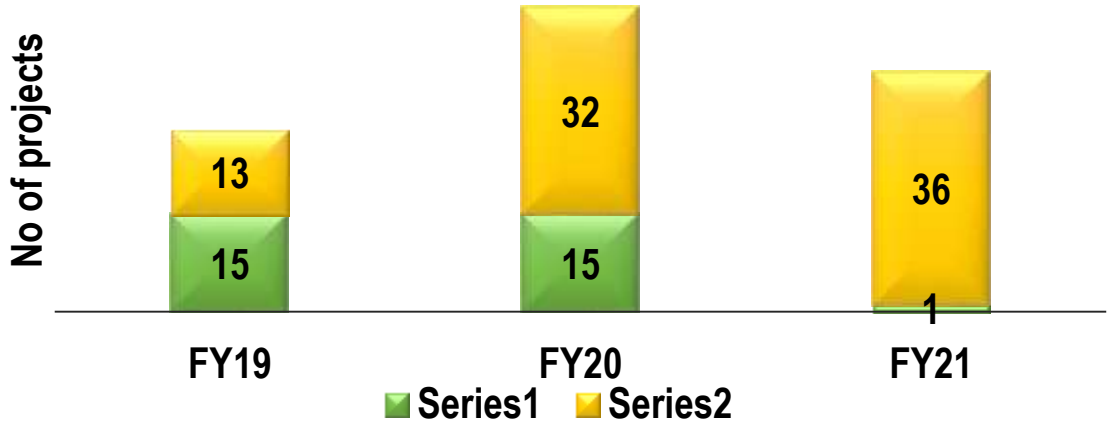




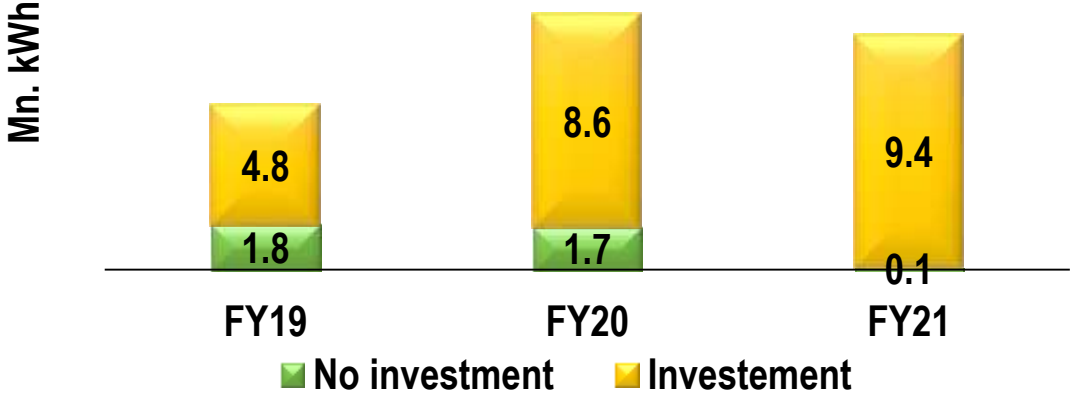
Year	No of Projects	Investment (in Mn)	Savings (in Mn)	Payback (in Years)
FY19	27	3.51	17.9	0.2
FY20	44	9.65	29.23	0.3
FY21	34	11.85	13.87	0.8

Statistics on EnCon Projects

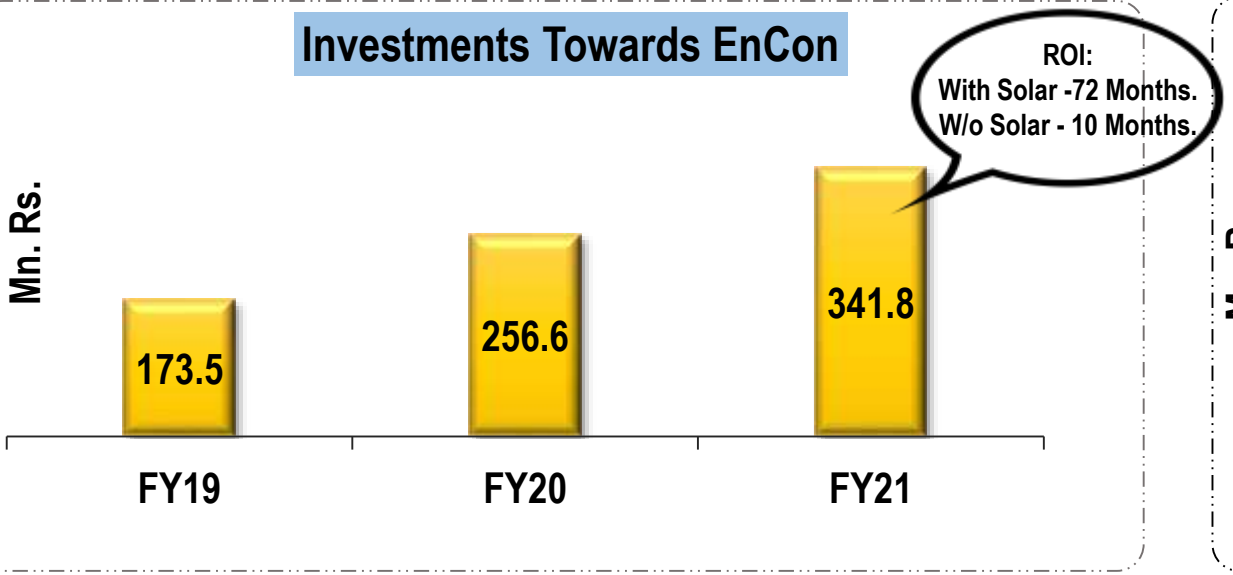
Encon projects trend



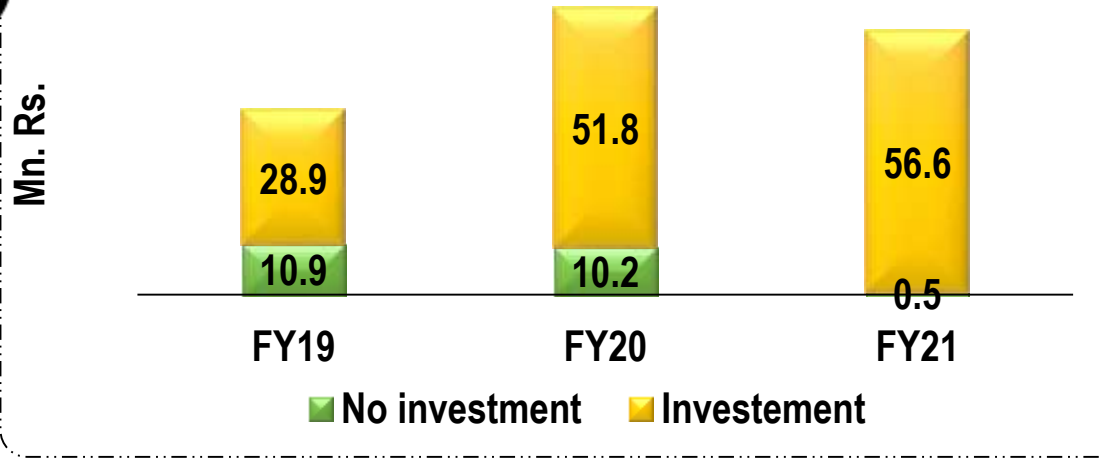
Mn. kWh Savings



Investments Towards EnCon



Cost Savings



Energy Saving Projects

1. Replacement of Centrifugal blower with BLDC fans.

Centrifugal blowers are replaced with BLDC fans in AHUs for energy saving

Energy savings/Annum: Rs 0.50 Mn. HD : 1.32 Mn

Before

After

2. Reduction of skin temperature.

Skin temperature of lead melting pot is reduced from 120°c to 55°c by provide insulation (Nano gel blanket)

Energy savings/Annum: Rs 0.63 Mn. HD : 0.82 Mn

3. Elimination of cooling tower fan

Replace the conventional cooling tower with fan less cooling tower.

Energy savings/Annum: Rs 0.28 Mn. HD : 1.2 Mn

Energy Saving Projects

Before | After

4. Auto descaling of condenser tubes in water chillers

Provided auto descaling system for cleaning of tubes in condensers in water chillers to reduce the energy consumption.

Energy savings/Annum: Rs 0.53 Mn. HD : 1.10 Mn

5. Replace pneumatic vibrators to electrical vibrators

Replaced pneumatically operated vibrators with electrical vibrators in pasting day tank.

Energy savings/Annum: Rs 0.16 Mn. HD : 0.58 Mn

6. Thyristor controls for Heaters.

Replace Thyristor control SCR in place of contactor for PDC machine lead pots.

Energy savings/Annum: Rs 0.20 Mn. HD : 0.62 Mn

Energy Saving Projects

7. Direct coupling in place of blower belt.

Replace with Direct coupling in place of blower belt for 13 ovens

Energy savings/Annum: Rs 0.34 Mn. **HD : 2 .0 Mn**

Before

After

8. Replaced AODD pumps with IE3 pumps

Replace the Air operated double diaphragm pumps with Electrically operated UHMW-PE semi opened impeller pumps

Energy savings/ Annum: Rs 0.86 Mn. **HD : 1.6 Mn**

9. Provide VFD for Water Recirculation System (WRS) pumps

Provided VFD in Formation WRS hot well & cold well pumps with feedback mechanism

Energy savings/Annum: Rs 1.25 Mn. **HD : 2.51 Mn**

Strategic Plan-Reduction of compressor load by 30%

Ultra sonic compressed air leak Detection-15%

The compressed air leak survey and cost estimation for losses.

Size Optimization of Pneumatic Cylinder-5%

Reduction of the pneumatic cylinder Size without compromising application.

Exhaust & Support operations-2%

1. Float based drain valves
2. EE nozzles
3. ES controller

Intelligent flow controller (IFC)-7%

IFC isolates the compressors from demand side fluctuations.

Pneumatic vibrators replacement- 1%

Pneumatically operated vibrators replacement with electrical vibrators

AODD Pumps replacement- 1%

Replacement of the AODD pumps with the Electrical operated PP pumps

Elimination of compressed air application-1%

High volume blower is implemented with low pressure cleaning applications.

Pulsation cycle optimization-1%

Dust collection application pulsation cycle optimization by feasibility studies.

Innovative Project -Pneumatic Cylinder Size Optimization

Methodology

Cylinder Bore
Before: Ø 80 mm

Force Required

(i) Calculate Load to be moved(m)= 63 Kg

(ii) Cylinder Force required = m*9.81
= 618 N

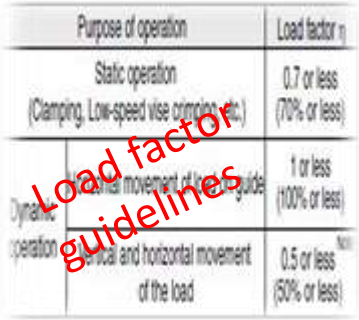
1

Load Factor

(i) Select Load factor based on type of operation.

(ii) Load factor for Clamping operation is 0.7

2

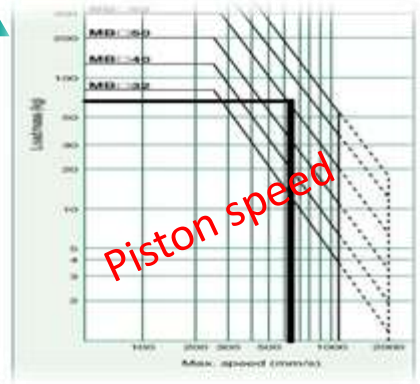


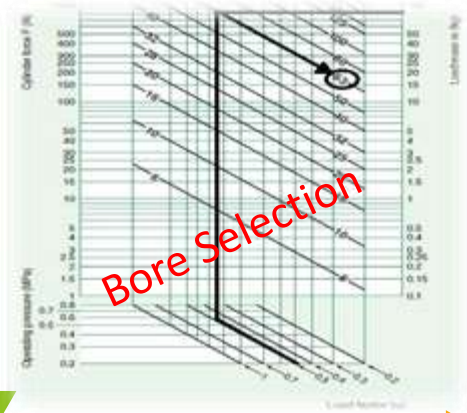
Bore Selection

(i) Coinciding point of Load, Force, load factor, Operating pressure & bore gives the suitable cylinder size.

(ii) Required bore is of 50 mm

3





Stroke length& Piston speed

(i) Look graph for Load vs Stroke speed(mm/s) to get stroke end impact.

(ii) Desired Stroke length- 80mm (Constraint of 100mm/s)

4

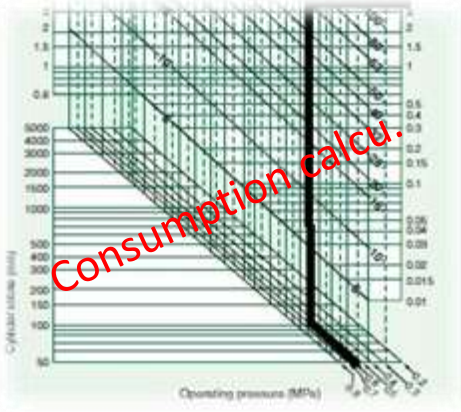
Cylinder Bore
After: Ø 50 mm

Air Consumption

(i) The Intersection point of Stroke vs Bore vs operating pressure vs consumption gives per cycle.

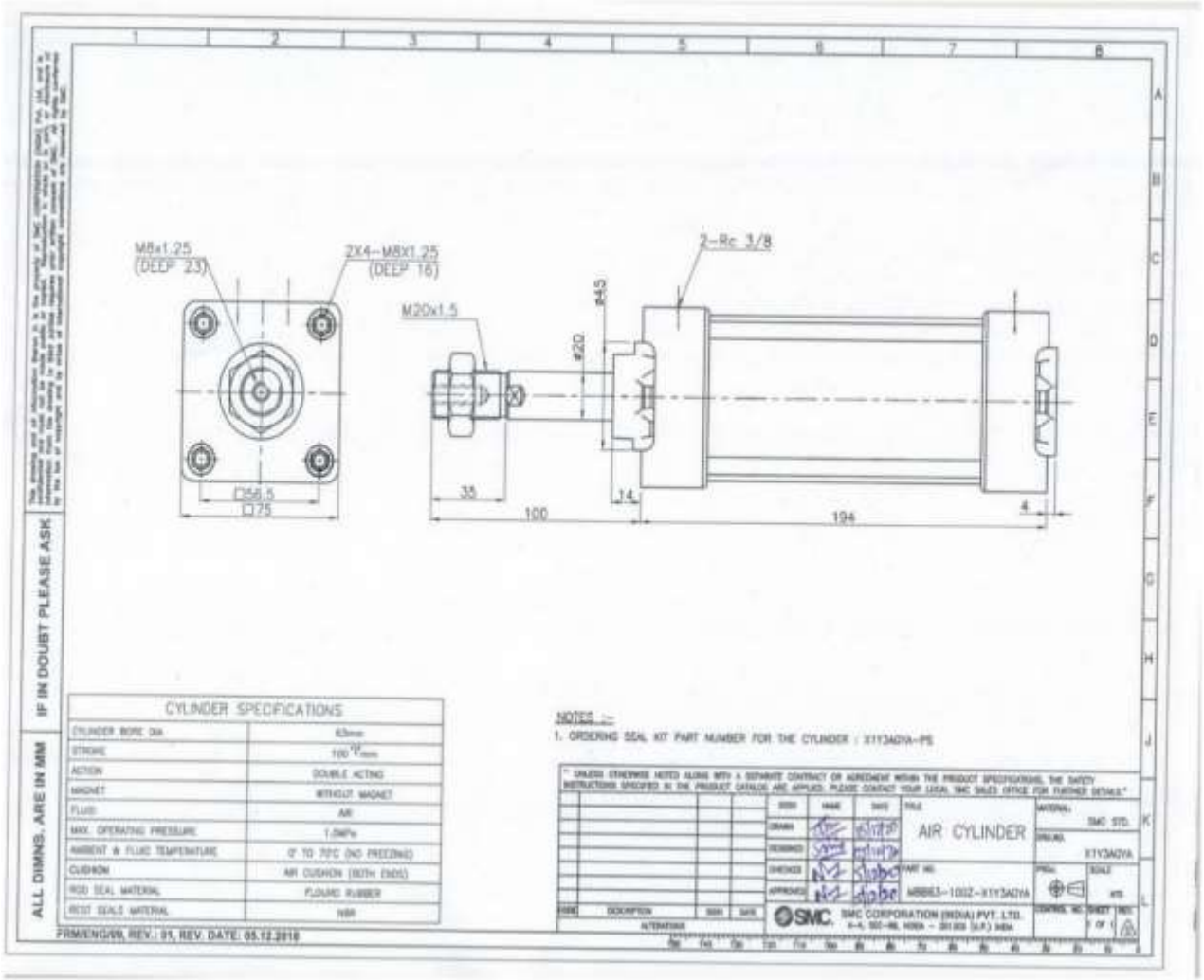
(ii) The applicable consumption is 0.04cfm

5



Innovative Project -Pneumatic Cylinder Size Optimization

Proposed Customized design-SMC



CFT Approvals

Amara Raja Batteries Limited

REQUEST FOR 4M CHANGE

REQUESTION BY	Tirumala Chengaiah	Line no	1,2,3,4&5	Type	Cylinder Bore optimization	DATE	12/5/2021
MODEL	MBB63-100Z-X13AGYA	PART NO	NA		PART NAME	Pneumatic cylinder	
CLASSIFICATION		☐ MATERIAL	☒ MACHINE		☐ MAN	☐ OTHERS	

SUBJECT	Pneumatic cylinder Bore optimization of grid casting mold clamping cylinder of machine-1,2,3,4&5
CURRENT STATUS DETAILS	In present scenario, the cylinder is operating with 80mm bore and 100mm stroke length for clamping operation.
SUGGESTION STATUS DETAILS	The proposed method is optimization of cylinder bore to 63mm without compromising the productivity.
BENIFITS	Reduction of compressed air consumption by 1.4 CFM per cycle.
I REQUEST YOU TO APPROVE THE '4M CHANGE' AND PLEASE GIVE US APPROVAL FOR FINISHING SERIAL NUMBER TRACEBILITY SYSTEM	

☐ Request Accepted ☐ Request Rejected

Reasons for Request Rejection:

ASBU APPROVAL

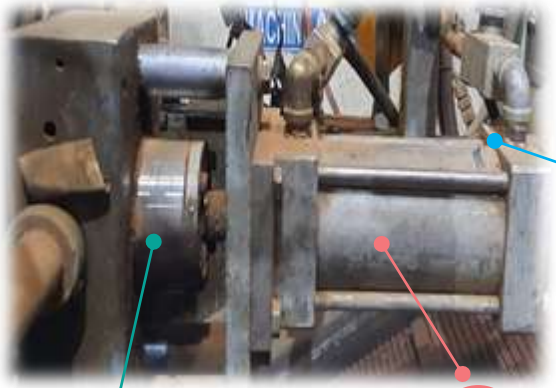
Section Incharge	Prod. HOD	Mnt. HOD	QA HOD
P.M.Naik 12.15/2021	U.Raj 13/05/2021	13/05/2021	13/05/2021

SBD-SFS-58

Innovative Project -Pneumatic Cylinder Size Optimization

Before Condition

Air Consumption: 0.16cfm /Cycle



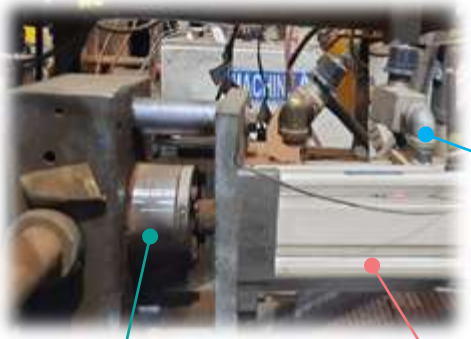
1 Stroke length-100mm

2 Bore-80mm

3 Exhaust air to atmosphere

After condition-Air Saving Opportunity

Air Consumption: 0.04cfm /Cycle

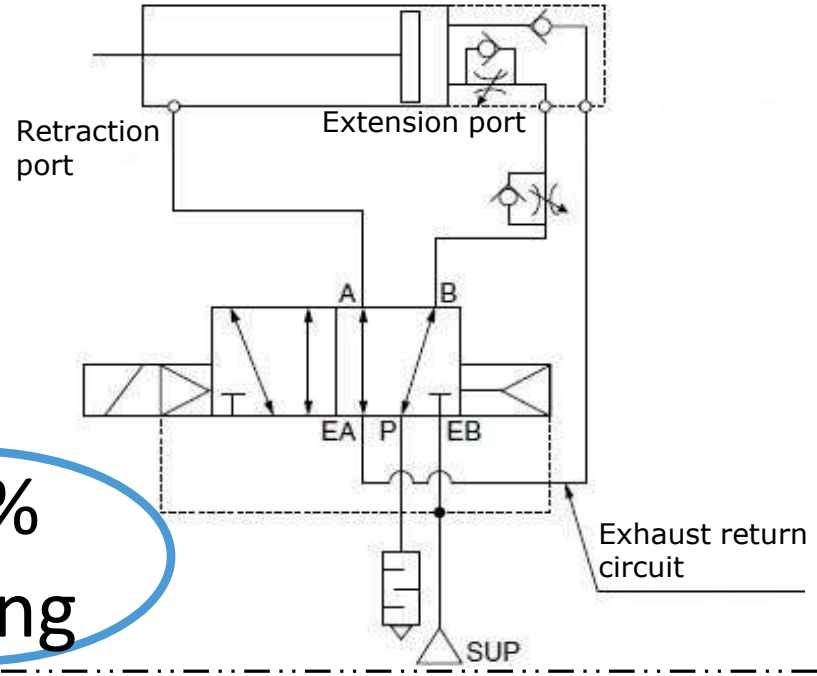


1 Stroke length-80mm

2 Bore-50 mm

3 Built-in exhaust return port

75% Saving



Benefits

No of Cylinders Replaced : 52

Investment : Rs 2,17,360/-

Energy Savings : 1,10,032KWH

Cost Savings : Rs 6,60,192/-

Horizontal deployment

Quantity : 184

Energy Savings: 0.66 Mn Units

Cost Savings : Rs 3.9 Mn

Innovative Project -Pneumatic Cylinder Size Optimization

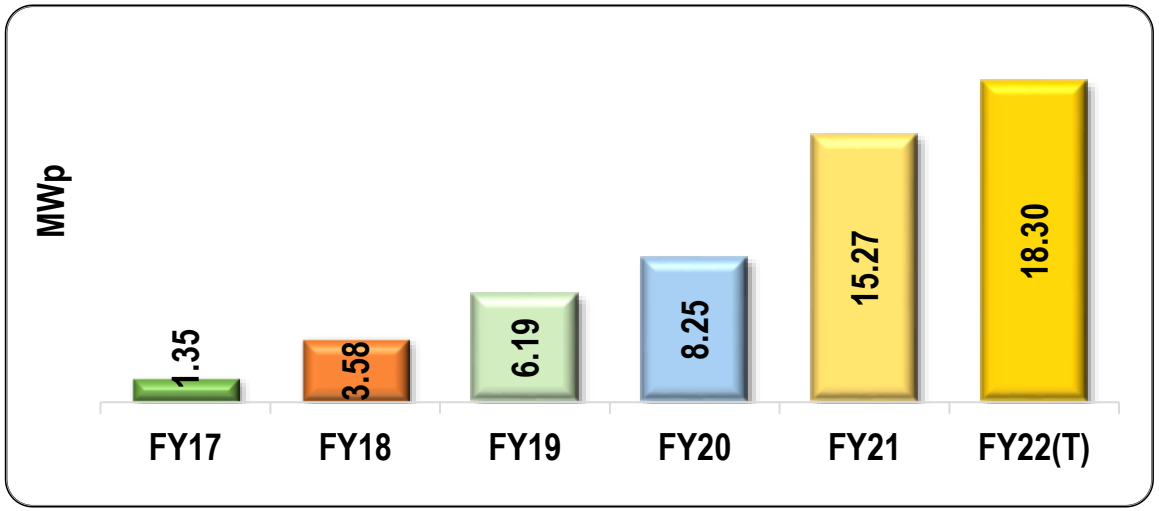
One of the Strategic plan to reduce the compressor energy consumption by 5%

Proposed list of Cylinders

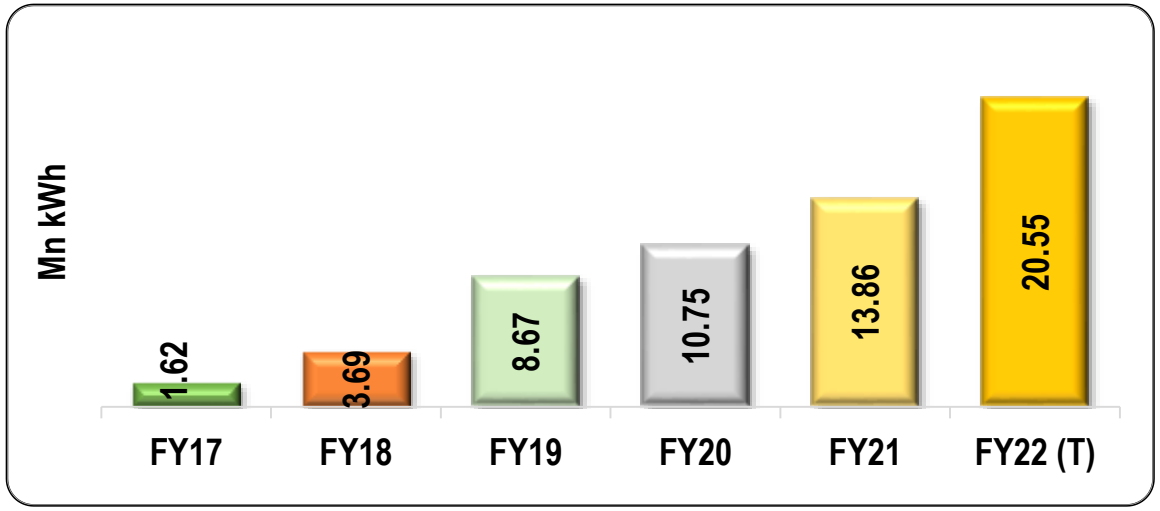
Sl.No	Machine	Cylinder model	Actual			Required force (N)	Recommended		Before air consumption (CFM)	After air consumption (CFM)	Air Savings (CFM)	Energy Savings per year kwh	Cost savings /year @Rs.6	Horizontal deployment (Rs.)
			Bore (mm)	Stroke (mm)	Max. Available force (N)		Bore (mm)	Max. Available Force (N)						
1	Semi group-1	CDS2B140-250J	140	250	3000	392	80	1250	1.24	0.44	6.36	9,617	57,702	923228
2	Semi group-2	CDS2F125-175	125	175	2500	392	80	1250	0.64	0.25	3.11	4,702	28,210	451356
3	Charge eye insertion	MB1Z63-UDW002-410	63	410	600	5	50	400	0.44	0.23	1.70	2,565	15,387	738583
4	Grid Casting	100B80S	80	100	1500	618	50	900	0.16	0.04	2.67	4039	24,235	1744901
5	Half insertion	MDBD100-75Z-73L	100	75	2000	305	80	1250	0.18	0.11	0.57	855	5,129	41032
6	Full insertion	MDBWF80-125Z-M9BL	80	125	1250	196	63	600	0.16	0.11	0.42	641	3,847	30774
7	Mold releasing	MDBF80-100Z-Z3L	80	100	1250	181	63	600	0.12	0.08	0.35	534	3,206	25645
8	Half insertion	MDBF100-25Z-73L	100	25	2000	270	80	1250	0.11	0.06	0.35	534	3,206	25645

Renewable Energy

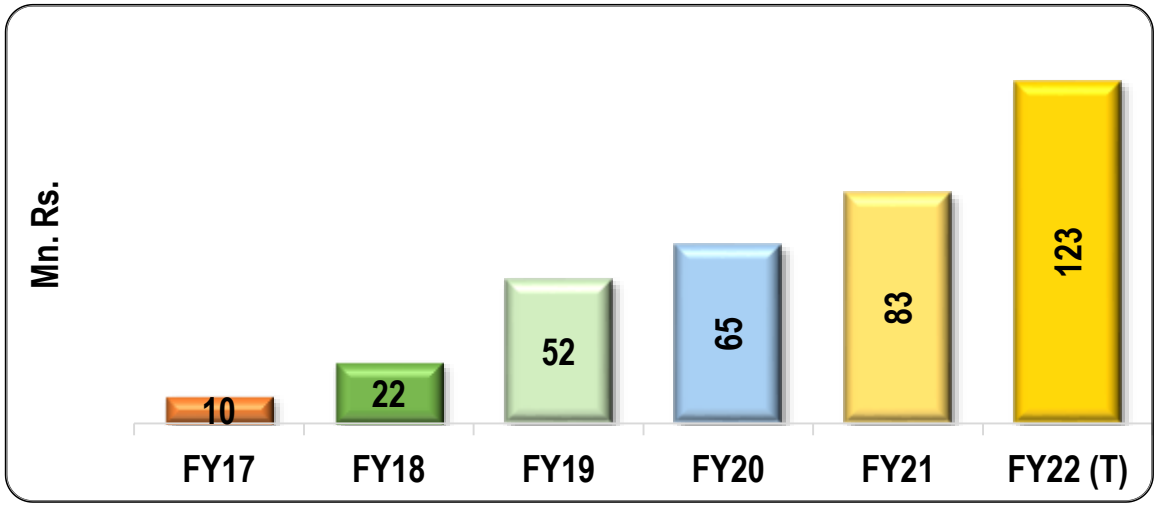
Installed Capacity



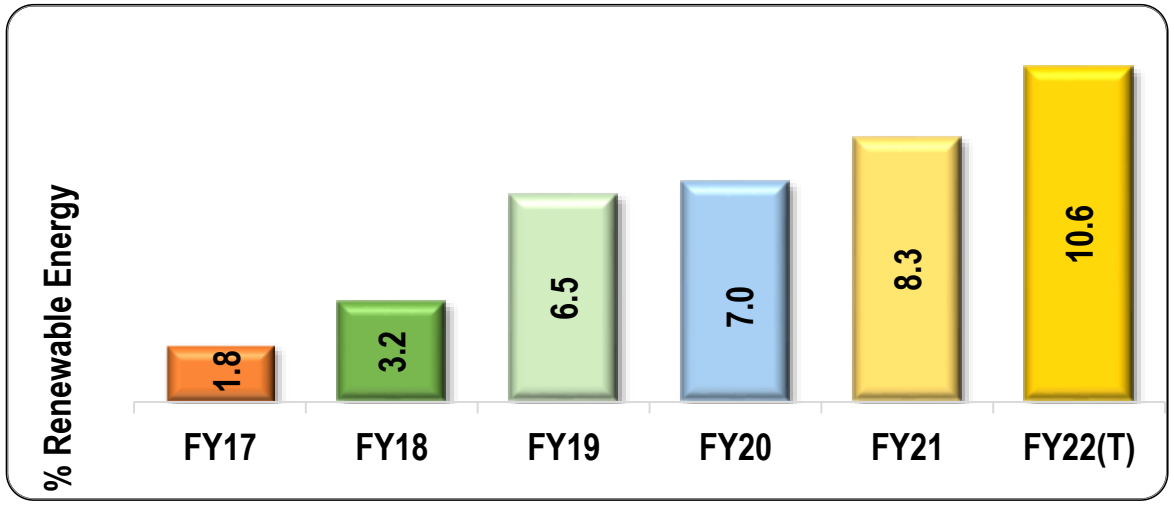
Power Generation



Renewable Energy Savings



Renewable Energy share in Overall Energy



Renewable Energy

Environmental Benefits:

- CO2 Avoided per Annum = 34734 MT
- SO2 Avoided per Annum = 2316 MT

Further Course of action:

Capex approved for Off grid Solar projects for 50MWp → **100% Renewable energy by FY'23**

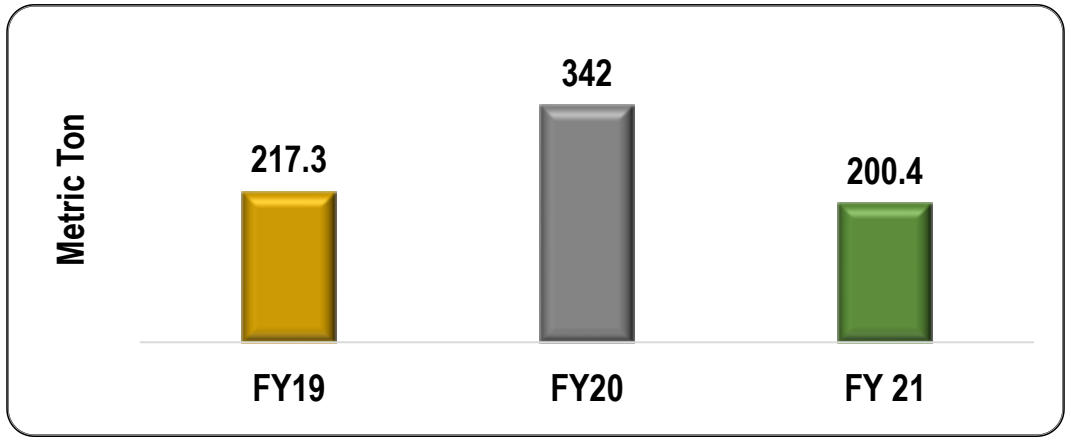
Renewable Energy – Smart Solar Monitoring

Main Objectives of Smart Solar System is to Maximize Our Solar Generation by

- *Real Time Solar plant performance monitoring by string level monitoring*
- *Smart demand management*
- *Real-time performance ratio, CUF, Irradiance vs solar yield*
- *Remotely Monitor all Solar Power Plant from a Centralized Platform*
- *Scheduling of O&M*
- *Mobile application*
- *Automatic Reports Generation and escalation*

Waste Utilization & Management

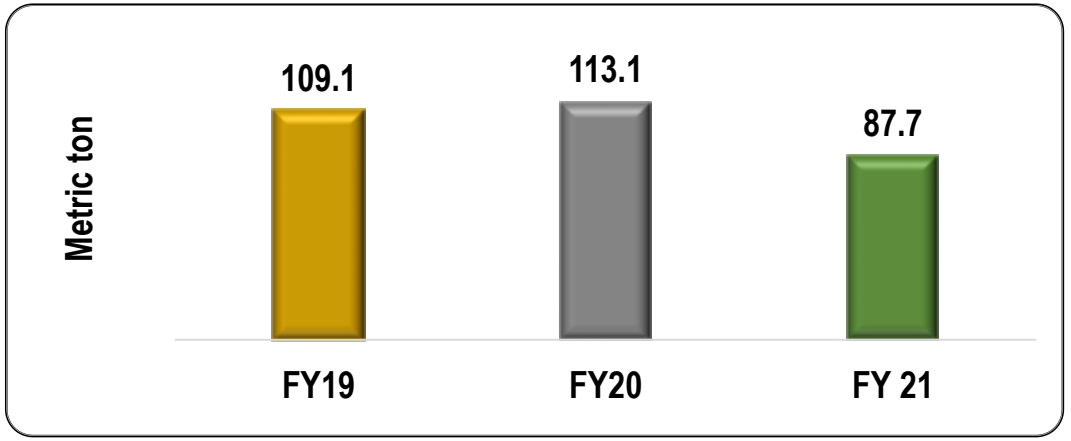
Wood Waste



Disposal Action:

for Boilers in Galla Foods (Amara Raja Gr. Co.)

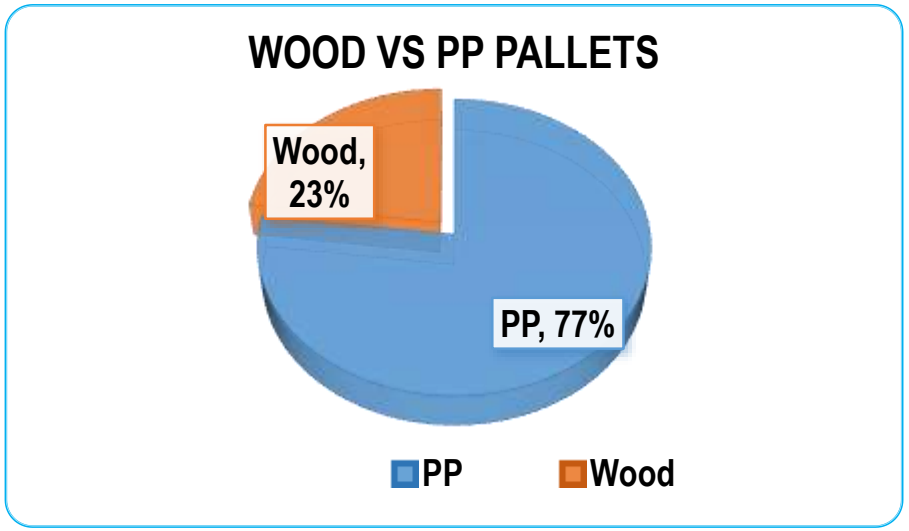
Canteen Food Waste



Disposal Action:

for composting and then for gardening

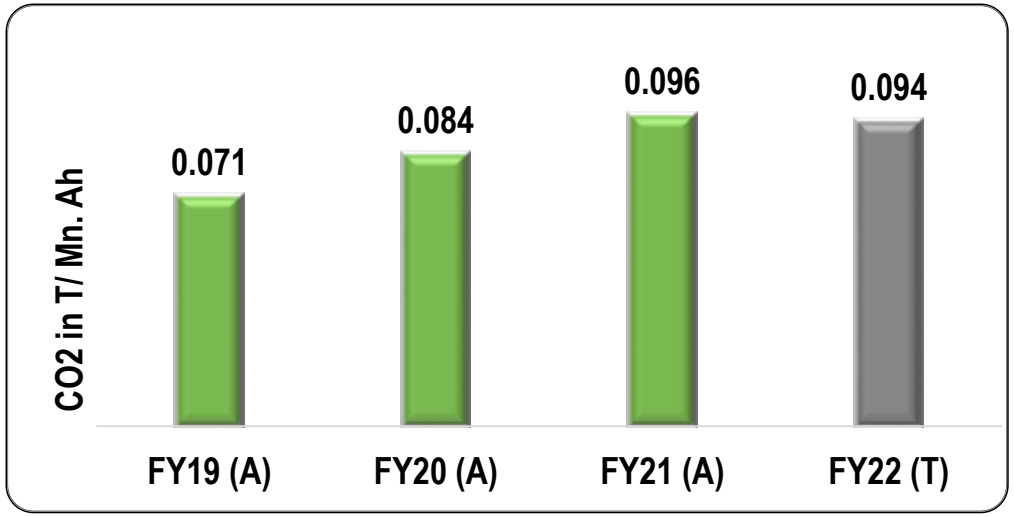
Way forward
To reduce wood consumption



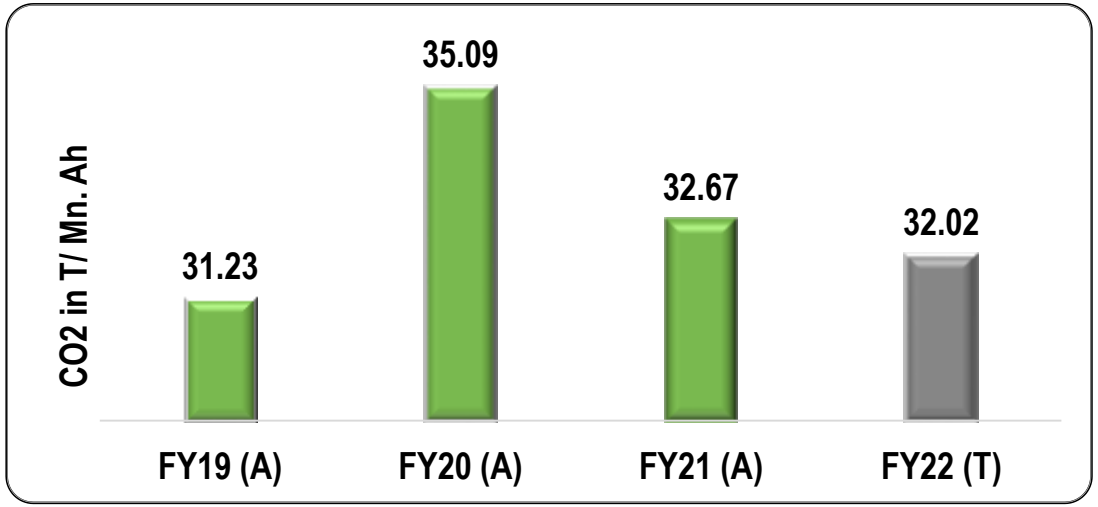
100% PP Pallets by FY 23

Green House Gas (GHG) Inventorization

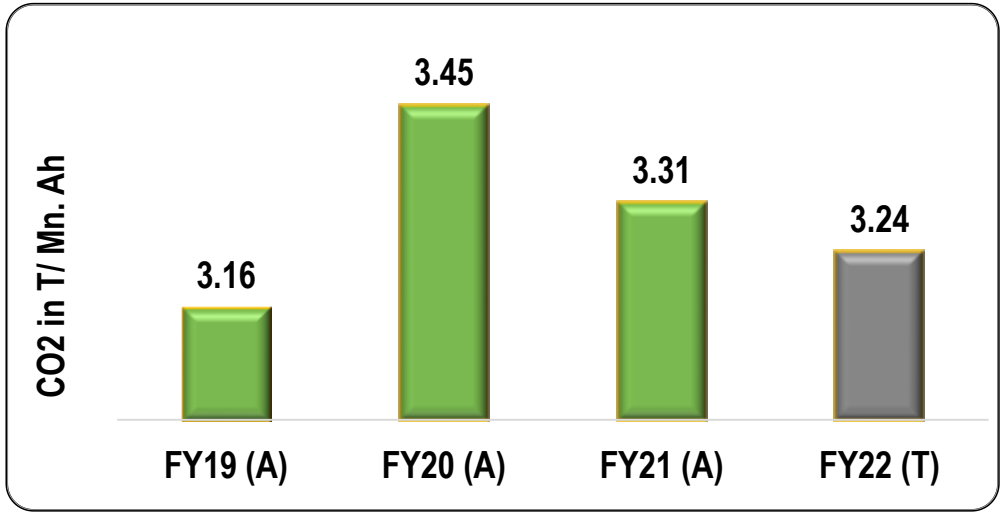
Scope 1: Direct GHG Emissions



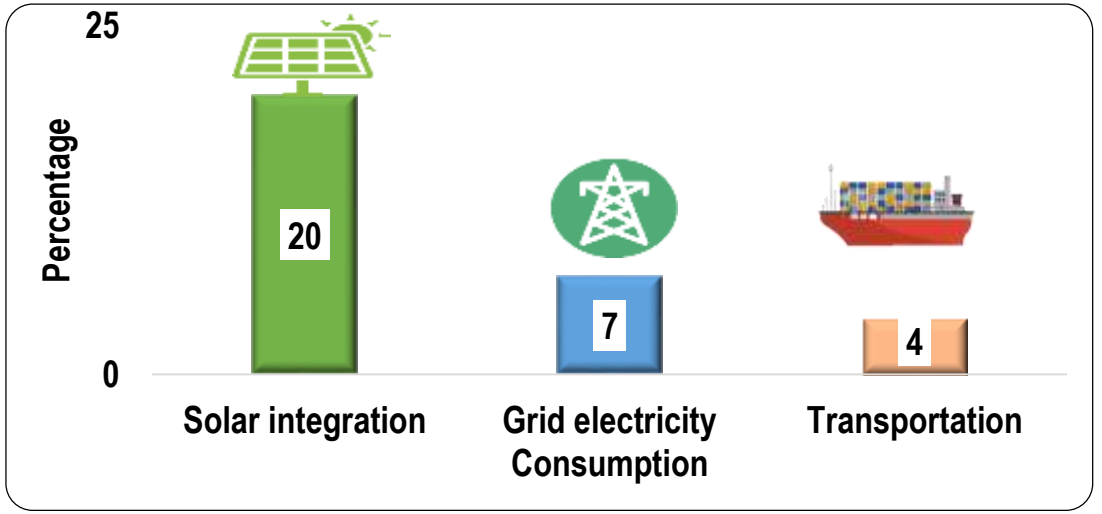
Scope 2: Electricity Indirect GHG Emissions



Scope 3: Other Indirect GHG Emissions



GHG emissions reduction percentage FY21



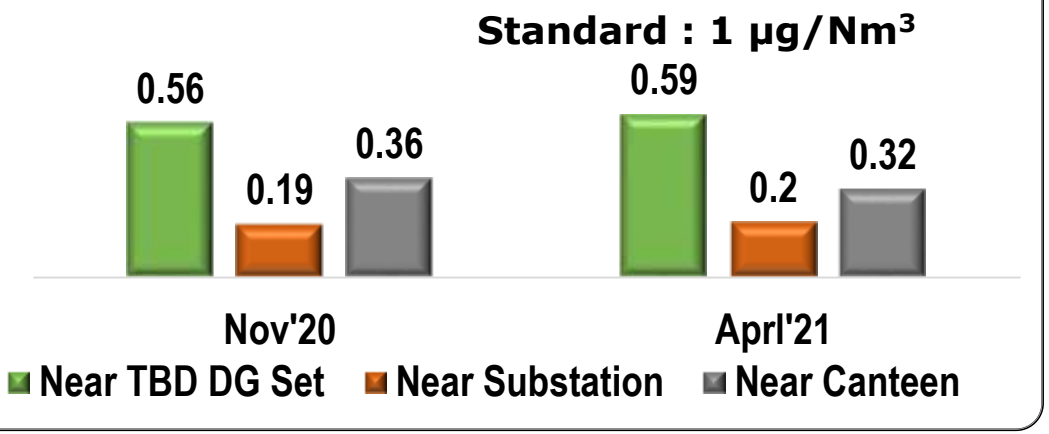
Emissions - Air quality monitoring

Dust extraction system with HEPA Filters

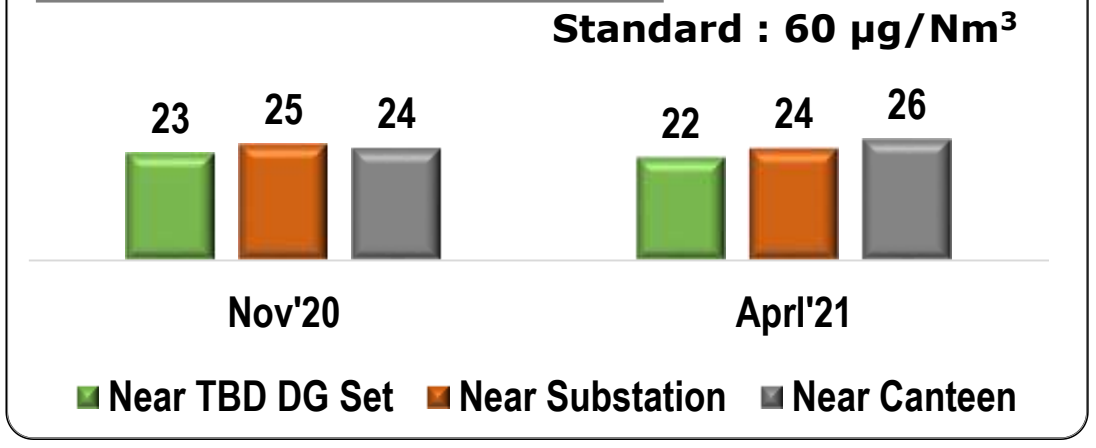
Fume extraction system with Wet Scrubbers

Continuous Ambient Air Quality monitoring Station (CAAQMS)

Ambient Air Quality - Lead (in µg/Nm3



Ambient Air Quality - PM2.5 (in µg/Nm3)



Green Supply Chain management- Key Initiatives FY 20-21

1. e-mobility for in-house transportation.
2. Capex approved for Lead recycling plant. 280 Cr
3. Increasing Rail & Ship Transportation
4. Life cycle cost approach in procurement.
5. Procurement of Energy Efficient products/Equipment
6. MOU signed with IIT-T for reusable mask

Green Supply Chain

Integrated Recycling approach

1,00,000 Tonne Capacity Lead recycling plant

Customer Ratings

Ford
- Q1 Award – Highest award

Honda
- Satisfactory – Highest rating

Renaults
- Excellent – Highest rating

TVS Motors
- Platinum – Highest Rating

Mahindra& Mahindra
- Excellent- Highest Rating

Renault Nissan
- L1 – Highest rating

Inbound e-Vehicle transportation

e-loading Cart

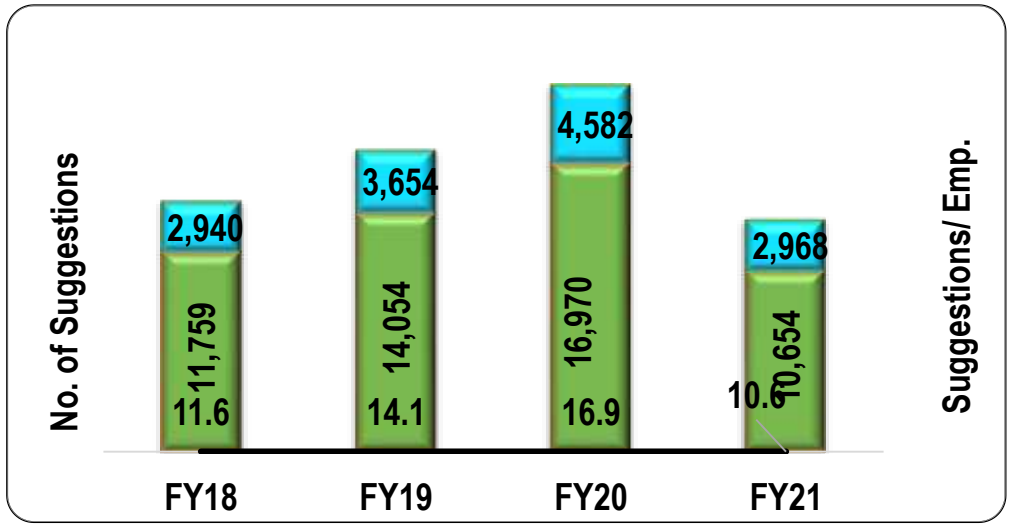
e-auto

e-bikes

TEI &Team Work /Operator level

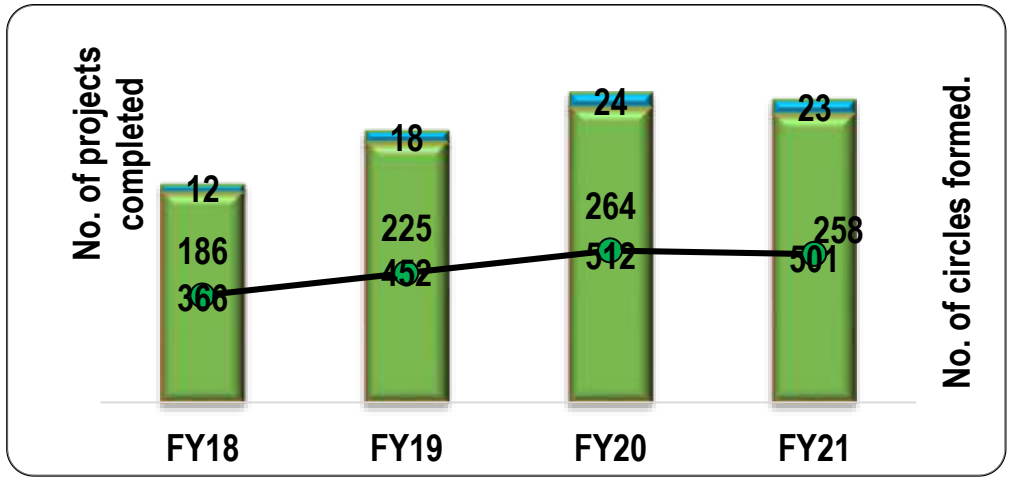
Awareness session

Employee suggestions



Best QCC Team

Quality control circles (QCC)

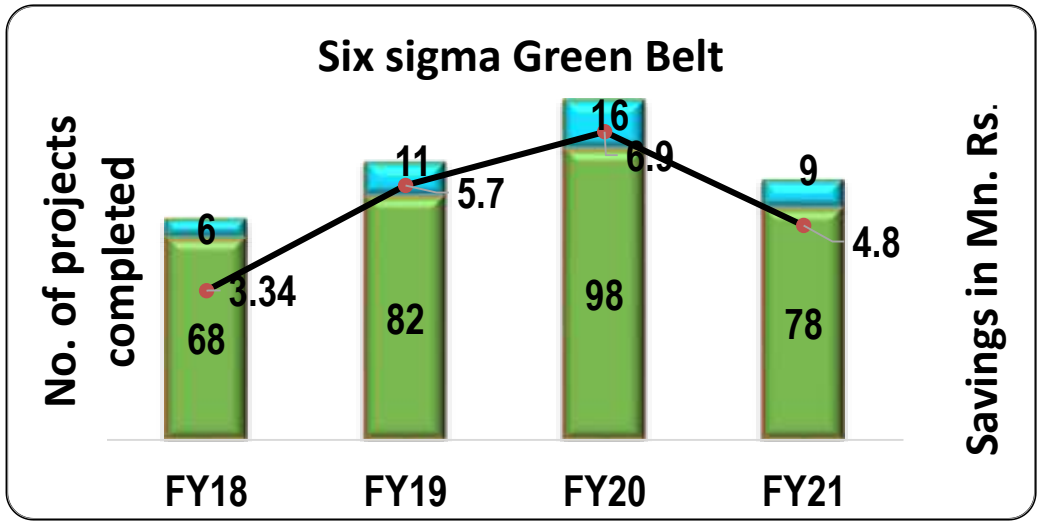


TEI & team work/Supervisor level

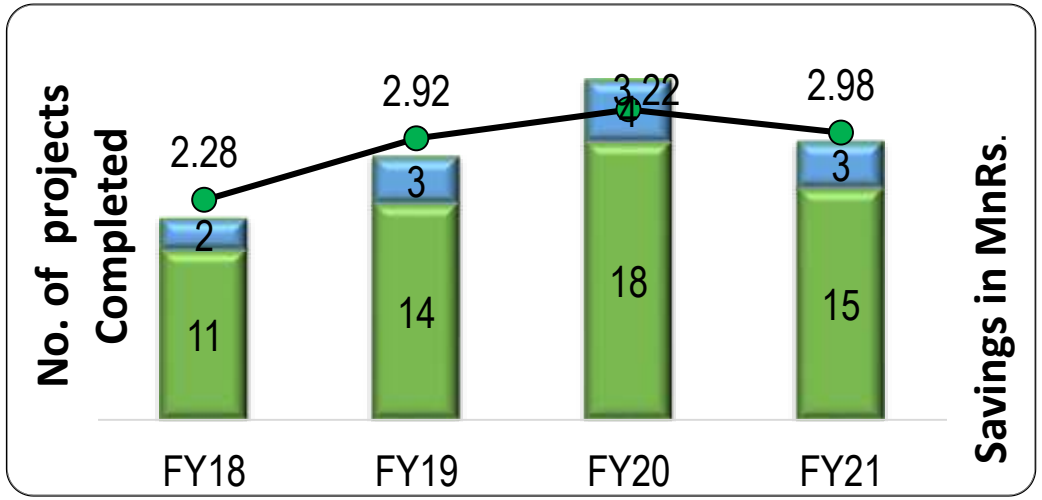
Kaizens

Collecting the data on real time from machine by Using IIOT platform

Sis sigma Green Belt projects

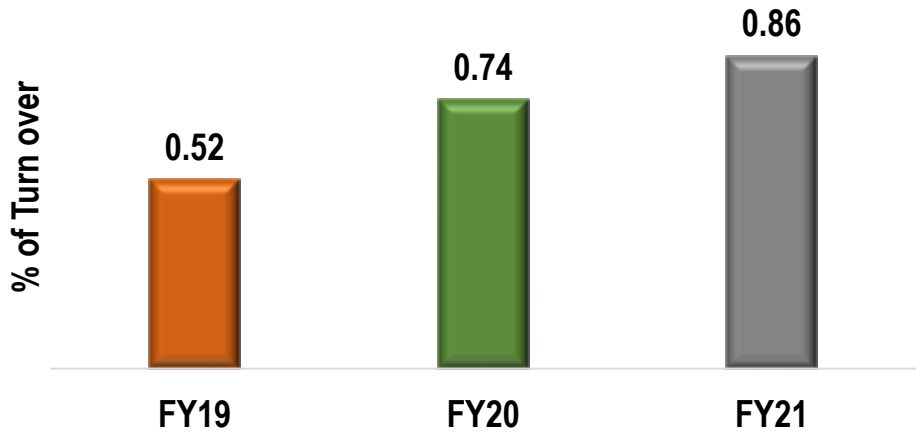


Six sigma Black Belt

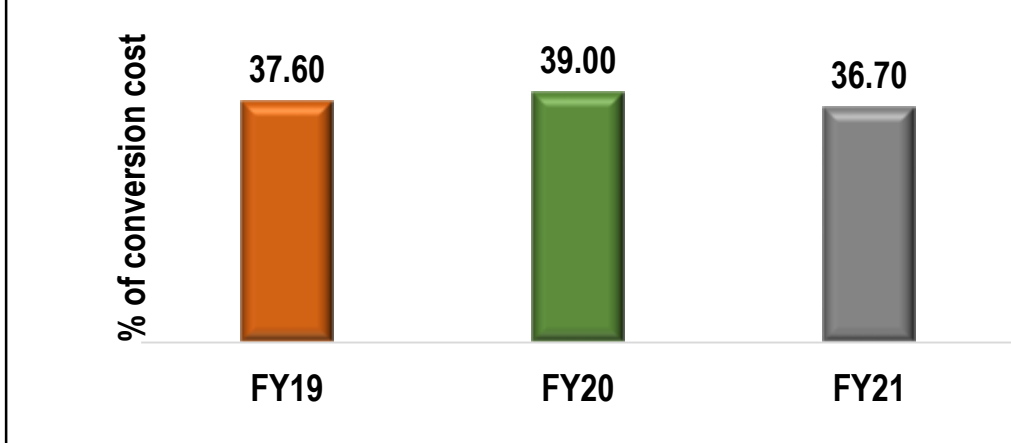


TEI & team work/Middle Management Level

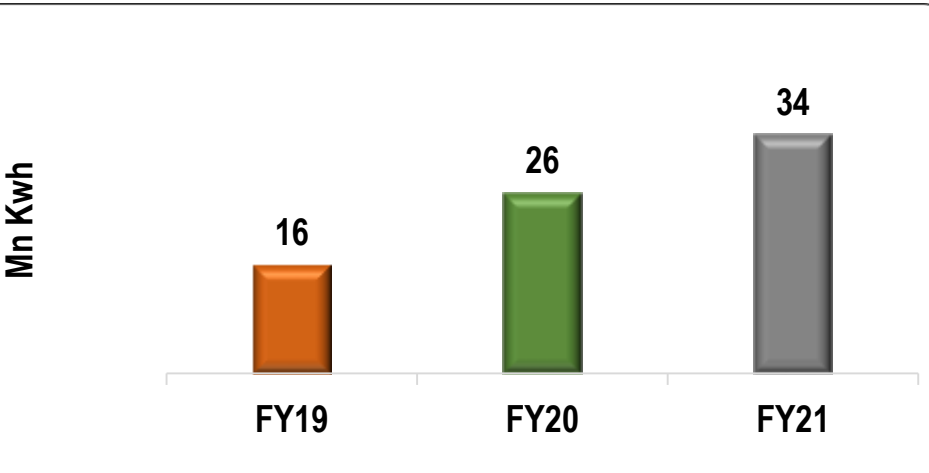
Investment for EnCon as % of turnover



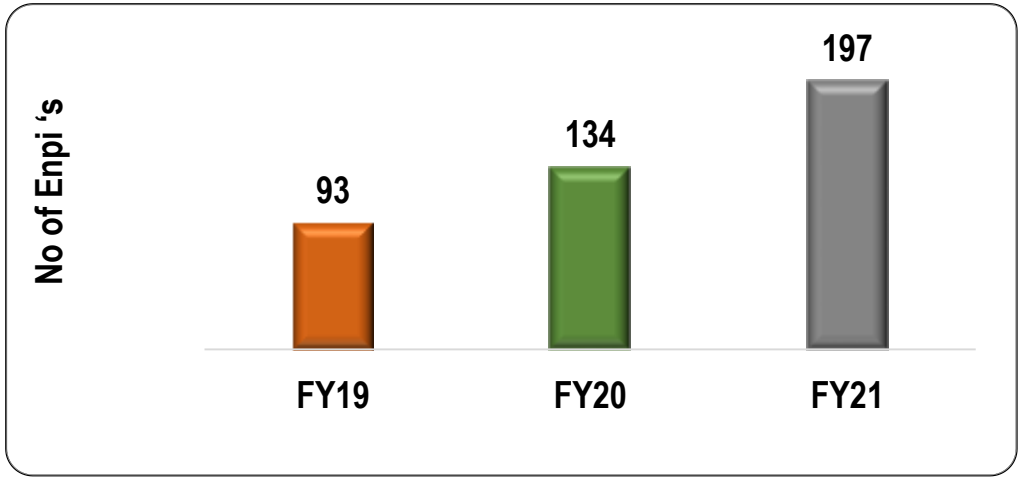
Energy Cost as % of Conversion cost



Cumulative Energy savings



Energy performance Indicators EnPI's

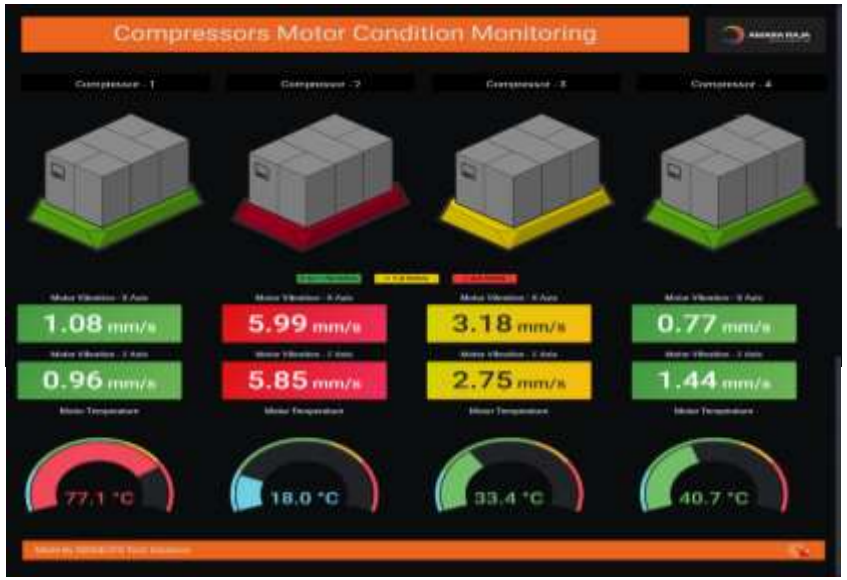


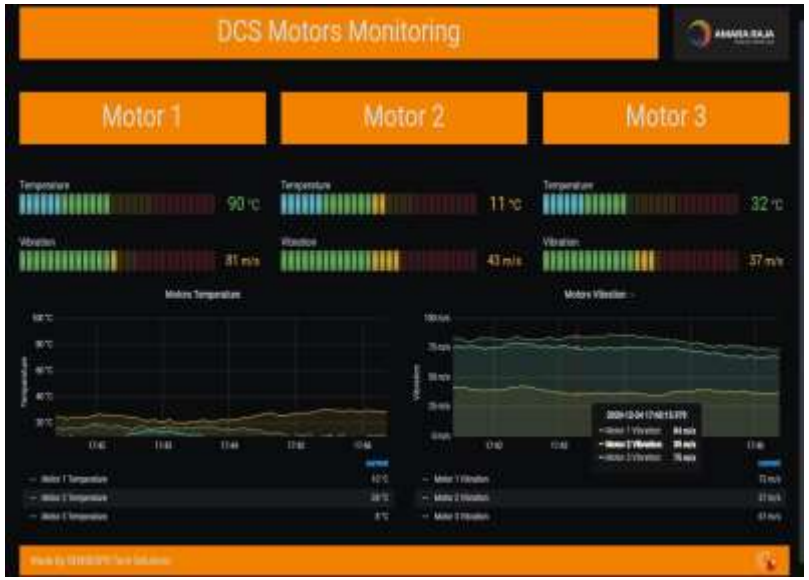
Learnings from the Summit

Sl. No	Concept
1	Ductless Air conditioners
2	Tyre pressure and GPS monitoring of vehicles
3	Cycle time for retrieval of spares
4	AHUs with HVLS fans
5	Compressor air leakage checking at defined frequency
6	CNG vehicles for Goods transportation
7	Classification of energy based on fixed and variable loads
8	Hybrid heat pump
9	Six Sigma project for Energy target setting.
10	Office AC accumulator
11	Pneumatic tools replaced with Battery operated.
12	Semi fixed and semi variable loads identification
13	Water pumps to run in non peak hours for demand control.

IIOT to enhance our operational efficiency

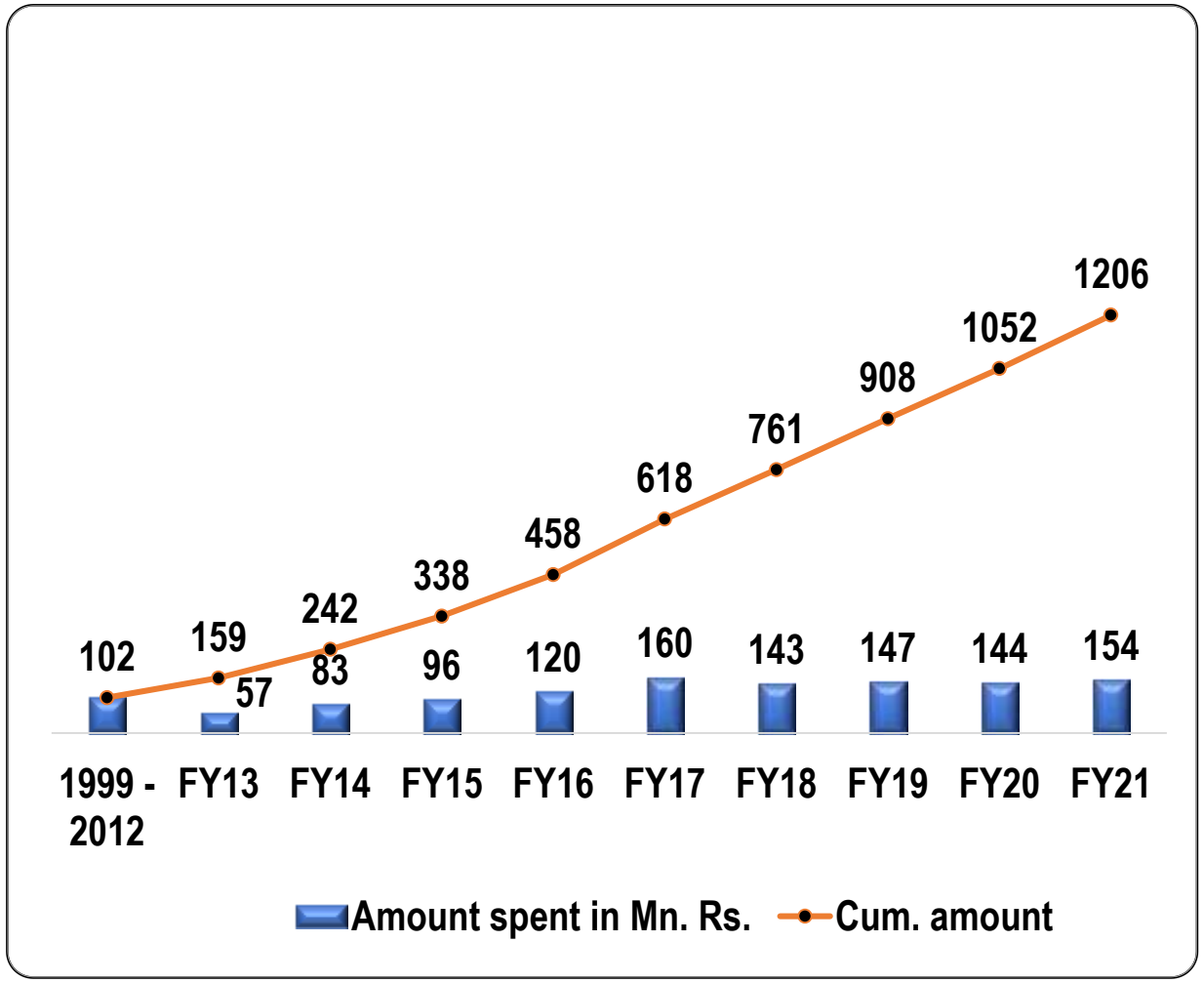
Dash Boards for Equipments



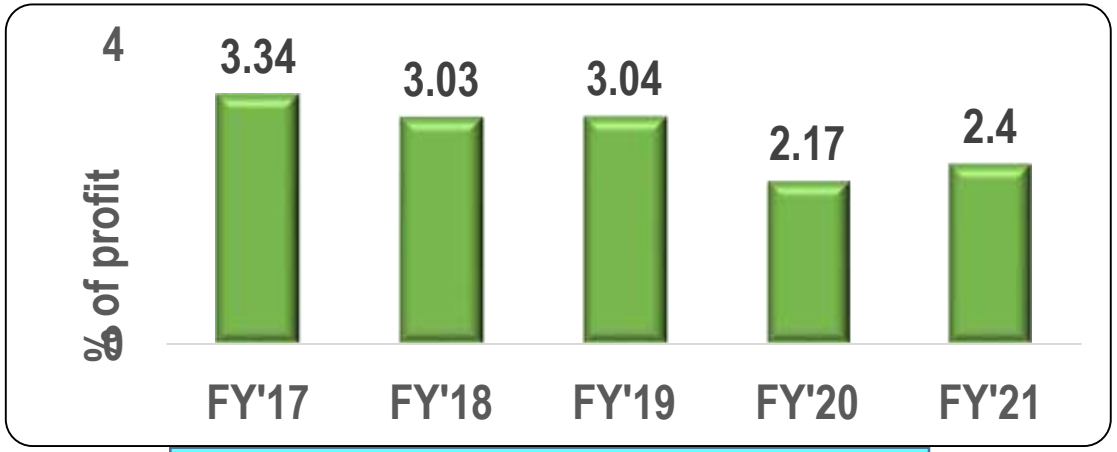


CSR Initiatives

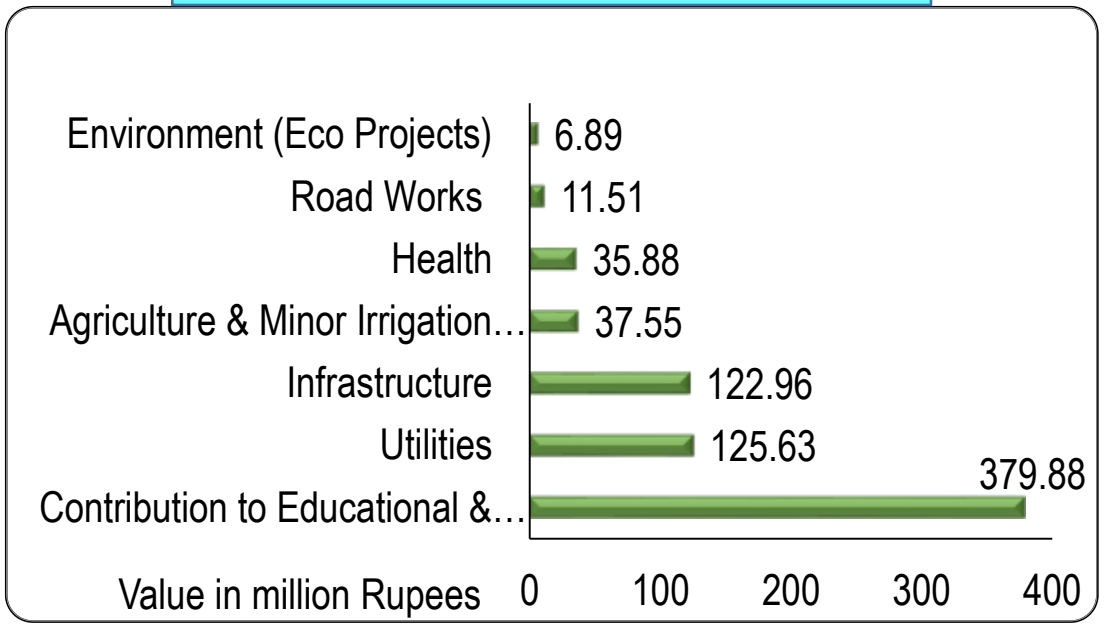
Amount Spent for CSR Activity



Amount Spent for CSR Activity



CSR - Activity Wise Distribution



CSR Initiatives

- Amara Raja Vidyalayam at Karakambadi

- Social Forestry
- 250 Hectare of barren hillock Adopted
- Planted 2,00,000 trees as on date at Karakambadi

- 30 bed primary health centre under PPP Program (Public Private Partnership Program)

- Water conservation
- Number of projects taken up: Check dams 23, tanks distilled 3
- Benefit reached to :12panchayats, covering 60 villages

CSR Initiatives During Pandemic

Donates Rs. 5cr to AP CM relief fund for Covid relief.

Rs. 1cr to Telangana CM relief fund for Covid relief.

Chittoor: Amara Raja Group donates Covid relief material

Hans News Service | 4 Jun 2021 12:17 AM IST

Representatives of Amara Raja Industries handing over Rs one crore worth Covid medical items to joint collector (welfare) Rajasekhar (welfare) in Chittoor on Thursday

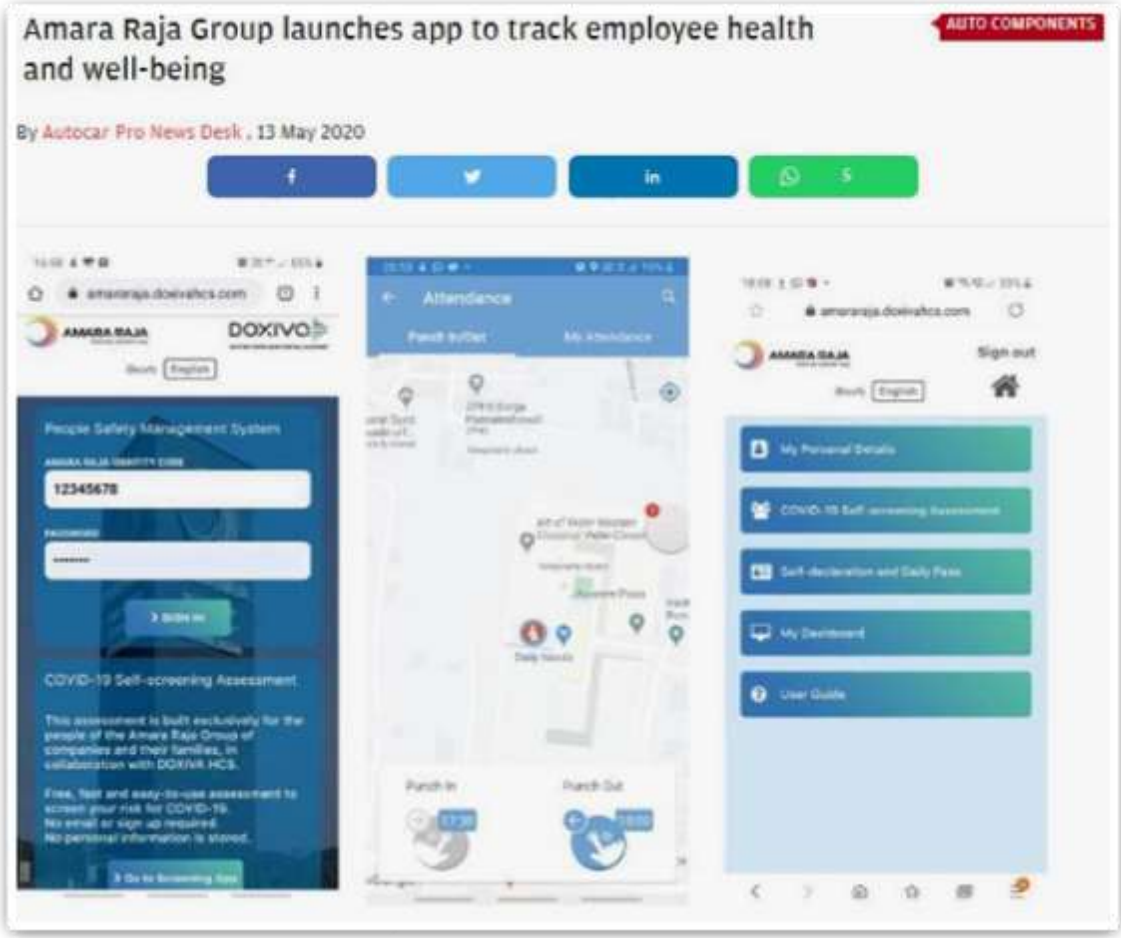
HIGHLIGHTS

As a token of their support to the district administration fighting against the Covid, the Amara Raja Group of Companies on Thursday donated Rs 1 crore worth of medical items required for Covid patients and also the personnels involved in Covid control in the district

25 Oxygen concentrator donated to Govt. Hospital

CSR Initiatives During Pandemic

Amara Raja Vaccine Inoculation for employee & their families.



Health Screening Web App as per WHO &center for disease control (CDC) Guidelines.

CSR Initiatives During Pandemic

Source: https://www.thehindu.com/news/national/andhra-pradesh/iit-t-amara-raja-sign-mou-on-producing-reusable-face-mask/article33069749.ece/

Water Management

Other Initiatives

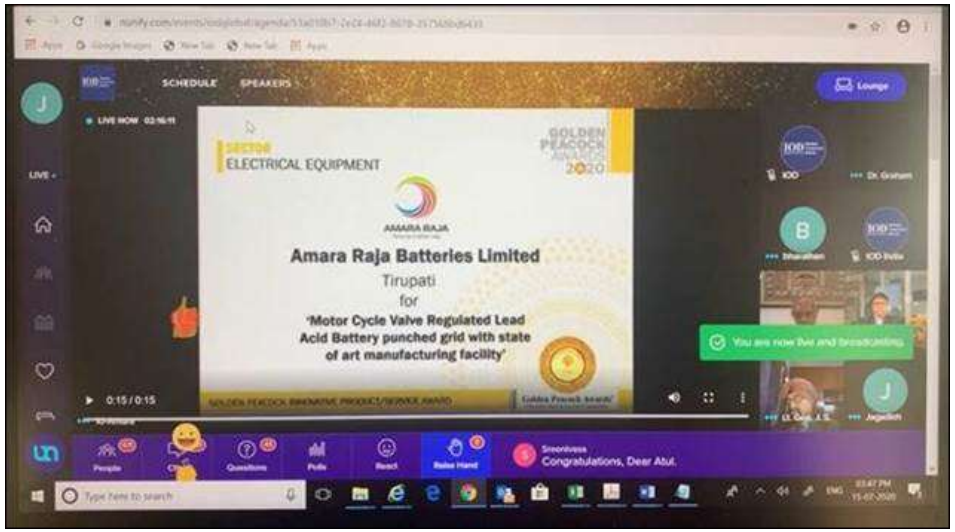
Issued 600 no's of **T-Shirts** to the community members on the eve of "**World Environment Day**"

Issued 1000 no's of **Jute Bags** to AR Cooperative Stores members on the eve of "**World Environment Day**"

Awards and Accolades

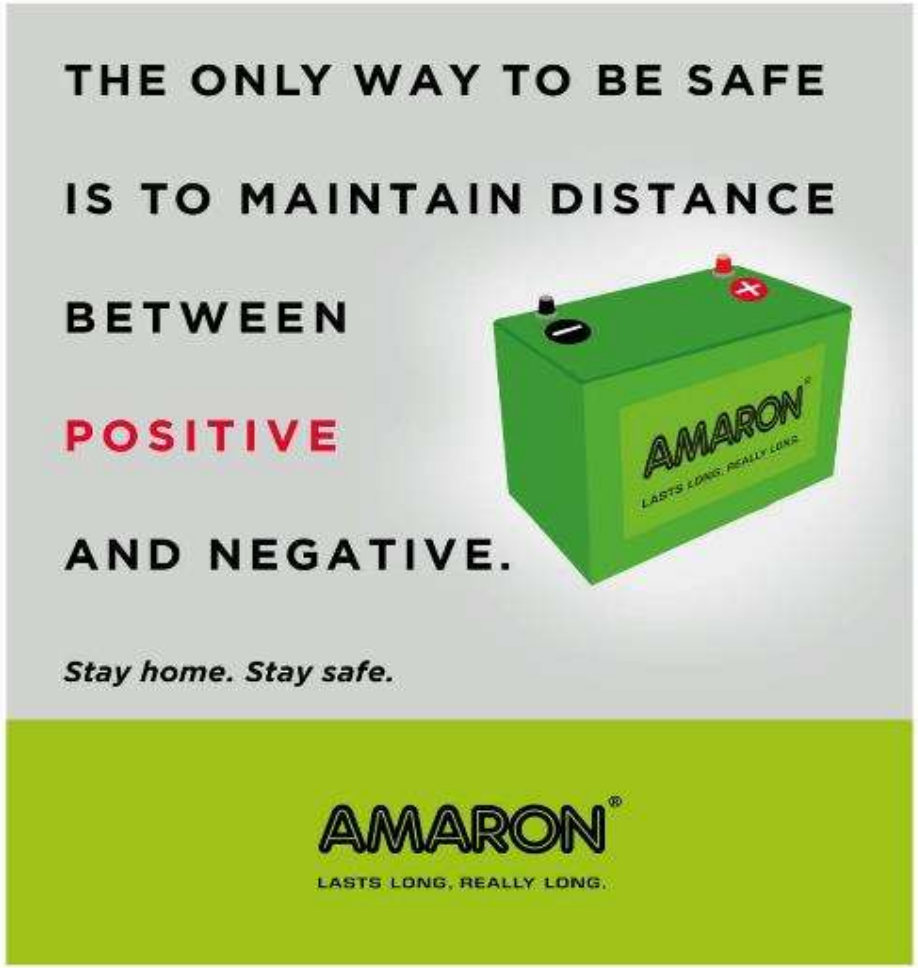
Environmental Leadership Award

Golden Peacock Award In the Category of Innovation



Platinum award in 6sigma Black Belt

International Convention on QCC Awards



GOTTA BE A BETTER WAY

AMARA RAJA BATTERIES LIMITED | 2010-11 ANNUAL REPORT

For feedback

K. B. Vinaya Sagar, Head - Energy management

Email: kbvs@amararaja.com

Thank You