Honda Motorcycle and Scooter India Pvt. Ltd.
Ahmedabad Gujarat. (HMSI - 4F)

ISO 9001, 14001 & 27001 Certified Company

BLUE SKIES FOR OUR CHILDREN

Participating in

CII – National Award for Environmental Best Practices - 2021

Project Title

"Productivity Enhancement & Waste Minimization"

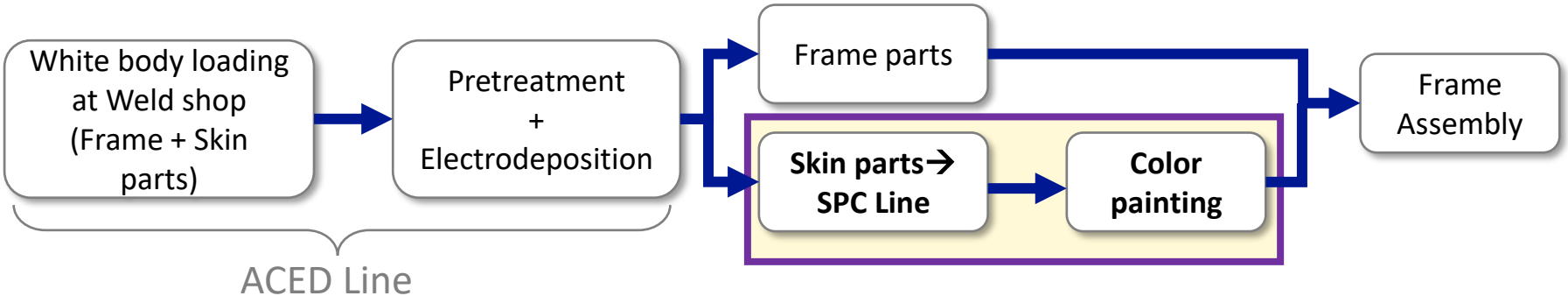
Presented By,

1. Shubham Aggarwal
2. Ravinder Chaudhary

HONDA
The Power of Dreams

Project 01 - : **Paint shop capacity enhancement for energy saving (Steel Processing Component - SPC)**

PFD :



Category : Resource Conservation

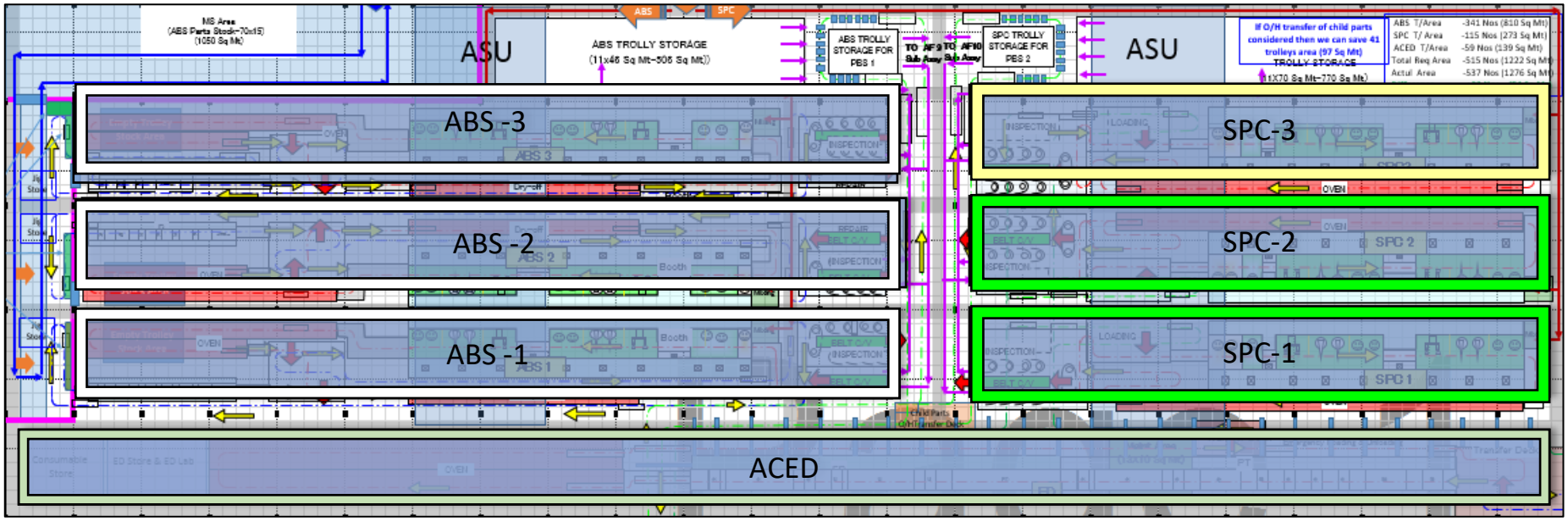
Trigger Point : Business Plan Activity (Middle level Management)
Management drive to push for ideas that reduce environmental impact.

Date of Implement: Novemember'2020

Project Uniqueness:

- **Benchmark Practice in HONDA Global** (First time introduced by HMSI-4F)
- A best example of maximizing the utilization of available resources .
- Big savings through small idea..
- Multi-benefits (resource conservation, productivity improvement , cost saving, efficiency improvement)

Area Introduction



PAINT SHOP SYNOPSIS	
Capacity	1.3 million/annum
Area	17250m^2
Space Utilization	75 veh/m^2
No. of lines	7
Models	Activa 6G/Activa 125/ Dio/ Grazia

SPC-1 & 2

ABS-1

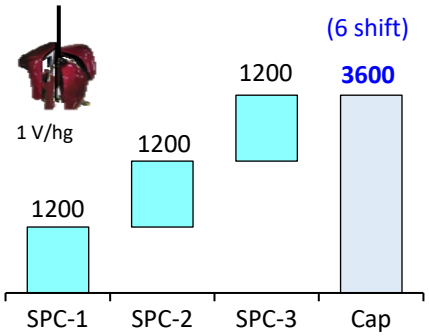
SPC-3

ACED Line

Total 7 lines in paint shop.

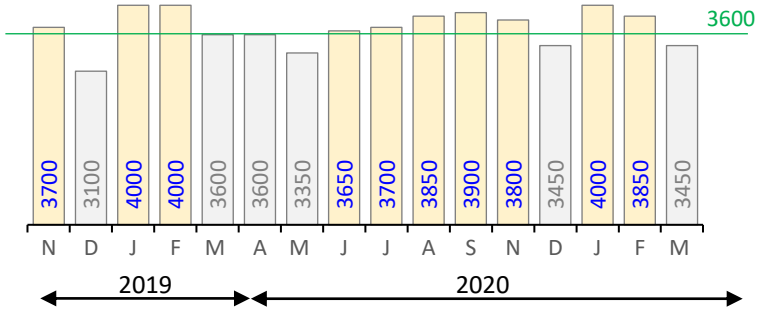
Situation Analysis

SPC line current capacity (veh)



Capacity- 3600 vehicles (6 shift)

SPC line prod volume (Activa 110 + Activa 125) – Production



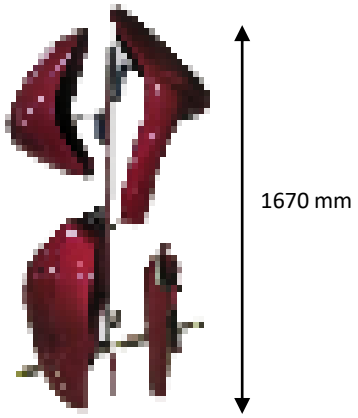
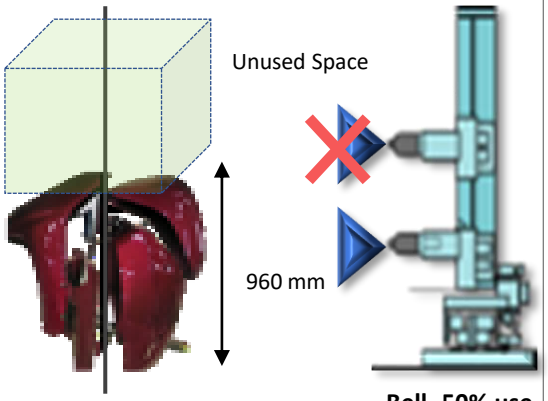
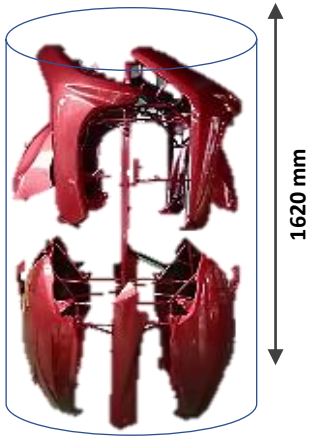
Sales demand high during festive season

In order to achieve Peak production

Cat.	Concern / Challenges
Env.	➢ High Energy Consumption ➢ Generation of waste
Quality	➢ Less time for preventive maintenance ➢ Dust generation → Booth pit & water curtain cleaning time NA
Mgmt.	➢ Daily overtime – 175 man hr. (C-shift)

Need to increase SPC capacity

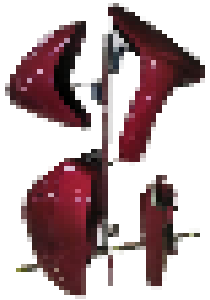
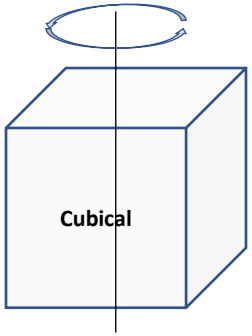
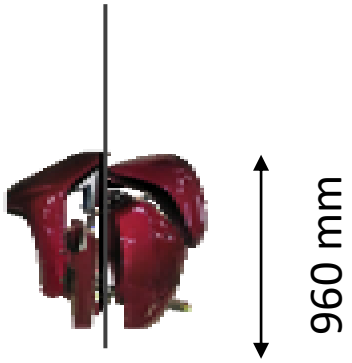
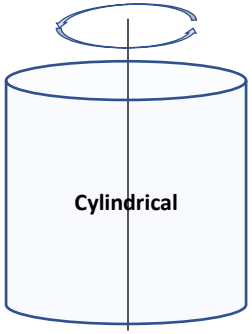
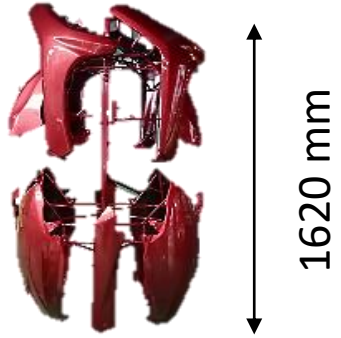
Idea generation

Year	2016	2017 - 18	2020
Loading Pattern	KWP &K24  **1 Veh / hgr** **Global Honda concept-** Same as 3F	KWP &K24  **Bell -50% use** **1 Veh / hgr** **CR Theme :** T.E 30% to 38%	K0L & K0P K0L & K0P  **2 Veh / hgr**

SPC line part loading capacity doubled…

Key Change Points & Tangible Benefits

Key change points

Change Point	Part Hanging	Envelop Shape	Envelop Height
Before	 7 Nos./hanger	 Cubical	
After	 14 Nos./hanger	 Cylindrical	

CO_2 Reduction	Shift Running	Utility Cost Reduction	Manpower Reduction
149 Ton/yr.	6 nos → 4 nos	14.1 Mn/yr.	8.3 Mn/yr.

Total annual saving – Rs 22.4 Mn/yr.

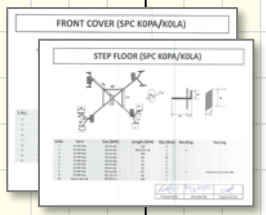
Intangible Benefits

Category		Control item	Benchmark	Target	Actual	Status
Safety	Safe & op. friendly	Accident	Zero operational Accident	0	0	
Quality	High Quality parts	Straight pass ratio	93%	95%	96.2%	
		Market claim	0.0012	0	0	
		DPV (Defect/1000 vehicle)	12	12	8	
Cost	Minimum investment & Max out put	Consumable cost	Rs 35/V	Rs 32/V	Rs 30.8/V	
		Paint Cost	Rs 256 /V	Rs 256/V	Rs 251/V	
Delivery	Highest efficiency with minimum loss	Breakdown	20 mins/shift	20 mins/shift	18.4 mins/shift	
		Automation (Robotic painting)	90%	90%	90%	

Intangible benefits in SQCD parameters…

Schedule

	Activities	Plan Act	2019	Apr'20 W1	W2	W3	W4	May'20 W1	W2	W3	W4	Jun'20 W1	W2	W3	W4	July'20 W1	W2	W3	W4	Aug'20 W1	W2	W3	W4	Sept'20 W1	W2	W3	W4	Oct'20 W1	W2	W3	W4	Nov'20 W1	W2	W3	W4	Dec'20 W1	W2	W3	W4
Jigs & hanger development	Concept	P		COVID-19 Lockdown																																			
		A																																					
	Jig design finalize	P																																					
		A																																					
	PR/PO	P																																					
		A																																					
	Maker sample trial & Mfg. Go-ahead	P																																					
		A																																					
	Mfg. @ maker	P																																					
		A																																					
	Receiving @ HMSI	P																																					
		A																																					
Approvals & MP implementation	Safety Approval	P																																					
		A																																					
	Quality Testing approval	P																																					
		A																																					
	Oven calibration	P																																					
		A																																					
	Trial & Training	P																																					
		A																																					
	Top Management Review	A																																					
	SPC 1 MP	A																																					
	SPC 2 MP	A																																					



Sample NG

Education to maker @ HMSI

Sample re-submit

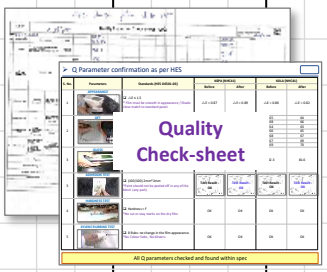
Jig verification

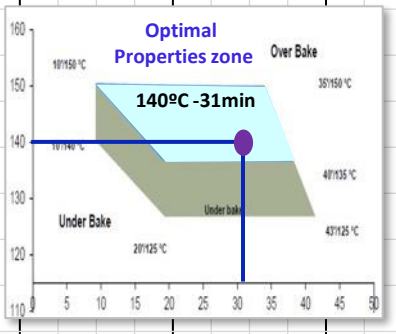
Maker sample

HMSI sample

Reached @ HMSI SPC1

Reached @ HMSI SPC2





Umeki San Approval

SPC 1 MP

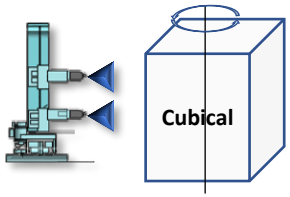
SPC 2 MP

Theme implemented in SPC 1 & SPC-2 in Oct'20 W4 & Nov'20 W1 respectively

Challenge - Jig Development

New Design Development

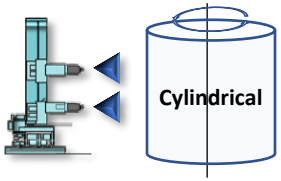
5 hg trial -Cubical jig



Concern

- **Dry Film Thickness (DFT) uneven on parts**
- Uneven paint spray.

Action – New Idea



Advantage

- **Even DFT on parts**
- Even paint spray.

New Design Developed → Cylindrical

Trials

50 hg trial - Cylindrical jig

Trial Result

S	Parameter	Result
1	Envelope size	●
2	No Part falling	●
3	Loading & unloading	●
4	No hanger deformation	▲

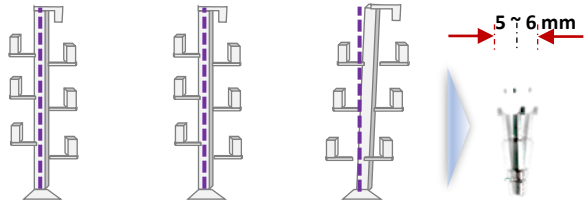
Result

1) **5 -6 mm bend in sec. carrier**

2) All Other parameters OK

Deformation observed on secondary carrier

Root cause & Actions



Actions taken

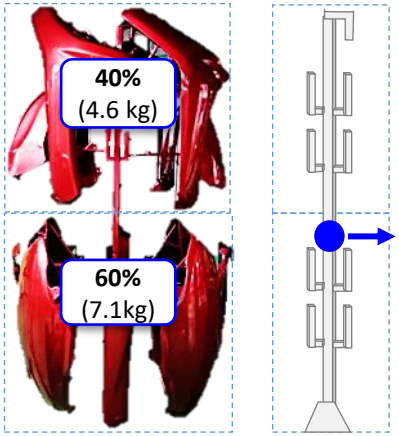
① Load Balancing on hanger.

② Secondary carrier strength increase:

Actions taken to prevent bending

① Load Balancing

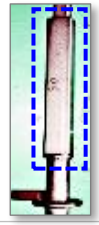
Parts weight balancing on hanger:



Hanger balancing done

② Sec. Carrier Strengthening

Bending Concerns addressed:

S	Hg	Before	After
1		2.4 mm thick	3.0 mm thick
2		No sleeve at bottom	Additional sleeve
3		 Hanger rotation – 48 RPM	 Hanger rotation – 32 RPM

Carrier strength enhanced

Final Development Result

100 hg trial Taken

S	Item	Before	After	Result
1	Envelope size	960 X 830 X 660	1620 X 830 X 830	OK
2	C/V load	34.2 kgs	47.6 kgs	OK
3	Bending	5~6 mm	No bending	OK

Results:

- Load Balance maintained.
- No bending observed
- All parameters OK

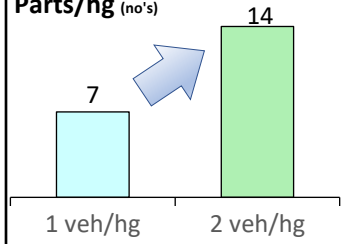
Extensive trials taken, all parameters OK

Two C/M taken for carrier strengthen and result are OK .

➢ Challenge – Line Re-layout & Approvals

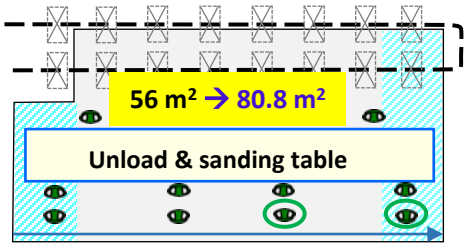
SPC Line Re - Layout

Parts/hg (no's)



- Parts have doubled
- Area re-layout required
- Area extension for accommodating additional equipment & MP.

Loading area

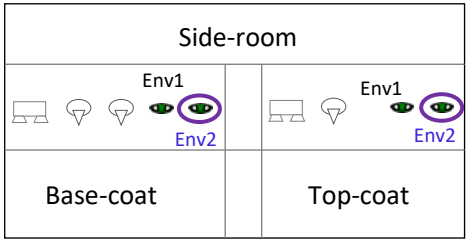


Investment : 1.2 Mn

Area	MP	New item
+24.8 m2	+2 nos	Platform, Table -2 nos

Modification	Temporary action
Dec'20 Shutdown	+1 m/p deployed completed.

Booth area

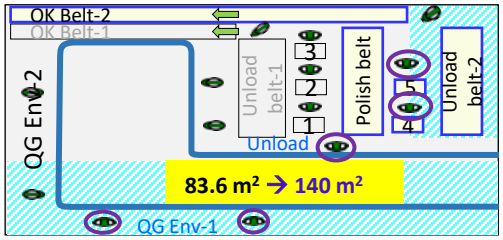


Investment : None

Area	MP	New item
No change	+2 nos	Platform for painters

Modification	Temporary action
Not required (Platform – Maker)	In-house platforms made.

Inspection area



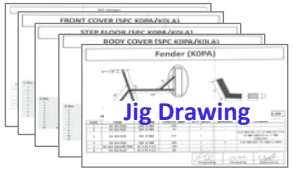
Investment : 2.9 Mn

Area	MP	New item
+56.4 m2	+6 nos	C/V belt, Polish table, platform - 3 nos

Modification	Temporary action
Dec'20 shutdown	+1 m/p deployed completed.

Safety approval

- **All data & drawing provided to safety team .**
- **Joint genba by PA & safety done .**



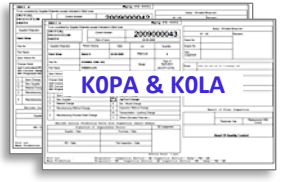
Key points

S	Risk	C/M	Sts
1	Cut injury during jig change.	Cut resistant gloves-B90 to be provided	●
2	Cut , crush injury due to part or jig fall from upper envelope	Platform to be provided with handrail.	●
3	Speedy rotation at recip may cause parts to fall on recip.& generate spark	Hanger RPM reduce Existing – 48 rpm Modified – 24 rpm	●

All points by safety team in RA have been closed

Quality approval

IPP approval done for both models K0PA & K0LA



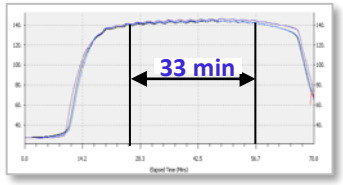
Quality testing done as per HES-D2018 guideline

Test	Standard	Actual	Judge
Adhesion	100/100	100/100	●
Gloss	Met : >80 Matt: >70	Met : 87 Matt : 72	●
Xylene Rub	No change in film app.	No change in film app.	●
Pencil harness	>F – No cut mark	>F – No cut mark	●

All quality parameters checked and found OK

Oven Calibration

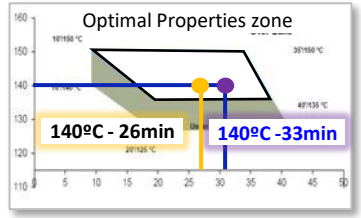
TTR report (HMSI)



Set Conditions

Tact	Oven temp	EMT
45 sec	145 ºC (No change)	140ºC

Baking Window (Paint maker)



- TTR result – **140 ºC for 33 mins**
- **Judge – OK**

[Value lies in the optimal properties zone]

Oven calibration done & existing parameter found OK

Entire constitution of SPC line changed, all necessary trials & Management approvals taken.

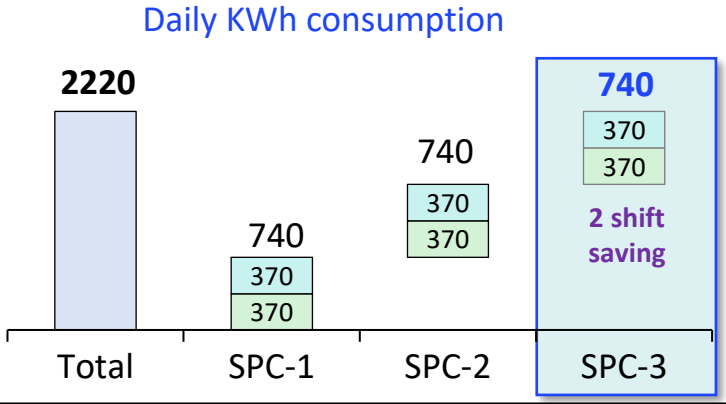
SMQCD Results

Category	Parameter	Existing	Target	Results	Judgement
S	OSHMS approval (Safety)	No Open observation	Zero Observation	Zero Observation	●
	Fire & explosion approval	No Open observation	Zero Observation	Zero Observation	●
	Open observations (Safety – 4F)	No Open observation (Total – 8 nos)	Zero Observation	Zero Observation	●
M	Training & deployment	100%	100%	100%	●
Q	HES confirmation	All Test Pass	All Test Pass	All Test Pass	●
	Documentation	100%	100%	100%	●
	SPR %	93.4%	94%	93.1%	●
C	Total Investment (Rs Mn)	-	Rs 6.2 Mn	Rs 6.2 Mn	●
	Saving (Rs Mn/Yr.)	-	**Rs 22.4 Mn / Yr.**	**Rs 22.4 Mn /Yr.**	●
D	Capacity (Veh)	3600 veh	3650 Veh (+1825 veh – SPC-3)	3650 Veh	●

All parameters found within spec

Environmental Impact

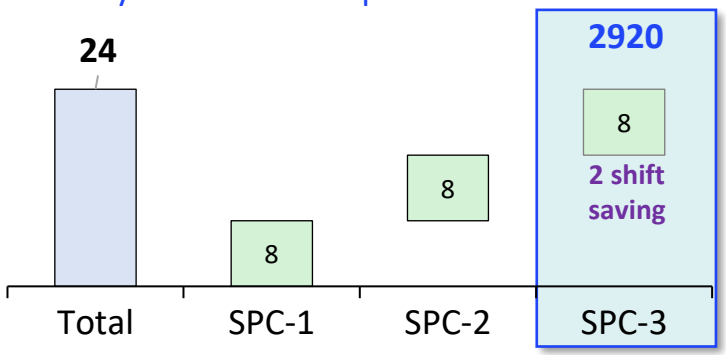
Carbon Footprint



KWh saving /day	740 KWh
KWh saving/yr.	2,00,000 KWh
Carbon emission reduced /Yr.	1,43,200 kg/Yr.
	149 Ton /Yr.

149 Ton/Yr.

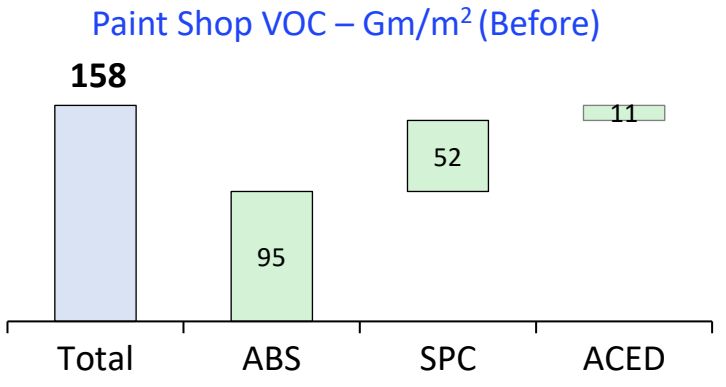
Water Saving

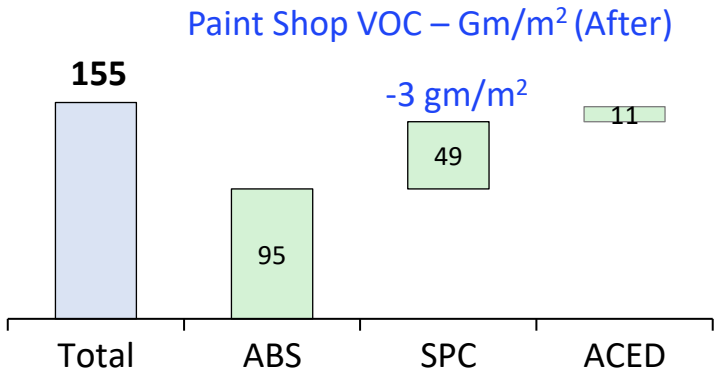


Water /day - ASU	8 KL/day
Water/yr. -ASU	2160 KL
Water/Yr. - Primer	520 KL
Water/Yr. – Sludge Pit	240 KL
Total	2920 KL

2920 KL /Yr.

VOC 's reduction



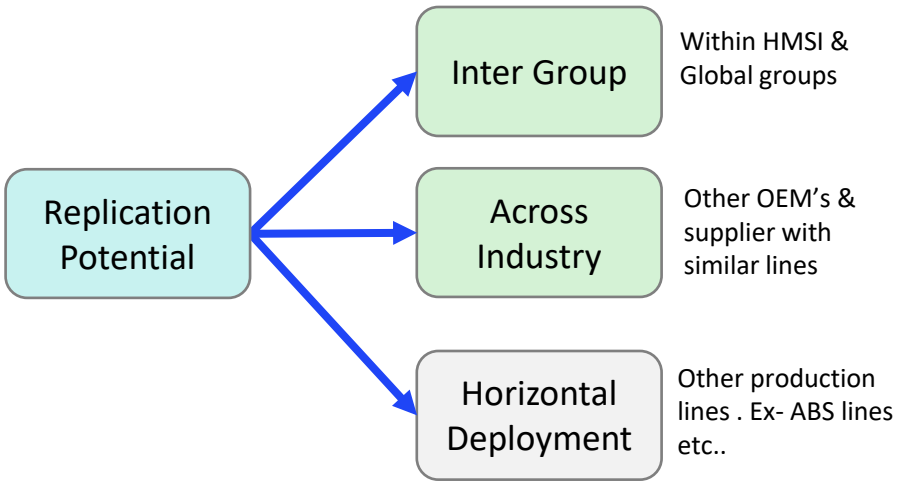


3 gm/m2
(Till now)

Significant positive environment impact by reduction in all key aspects…

Replication Potential

Potential Areas



Inter Group

HMSI Factories (Shared via HMSI BUKAI function)

1F-Manesar	2F-Tapukara	3F-Narsapura	4F - Vithalapur
			
NA	Applicable	Applicable	●

GENPO Countries [Shared via A&O PAPO BUKAI meeting)

Indonesia	Vietnam	Thailand	Philippines	Bangladesh
				

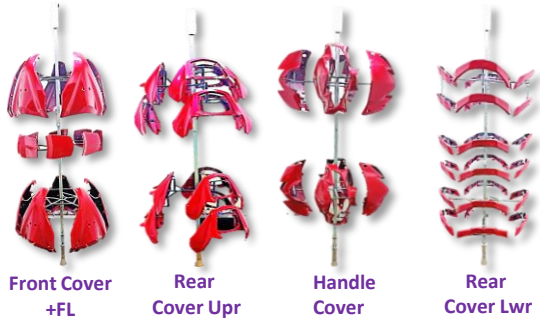
Across Industry

Feasibility can be checked across other OEM's with similar parts

- Similar scooter models across OEM's in India
- All models have similar sheet metal parts
- Feasibility for painting pattern in 2 veh/hg condition can be checked

Horizontal- Other Lines

Taking Cue from success of this project, we have now targeted ABS lines (Plastic parts) for similar concept implementation…



Veh/hg – 2.5

Veh/hg – 4.0

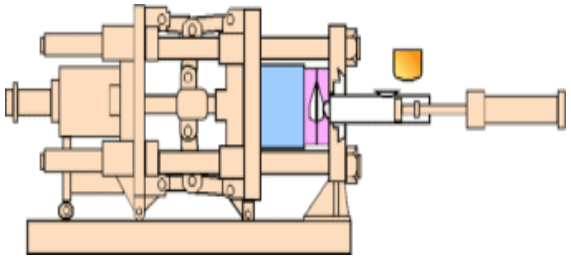
This theme has huge replication potential within HMSI & across other automobile industries..

HONDA
The Power of Dreams

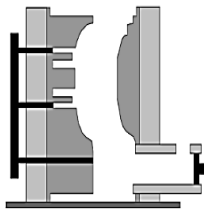
Project 02 - : **Die Lube Re-Cycle System for water saving**

PFD

Casting Making Process

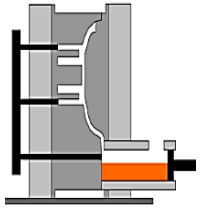


① Die Close



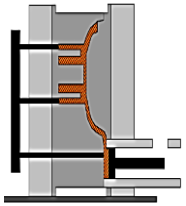
Moving die closed with Fix die.

② Metal IN



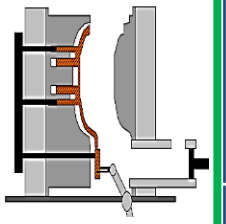
Molten Aluminium metal poured in to die sleeve

③ Injection



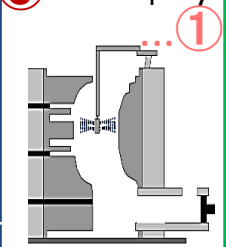
Aluminium molten metal injection with high speed.

④ Part Out



Casting curing, ejection from die and discharged.

⑤ Lube Spray



Die coolant spray to cool die surface and ready for next.

Category : Resource Conservation

Trigger Point : Business Plan Activity (Middle level Management)
Management drive to push for ideas that reduce environmental impact.

Date of Implement : January ’2020

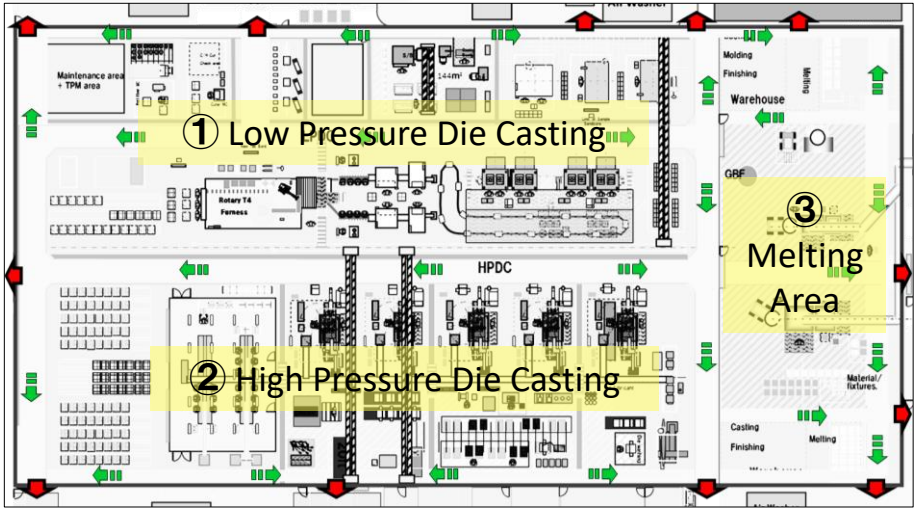
Total Investment : 2.1 Mn INR **ROI :** 14 Months

Project Uniqueness :
- ❖ Best example of maximizing the utilization of available resources.
- ❖ Big savings through small idea.
- ❖ Multi-benefits (resource conservation, cost saving, efficiency improvement).

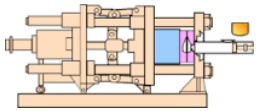
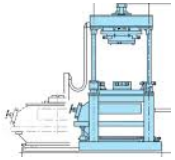
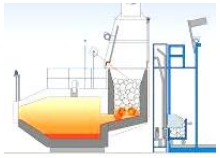
Introduction : Die Casting

Die Casting Building

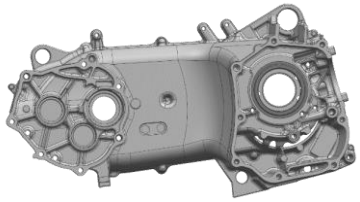
Die Casting Layout



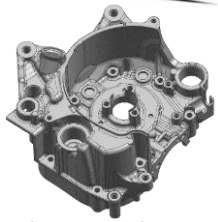
Major Equipment

HPDC Machine		Make : Toshiba Qty : 5 Sets
LPDC Machine		Make : ISUZU Qty : 4 Sets
Melting Furnace		Make : NK Qty : 2 Sets

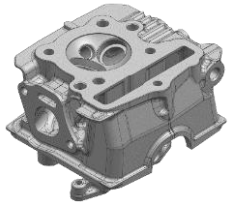
I/H Manufactured Parts



Left Crank Case
HPDC



Right Crank Case
HPDC

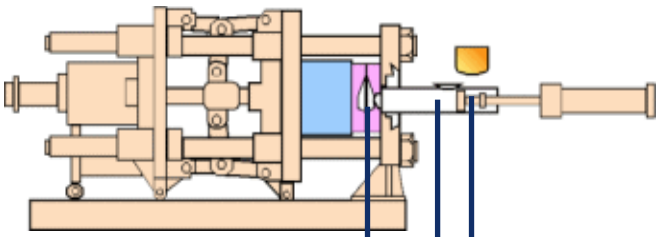


Cylinder Head
LPDC

Aluminium Foundry Manufacturing Set-up with latest technology

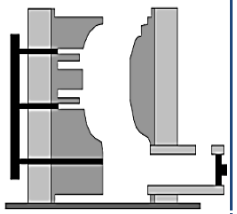
Introduction – Process (Die Casting)

Die Casting Process



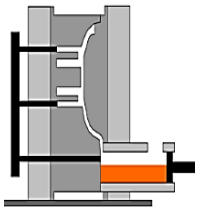
- HPDC Die (MD & FD)
- Hot Aluminium molten metal
- Plunger Sleeve & Plunger

Die Close ①



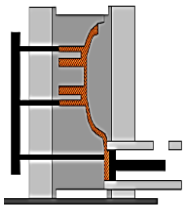
Moving die closed with Fix die.

Metal IN ②



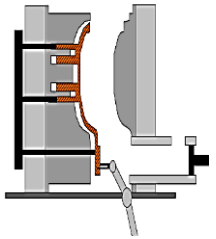
Molten Aluminium metal poured in to die sleeve

Injection ③



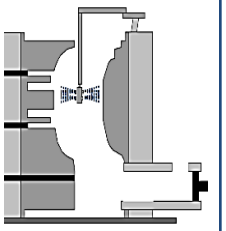
Aluminium molten metal injection with high speed.

Part Out ④



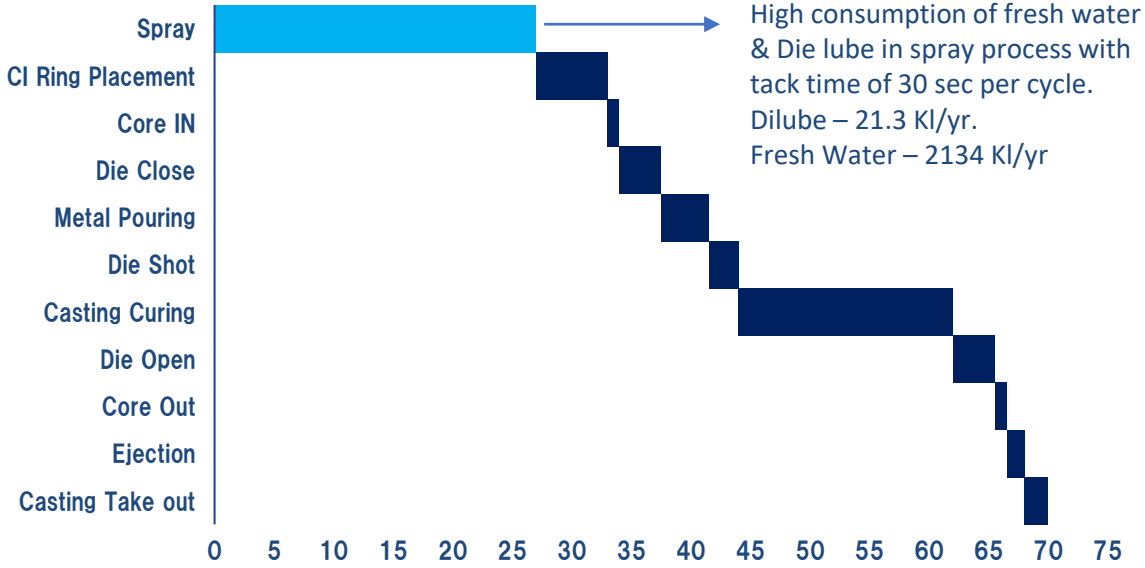
Casting curing, ejection from die and discharged.

Lube Spray ⑤....①



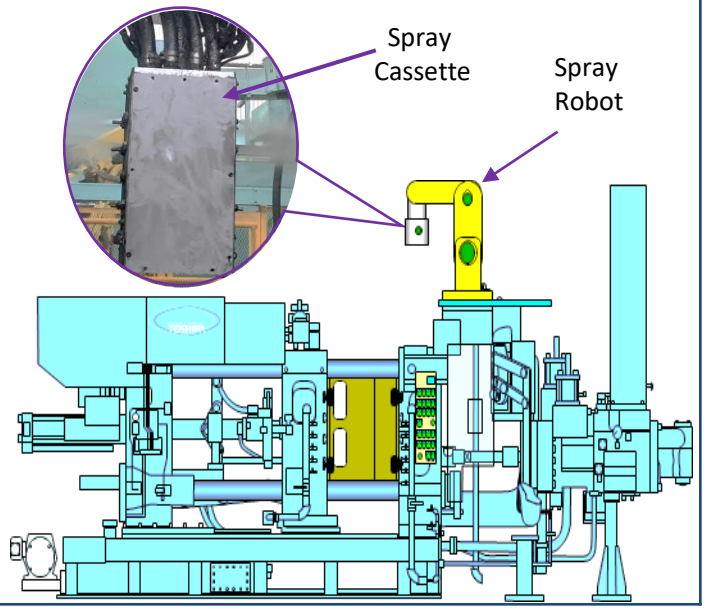
Die coolant spray to cool die surface and ready for next.

Die Casting Cycle Time Break-up



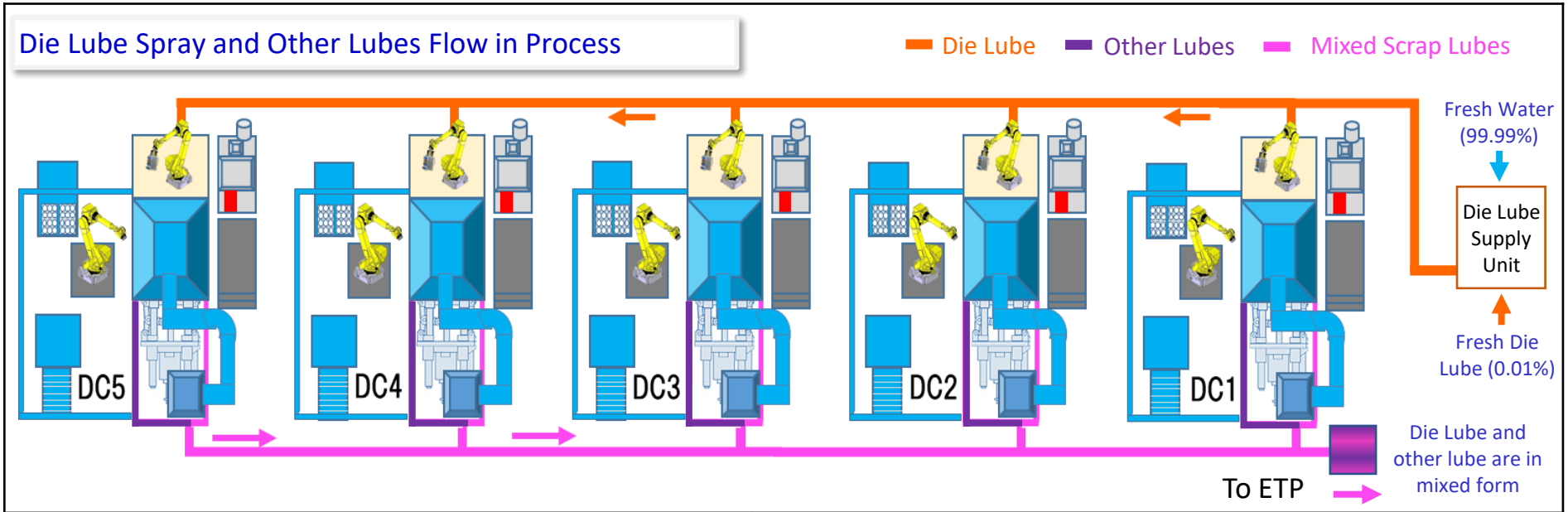
High consumption of fresh water & Die lube in spray process with tack time of 30 sec per cycle.
Dilube – 21.3 Kl/yr.
Fresh Water – 2134 Kl/yr

Spray Unit Introduction

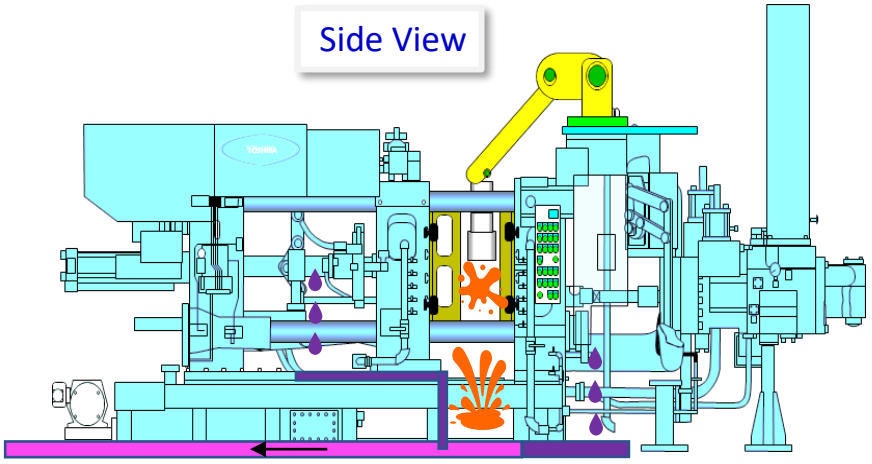


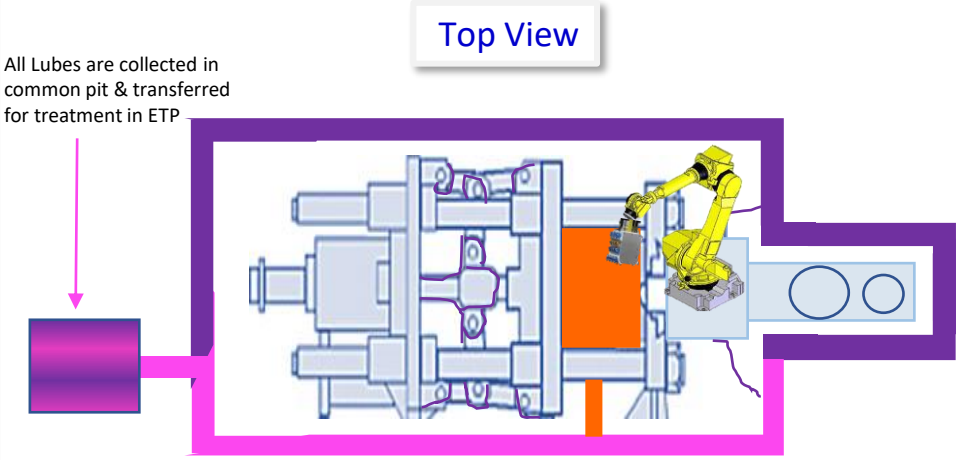
Maximum time is taken in spaying Die Lube during complete cycle

Die Lube Spray and Other Lubes Flow in Process



Die Lube Spray and Other Lubes Collection System in individual HPDC machine





Die Lube sprayed in Dies is mixed with other lubes and transferred to ETP

Scope of improvement in System

① Prevent Mixing of Different Dilube :

Diff types of lubes used for different purposes in Die Casting Machine, like :Die Lube, Hydraulic Oil, Machine Lubrication Oil & Plunger Lubrication Oil

Die lube can be separated from other oils & lubes with the help of separate collecting system & recycling system for reuse.

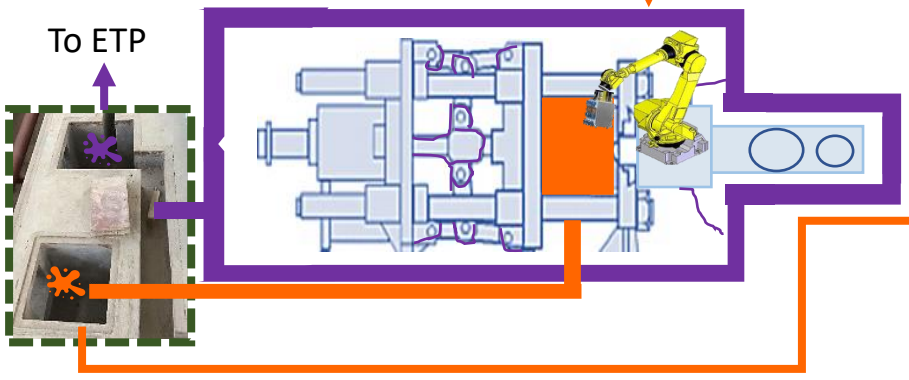
② Maintain Dilution ration of Used Dilube:

Dilution ration of the recycled Dilube can be maintained by density analyzer. The existing supply machine do not have online dilution ration checking mechanism

Direct supply unit without mixing system

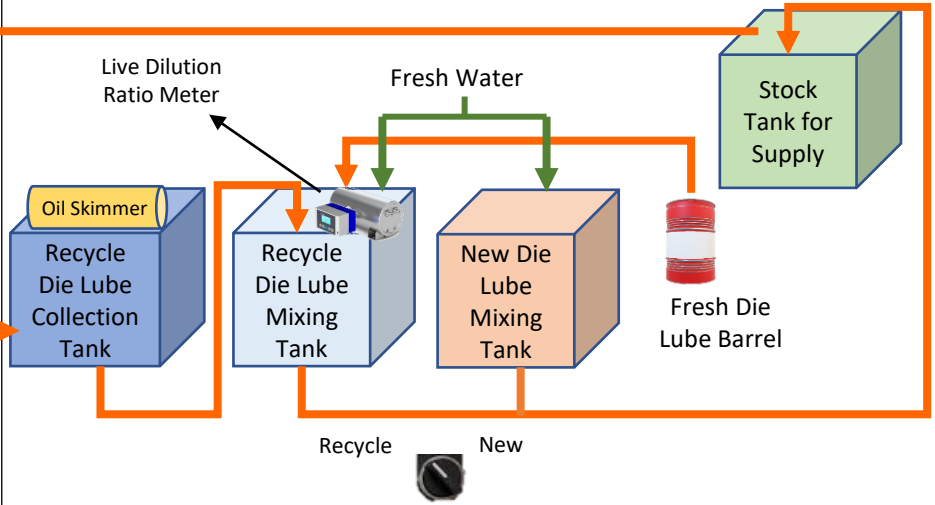
Technology Introduction

① Provision of separate mini pits for collection of Dilube :



Separate mini pit provided for waste Dilube collection

② Introduction of Online Dilube mixing machine

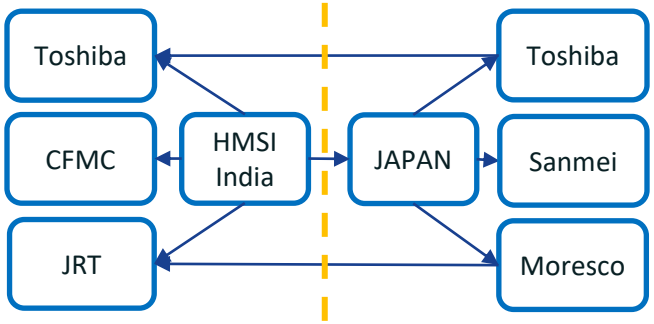


Die Lube Mixing Unit with online Density analysis

Die Lube Consumption is very high in Conventional system

Challenges faced in implementation

1. Maker Coordination and Implementation

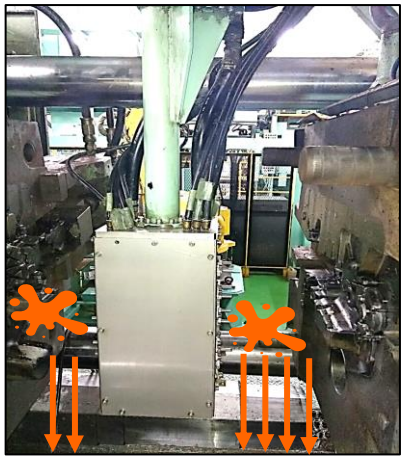


Main Challenge was to bring all vendors of different machines on same platform for implementing project and getting approval for the same

2. Die lube Collection

Due to congested location, there was very less space to install separate channel and mini pits for the collection of only die lube

Collection tray and mini pit was installed very precisely



Collection of Die Lube

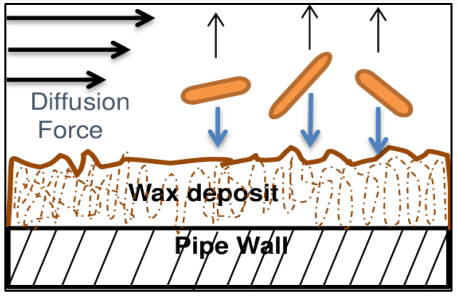
3. Maintain Die Lube Ratio

Maintaining the dilution ratio with continue mixing the fresh & recycled Die Lube with Fresh Water as per requirement become big challenge

Issue was resolved with the help of Online density analyzer & mixer

Online Density Analyzer

4. Storage & Transfer of Waste Lube



It was big challenge to maintain the recycled die lube in usable condition, it starts to produces the bad smell and wax of Die Lube starts to settle down in pipes, pits and tanks. Hence one day holding mini pit is made to avoid smell and wax deposition

5. Recycling of Die Lube

Oil traces get mixed with recycled die. It is very hard and difficult to make recycled die lube as same as fresh die lube.
Hence separation system installed to remove oil and other impurities

Oil & Other impurity Remover

Coordination & Concept sharing was biggest challenge faced in implementation

Achievement : Tangible Benefits

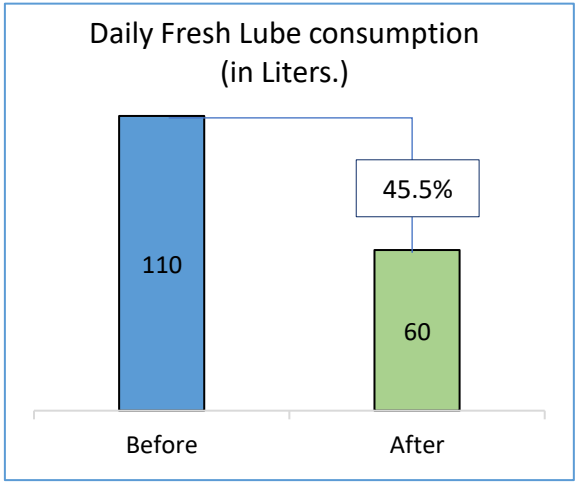
Before Re-Cycle Unit

- With out Re-cycle unit die lube mix with machine lube & will directly send to ETP for water treatment process.& will impact higher consumption of ETP chemicals.
- Higher water & die lube consumption.
- High cost due to more die lube consumption.

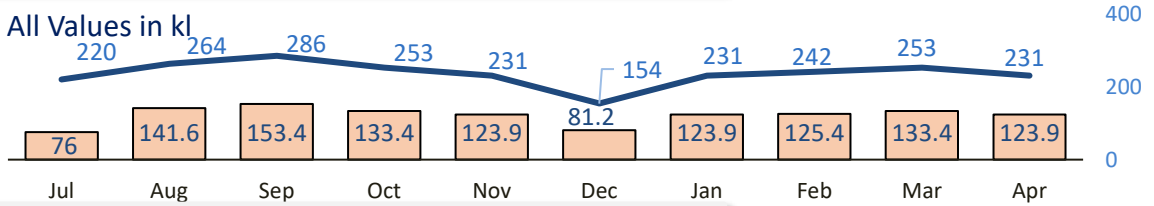
After Re-Cycle Unit

- With Re-cycle unit die lube will not mix with machine lube & lube collection will be at die lube Re-Cycle tank. Hence Less consumption of ETP chemicals and other Utilities.
- Fresh Die lube consumption will be less.
- Lower cost due to less die lube consumption.

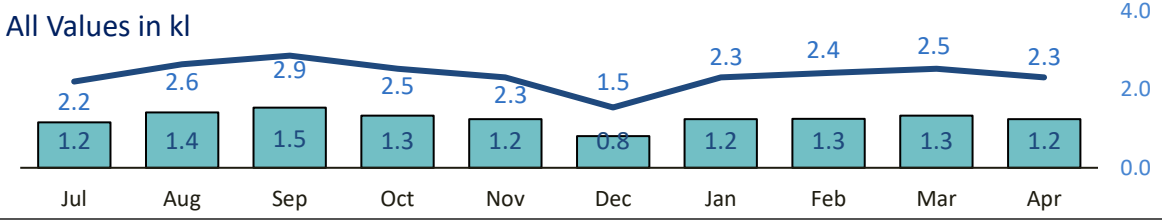
Die Lube Consumption



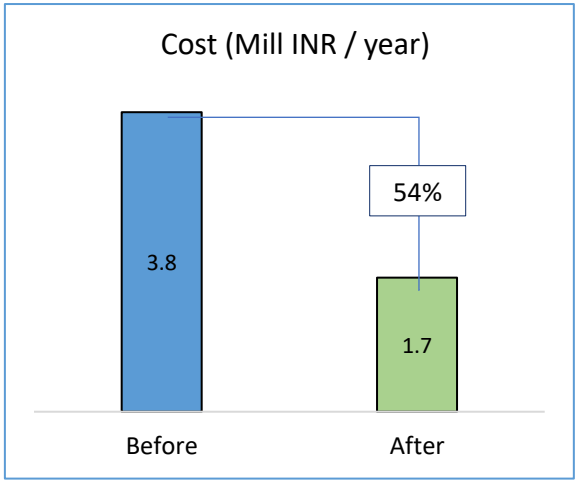
Water Consumption Plan v/s Actual



Avg Die Lube Consumption Plan v/s Actual



Cost – Saving



Process cost related to Die Lube is reduced by 54 percentage.

Achievement : Intangible Benefits

Category		Control item	Benchmark	Target	Actual	Status
S	Safe & op. friendly	Accident	Zero operational Accident	0	0	●
Q	Easy to integrate, Good Display & Alarms	Mode Selector	Flexibility of New or Re-Cycle mode	100%	100%	●
		Alarms	Max & Min with setting	100%	100%	●
		Easy Control	Easy to integrate & Control	Auto/Manual	Auto	●
		Ratio Maintained	1:100	1:100	1:100	●
C	Minimum investment & Max out put	Cost Reduction	54% Cost reduction	45%	45%	●
		No down time	Zero Down time	0 Min	0 min	●
D	Highest efficiency with minimum loss	Utilization rate	100%	100%	100%	●
		Change time	Single minute (auto/Manual)	O Min	0 min	●

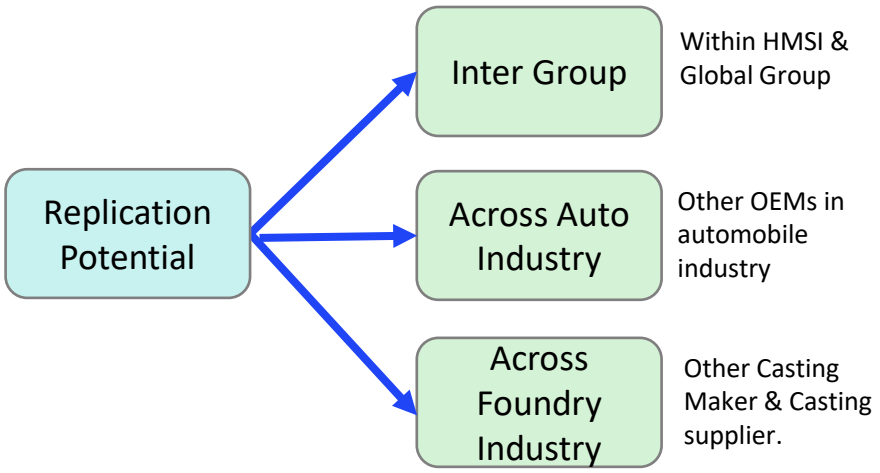
Env Impact

Die Lube Consumption	45% ~ 50% Less Consumption	Saving : 10 KL / Year Before : 21.3 KL; After : 11.3 KL
Water Consumption	45% ~ 50% Less Consumption	Saving : 1042 KL / Year Before : 2134 KL; After : 1092 KL
Treatment Chemical Consumption	50% ~ 55% Less Consumption	Saving : 256 Kg / Year Before : 749 Kg; After : 493 Kg
CO_2 Emission	40% ~ 45% Less Consumption	Saving : 0.65 Ton / Year Before : 2.1 T; After : 1.45 T
Wastewater Generation	25% ~ 30% Less Generation	Saving : 1180 KL / Year Before : 4188 KL; After : 3008 KL
Sludge Generation	25% ~ 30% Less Generation	Saving : 1291 Kg / Year Before : 4583 Kg; After : 3292 Kg

Less Resources Consumption and Scrap Generation Due to Re-Cycle System

Replication Potential

Potential Areas



Inter Group

HMSI Factories (Shared via HMSI BUKAI function)

1F-Manesar	2F-Tapukara	3F-Narsapura	4F - Vithalapur
			
NA	Applicable	NA	●

GENPO Countries [Shared via A&O PAPO BUKAI meeting)

Indonesia	Vietnam	Thailand	Philippines	Bangladesh
				

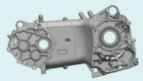
Across Auto Industry

Feasibility can be checked across other maker with similar parts

- Similar Manufacturing facility across OEM's in India.
- All models have similar Die Casting Parts.
- 4 – Wheelers also have Die Casting parts

Across Foundry Industry

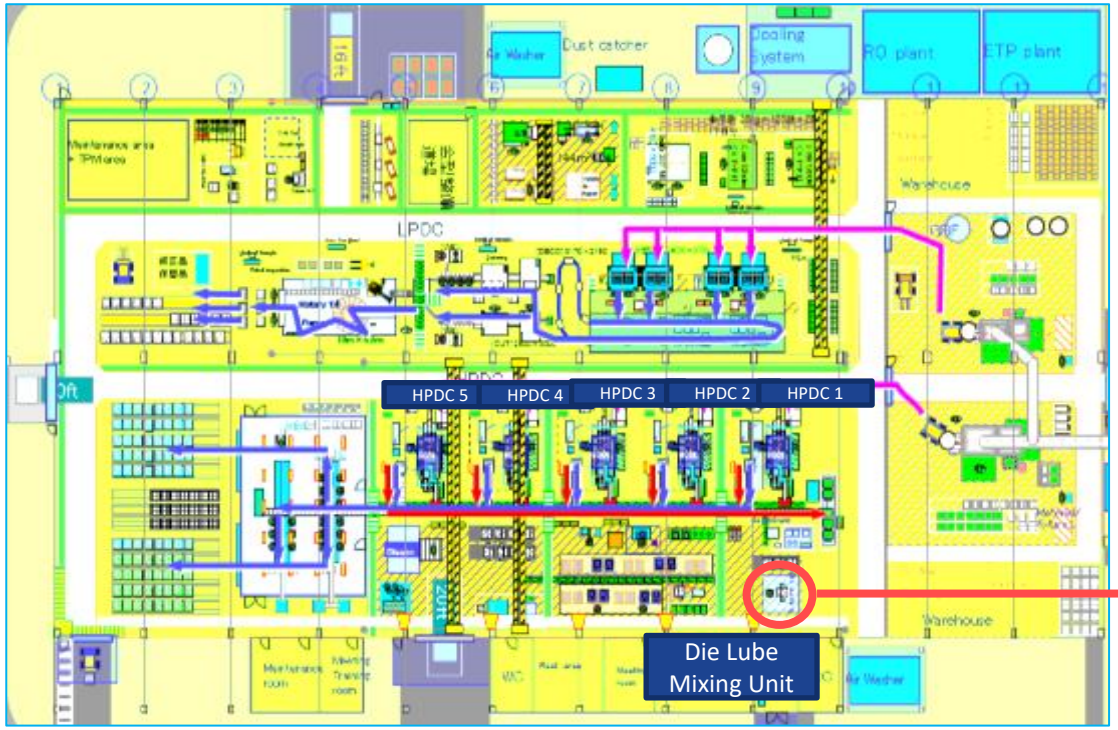
Feasibility can be checked across other Suppliers with similar parts

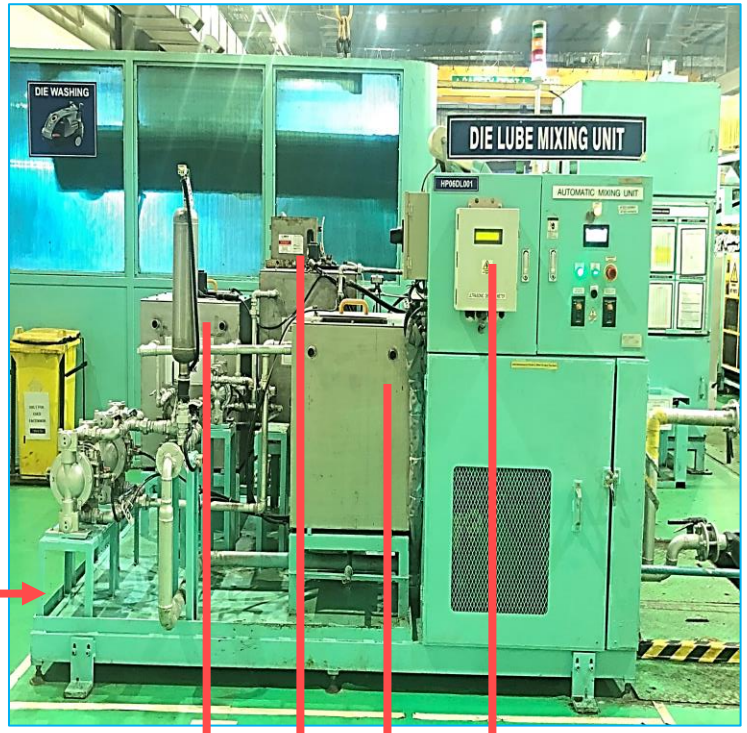
HMSI	Suzuki	ETPL	ASK	SAPL
				
OEM	OEM	Tier -1	Tier – 1	Tier - 1

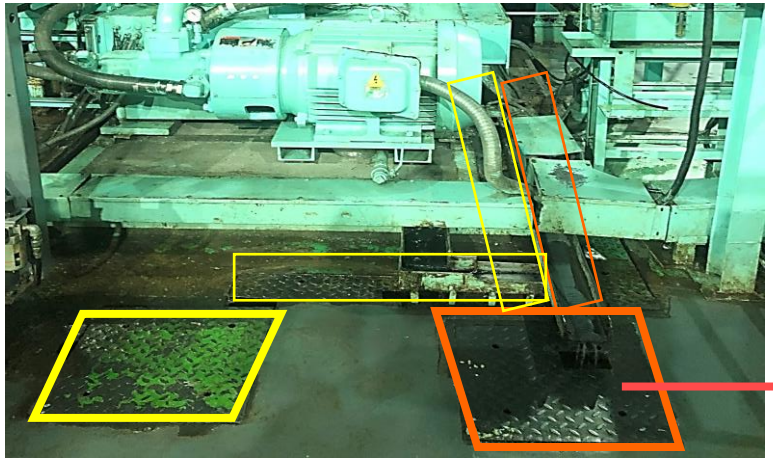
- Similar Manufacturing facility across Suppliers in India.
- All HPDC Casting makers.

This theme has huge replication potential across other Die Casting industries..

Actual System







Used Die lube Collecting Separate Pit

Dilution Ratio Meter

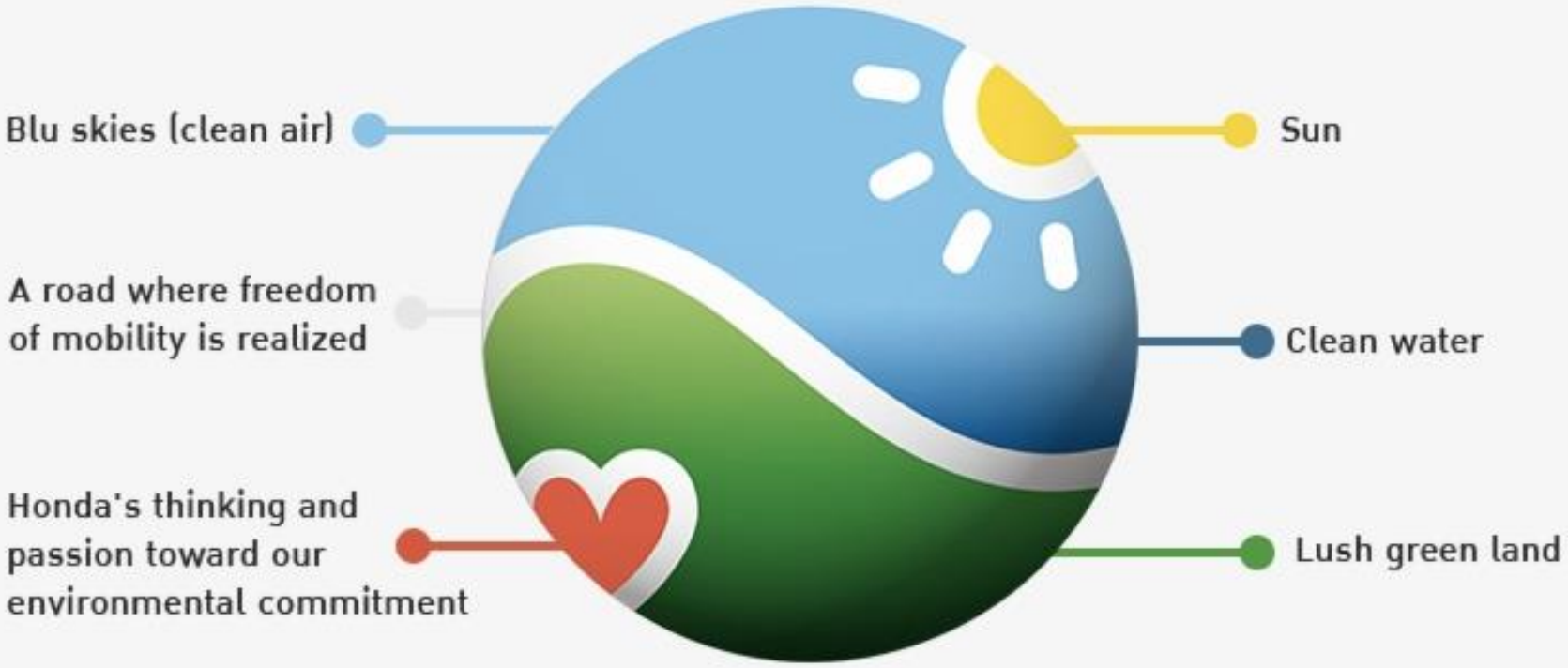
Supply Tank

Recycle Mixing Tank

New Lube Mixing Tank

Recycle Die Lube system implemented on Die Casting Machines

BLUE SKIES FOR OUR CHILDREN



Thank You...