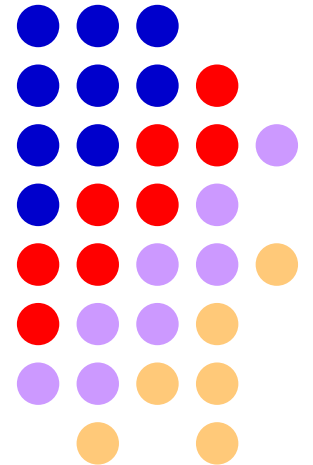


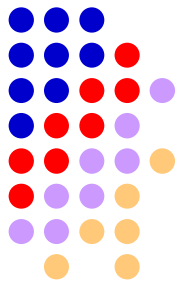
Energy Efficiency in Automobile Sector



**National Productivity Council,
New Delhi**



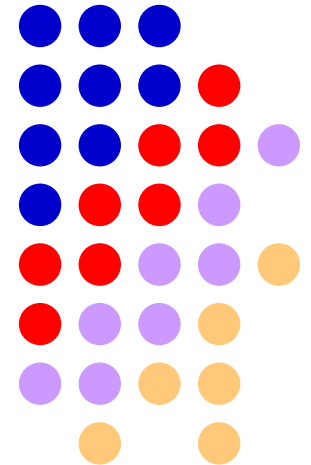
Savings at a Glance



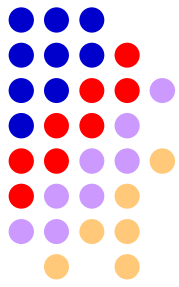
Option	Savings Rs (Lakhs)	Investment Rs (Lakhs)
Chiller Temperature Setting Improvement	0.96	Nil
Fuel Substitution and Thermic Fluid Heating	40.3	40
FRP Blades for Circulating Air Fans	3.89	8.4
FDV Improvement	10.47	Nil
Installation of Hood for Material Transfer	0.28	0.3
Pump Efficiency Improvement	7.76	9.0
Cooling Tower – FRP Fans	0.37	0.6
Outside Lighting Fixture replacement	0.79	0.92
TOTAL SAVINGS	64.82	59.22

Air Conditioning System

- Resetting of Chiller Temperature
 - Pump Efficiency
- Chiller Machine Performance Assessment
 - AHU Performance



Chiller Improvement



- Chilled Water Outlet Temperature setting increased by 0.5 °C

Existing System

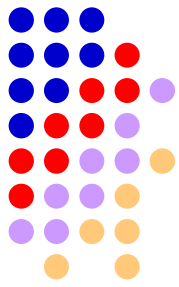
Chilled Water In: 14.1 & 14.8 °C
Chilled Water Out: 12.3 & 10.8 °C
Prod Office Temp: 23.8 °C
Engine Assembly Temp: 27.1 °C
Power Consumption: 153.9 kW

Proposed System

Chilled Water In: 14.1 & 14.8 °C
Chilled Water Out: 12.8 & 11.3 °C
Prod Office Temp: 24.0 °C
Engine Assembly Temp: 27.4 °C
Power Consumption: 143.1 kW

Annual Energy Savings: 23278 kWh
Annual Monetary Savings: Rs. 0.96 Lakhs

Chiller Pump Efficiency



- Efficiency of the Chilled Water Pump is calculated

Existing System

Pump Flow: 197 m³/hr

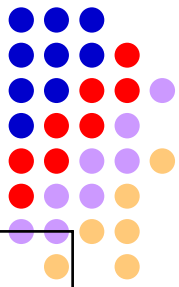
Suction Pressure: 1 kg/cm²

Discharge Pressure: 2.7 kg/cm²

Power Consumption: 18.91 kW

Combined Efficiency: 48.21%

Pump Efficiency: 60.57%

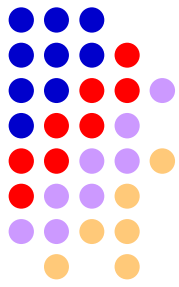


Performance Assessment of Chiller Machine

	Units	UNIT 1	Both in Operation
Chilled Water In Temp	°C	12.9	14.4
Chilled Water Out Temp	°C	10.2	11.5
Chilled Water Flow	m ³ /hr	119	197
Condenser Water In Temp	°C	33.2	33.1
Condenser Water Out Temp	°C	37.1	36.7
Condenser Water Flow	m ³ /hr	61.33	91.92
Power Consumption			
Chiller Machine	kW	96.5	180.8
Condenser Pump	kW	13.8	34.7
Chiller Pump	kW	9.65	18.91
Refrigeration Delivered	TR	109.31	190.01
Chiller Effectiveness	kW/TR	1.10	1.23

Can be improved upto 1.0 kW/TR with proper maintenance practice and complete overhauling of the machine

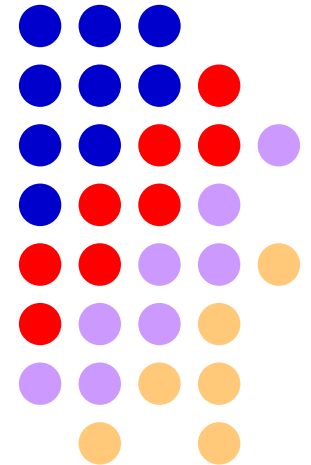
Performance Assessment of AHU's

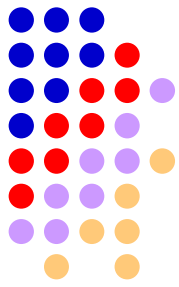


Area Reference	TR Delivered
New Engine Assembly	16.36
SAP	8.26
Material	5.68
Finance	9.99
Production Office (GF)	18.79
Production Office (FF)	20.88
Old Engine Assembly	32.19

Paint Shop

- Thermic Fluid Heating
 - Circulating Air Fans





Fuel Substitution with Thermic Fluid Heating

- Instead of LPG, HPS is to be used with help of thermic fluid heating in all the 7 water/paint drier of all the 4 paint shop,

Existing System

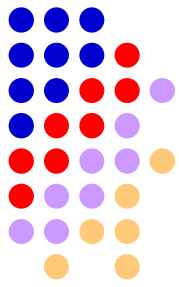
LPG Consumption: 1652 kg/day
LPG Cost: Rs 28/kg
Calorific Value: 11,500 kCal/kg
Efficiency: 85%
Annual Cost: Rs. 138.8 Lakhs

Proposed System

HPS Consumption: 2243 kg/day
HPS Cost: Rs 13/kg
Calorific Value: 9,600 kCal/kg
Efficiency: 75%
Annual HPS Cost: Rs. 87.5 Lakhs
Annual Aux Cost: Rs. 9 Lakhs
Misc Cost: Rs 2 Lakhs

Annual Cost Savings: Rs. 40.3 Lakhs
Budgetary Investment: Rs. 40 Lakhs
Simple Payback Period: 1 Year

Annual Working Days 300



FRP Blades for Circulating Air Fans

- Existing Fans are to be replaced with High Temperature resistant FRP Blades for Circulating Air Fans in all the 7 water/paint drier of all the 4 paint shop,

Existing System

Actual Power Consumption: 8.5 kW
(Average)
No of Fans: 14 No's (2 in Each)
Total Power Consumption: 119 kW
Annual Consumption: 9.42 Lakh Units

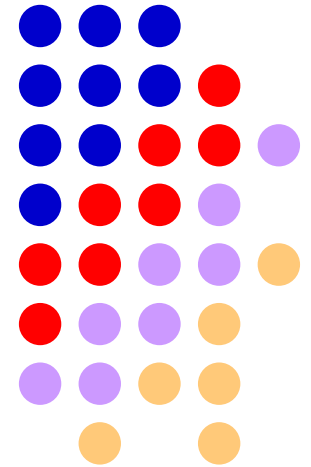
Proposed System

FRP Fan Blades is to be installed
New Power Consumption: 7.65 kW
(10% Savings of Actual
Consumption)
Annual Power Consumption: 8.48
Lakh Units

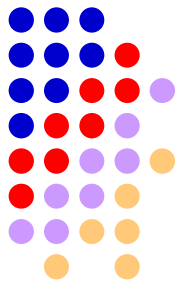
Annual Power Savings: 0.94 Lakh Units
Annual Cost Savings: Rs. 3.89 Lakhs
Budgetary Investment: Rs. 8.4 Lakhs
Simple Payback Period: 2.15 Year

FDV System

- FDV #1
- FDV #2
- FDV #3 (GF)
- FDV #5



FDV #1



Dampers are opened and one FDV Blower is stopped

Existing System

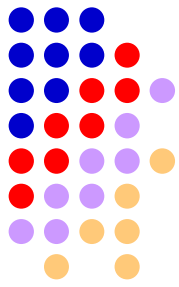
Fans in Operation: 5 Nos
Total Power Consumption: 87.07 kW
Velocity at Farthest End: 2.72 m/sec

Proposed System

Fans in Operation: 4 Nos
Total Power Consumption: 66.26 kW
Velocity at Farthest End: 2.6 m/sec

Annual Power Savings: 99,915 kWh
Annual Cost Savings: Rs. 4.14 Lakhs

FDV #2



Dampers are opened and one FDV Blower is stopped

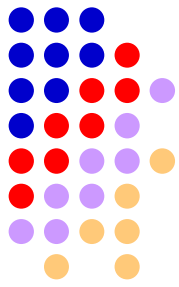
Existing System

Fans in Operation: 5
Total Power Consumption: 71.11 kW
Velocity at Farthest End: 4.7 m/sec

Proposed System

Fans in Operation: 4
Total Power Consumption 57.82 kW:
Velocity at Farthest End: 4.1 m/sec

Annual Power Savings: 63,775 kWh
Annual Cost Savings: Rs. 2.64 Lakhs



FDV #3 (Ground Floor)

Dampers are opened and one FDV Blower is stopped

Existing System

Fans in Operation: 3

Total Power Consumption: 53.11 kW

Velocity at Farthest End: 4 m/sec

Proposed System

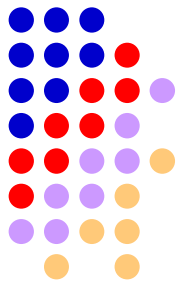
Fans in Operation: 2

Total Power Consumption: 41.10 kW

Velocity at Farthest End: 3.9 m/sec

Annual Power Savings: 57,663 kWh
Annual Cost Savings: Rs. 2.39 Lakhs

FDV #5



Dampers are opened and one FDV Blower is stopped

Existing System

Fans in Operation: 4
Total Power Consumption: 21.98 kW
Velocity at Farthest End: 4.6

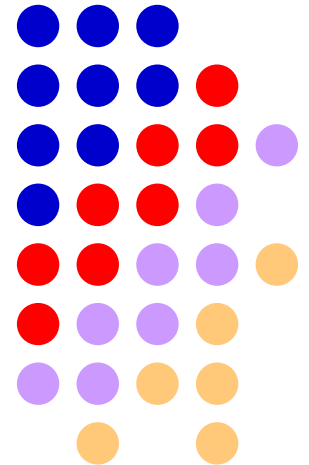
Proposed System

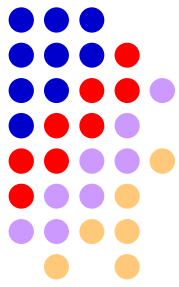
Fans in Operation: 3
Total Power Consumption: 15.44 kW
Velocity at Farthest End: 3.44 m/sec

Annual Power Savings: 33,378 kWh
Annual Cost Savings: Rs. 1.3 Lakhs

Heat Treatment Furnaces

- Installation of Hood for transfer of Material
 - Thermo-graphy Survey





Installation of Hood

Existing System

Transfer system for Pre – Heating Furnace to SQF is open to Atmosphere
Temperature Drop: 100 °C

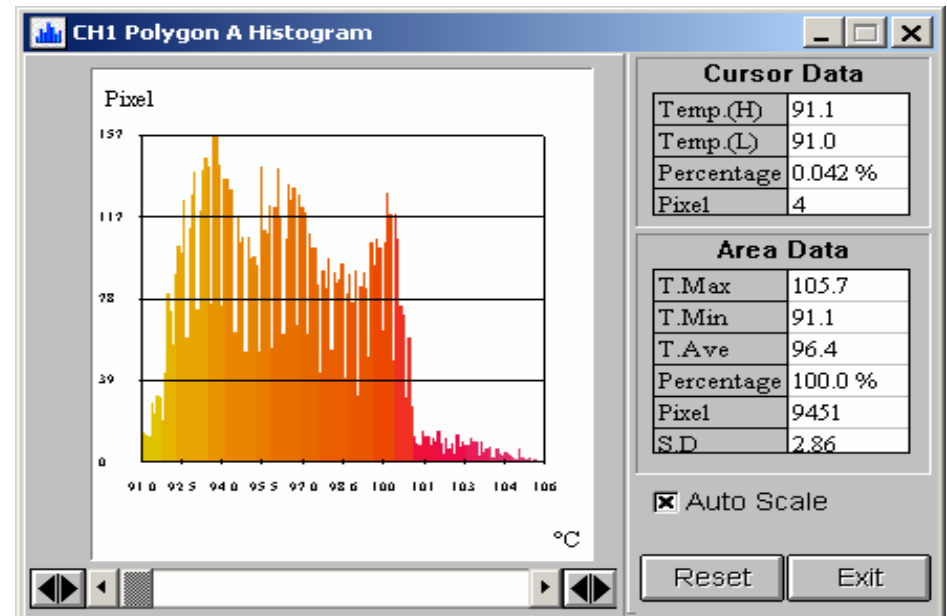
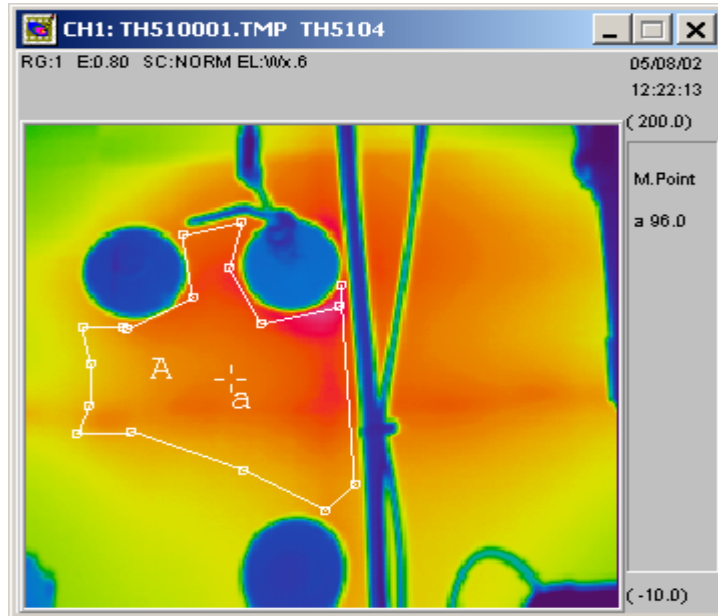
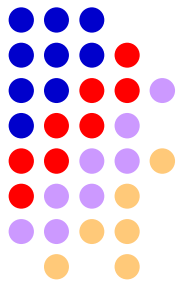
Proposed System

Hood Arrangement with **Insulation Lining** for Transferring of Material is to be provided for 3 sides & Top Surface

Temperature Drop: 40 °C
Energy Savings: 1800 kCal/Batch
No of Transfer in a Day: 10 Approx
Annual Energy Savings: 5.94 MkCal
Equivalent Electrical Energy Savings: 6900 kWh

Annual Cost Savings: Rs. 0.28 Lakhs
Investment: Rs. 0.30 Lakhs
Simple Payback Period: 1.07 Years

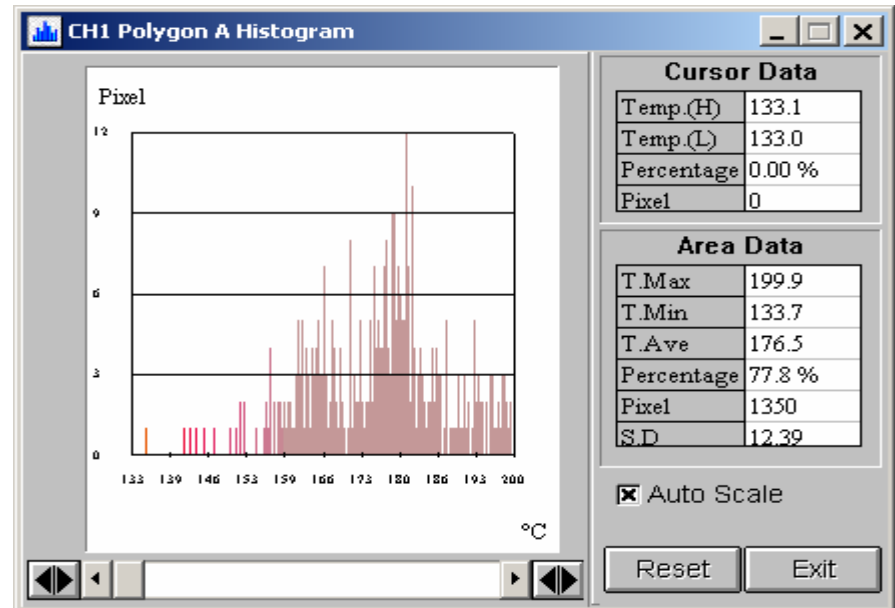
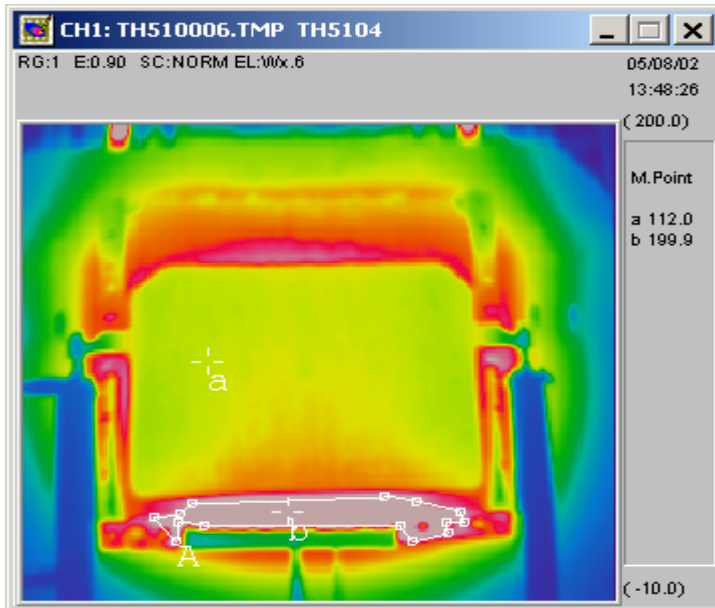
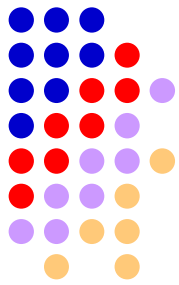
SQF #1 (Right side to the Entry)



Unavoidable Losses as it is near Temperature Sensor Probes

Temperature of Hot Spot : 96 °C
Area of Hot Spot : 30 x 70 cm

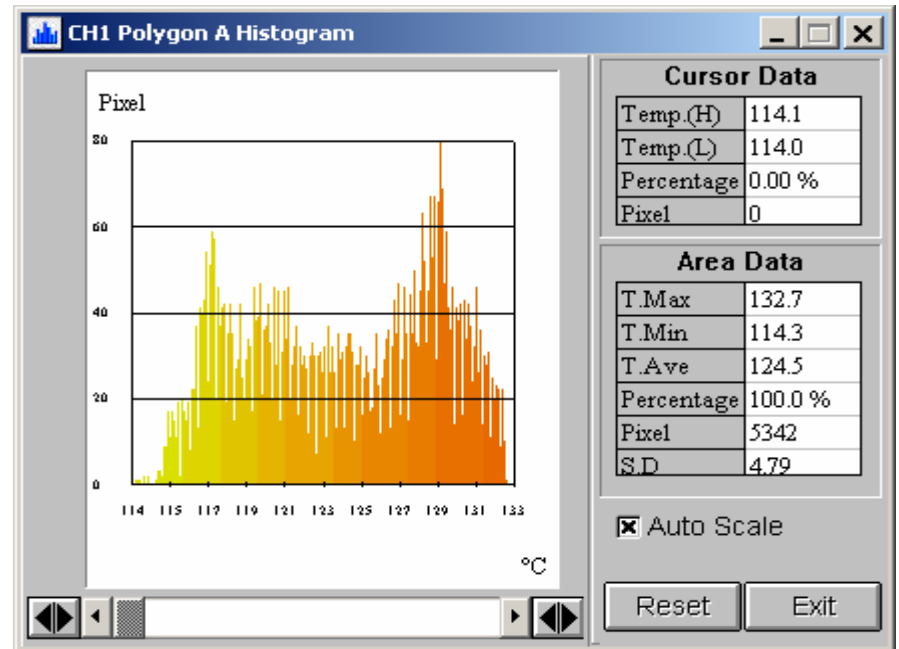
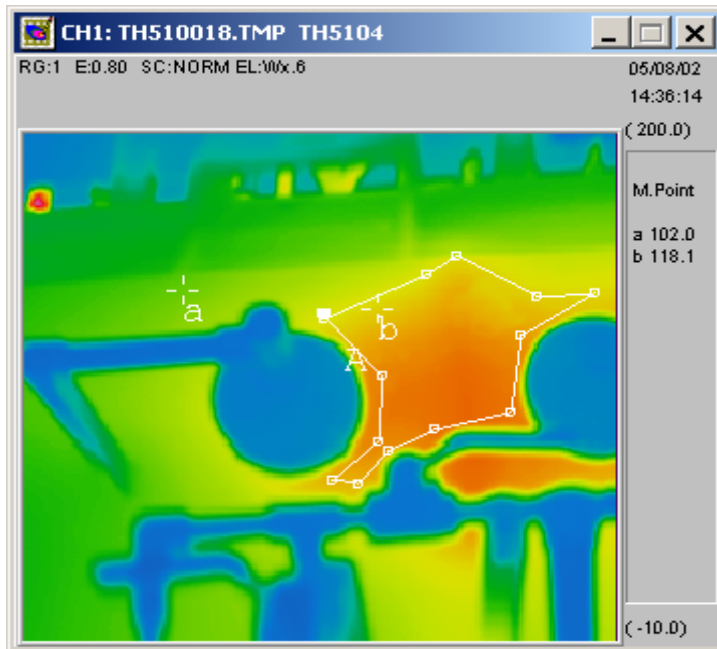
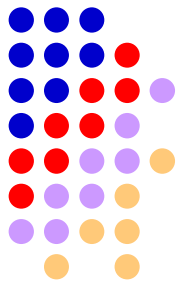
SQF #2 (Entry Side)



Unavoidable Losses as it is near to opening

- Temperature of Hot Spot :
 - Door : 112 °C
 - Bolts at Bottom : 199 °C
- Area of Hot Spot :
 - Above Door : 90 x 60 cm
 - Bolts at Bottom : 110 x 10 cm

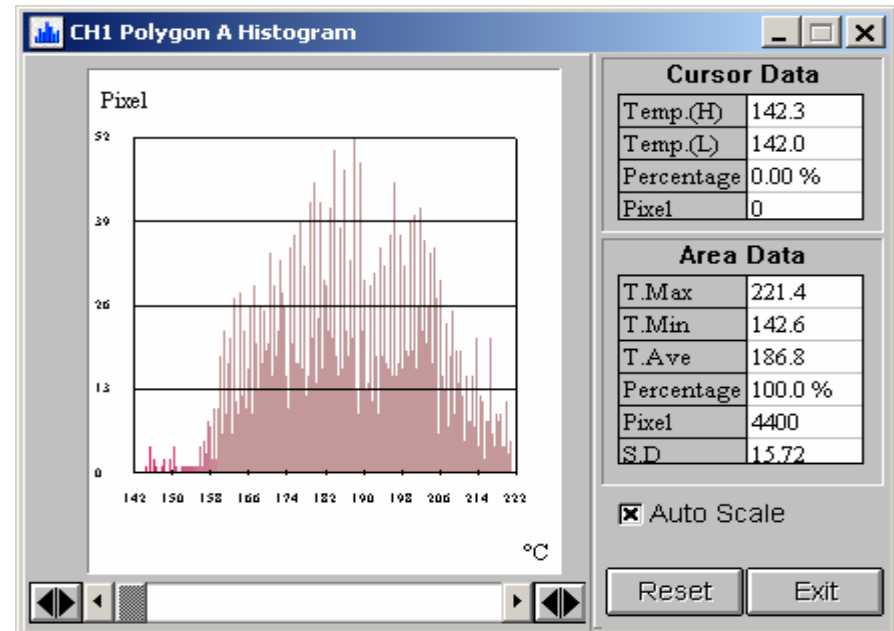
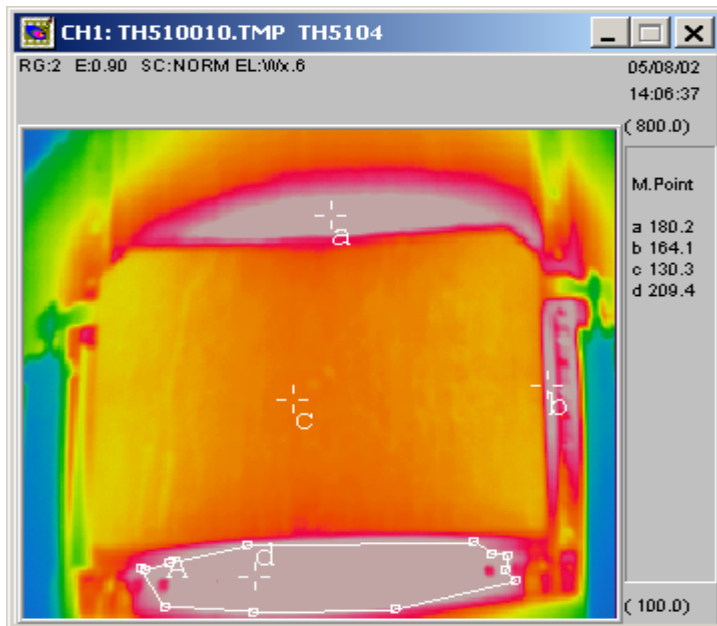
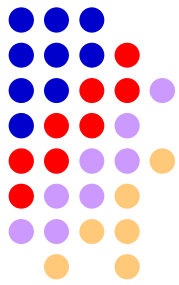
SQF #3 (Right side to the Entry)



Unavoidable Losses as it
is near Temperature
Sensor Probes

Temperature of Hot Spot : 130 °C
Area of Hot Spot : 30 x 30 cm

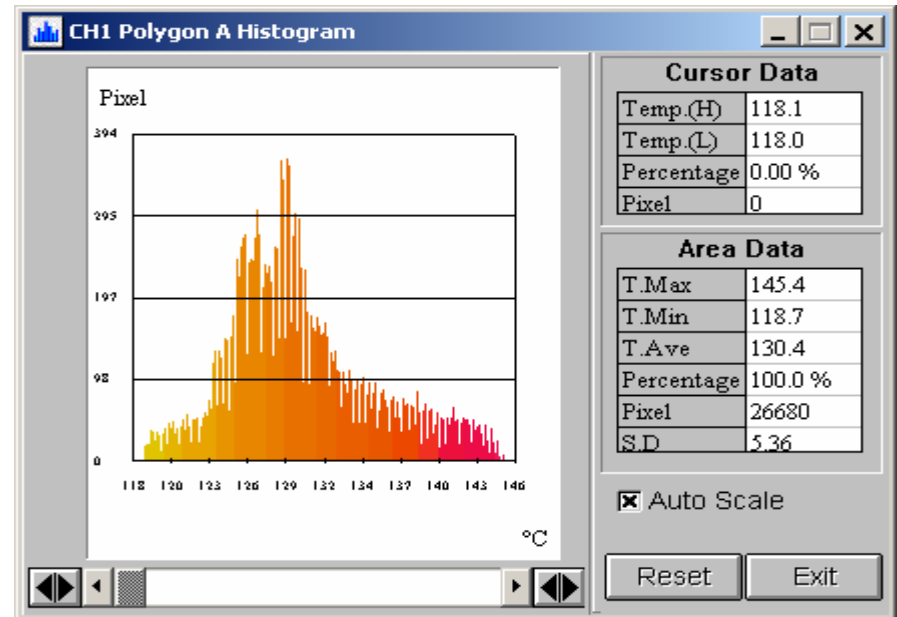
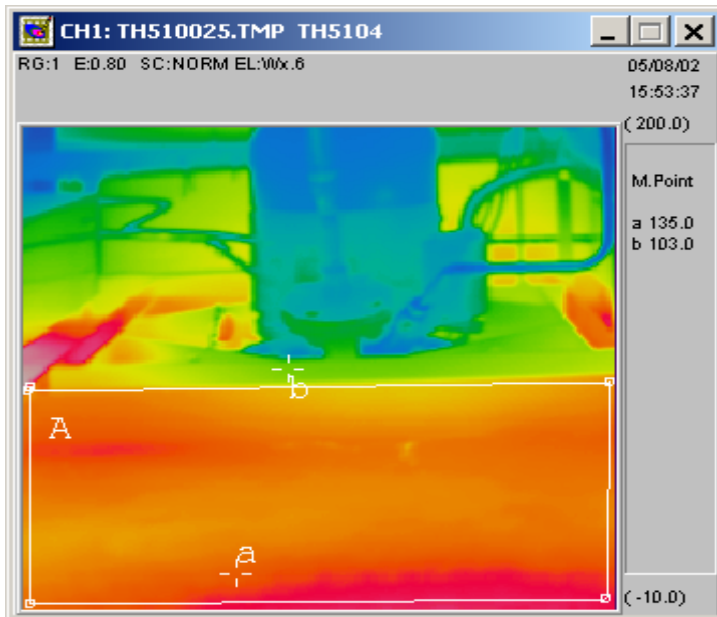
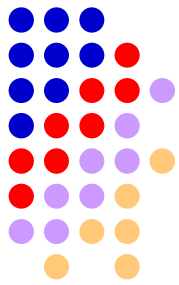
SQF #6 (Entry Side)



Unavoidable Losses as it
is near to opening

Temperature of Hot Spot :
Above Door : 180 °C
Bolts at Bottom : 210 °C
Area of Hot Spot :
Door : 120 x 20 cm
Bolts at Bottom : 120 x 10 cm

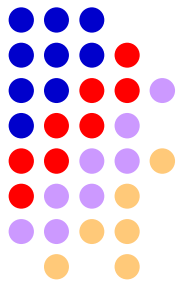
SQF #7 (Top)



Lining is to be repaired

Temperature of Hot Spot : 135 °C
Area of Hot Spot : 30 x 45 cm

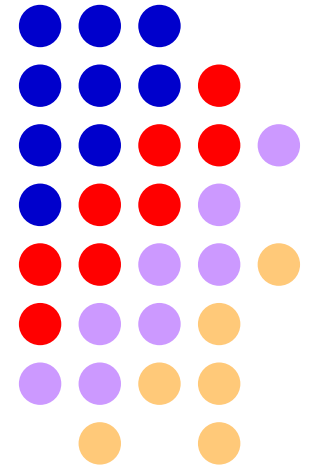
Pre Heating Furnaces



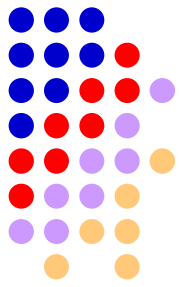
Furnace	Highest Temperature
Pre Heating #1	70 – 80 °C
Pre Heating #2	60 – 70 °C
Pre Heating #3	60 – 70 °C

Cooling Tower

- Effectiveness of Cooling Towers
- Pump Performance Assessment
 - Fans Blade Improvement

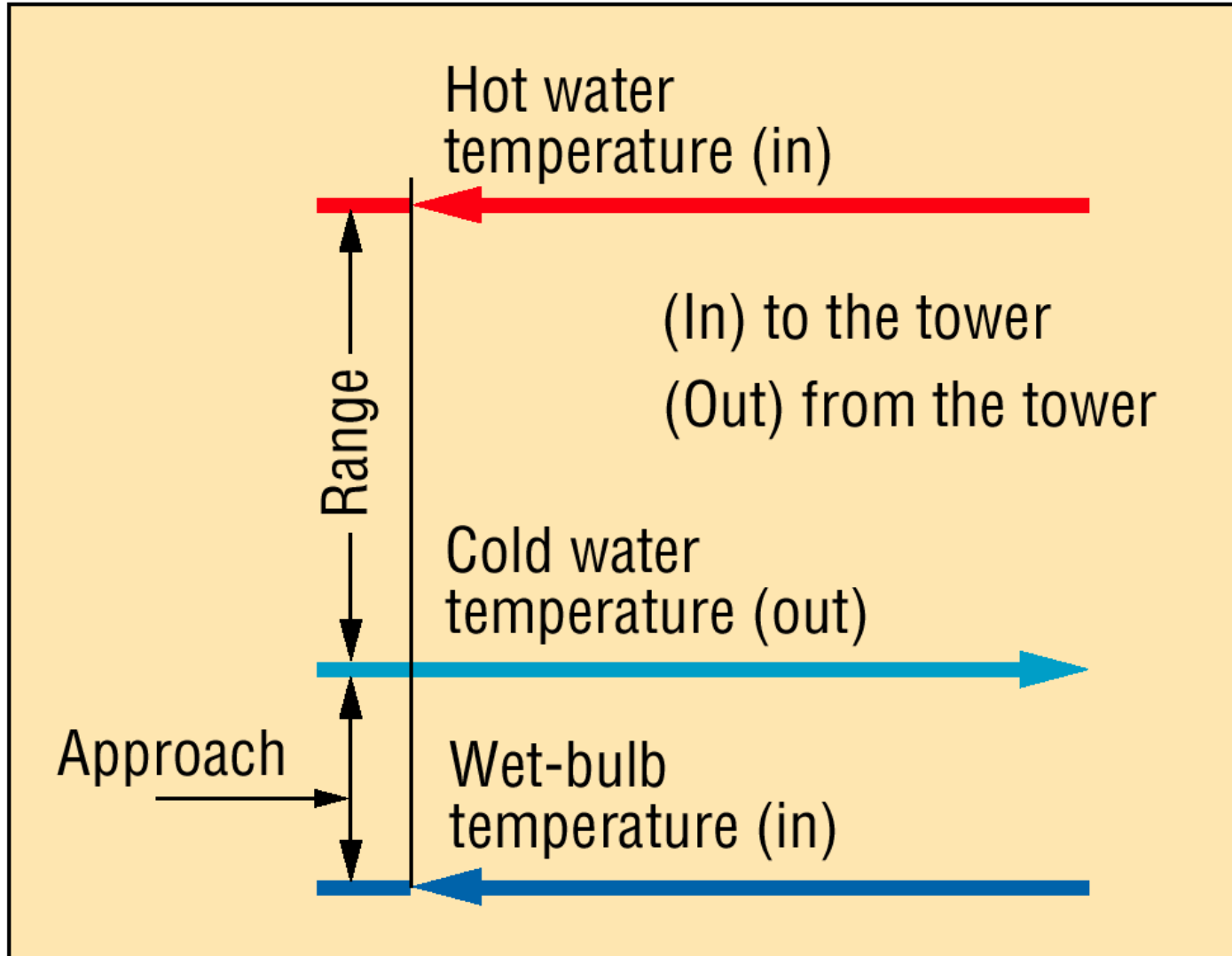
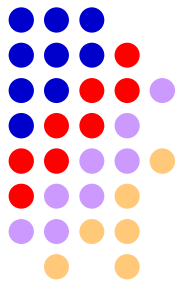


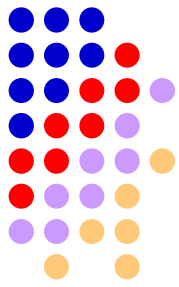
Cooling Tower Effectiveness



S. No	Item Reference	Units	Compressor House	DG House Old MAAN1	DG House Old MAAN1	DG House Old MAAN1	DG House New MAAN2	DG House CT1	DG House CT2
				Combined	Cell 1	Cell 2			
1	Cooling Water In Temp	°C	44	55	55	55	55	55	55
2	Cooling Water Out Temp	°C	39	40.25	42.5	38	36.4	34	37
3	Ambient Temperature	°C	35.3	36.8	36.8	36.8	35.2	35.2	35.2
4	Wet Bulb Temperature	°C	28.5	28.4	28.4	28.4	28.1	28.1	28.1
5	Range		5	14.75	12.5	17	18.6	21	18
6	Approach		10.5	11.85	14.1	9.6	8.3	5.9	8.9
7	Effectiveness		32.26	55.45	46.99	63.91	69.14	78.07	66.91

Cooling Tower Effectiveness





Pump Performance (DG House – Old Mann)

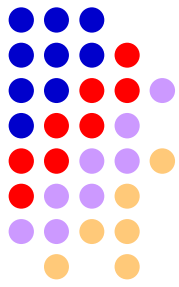
Existing System

No of Pumps in Operation: 2
Actual Water Flow: 130 m³/hr
Differential Pressure: 2.4 kg/cm²
Actual Power Consumption: 25.4 kW
Combined System Efficiency: 33.44%
Pump Efficiency: 42.01%

Proposed System

No of Pumps in Operation: 2
New Pump Efficiency: 75%
Combined System Efficiency: 59.7%
New Power Consumption: 14.2 kW

Annual Power Savings: 80,424 kWh
Annual Cost Savings: Rs. 3.33 Lakhs
Investment: Rs. 3.0 Lakhs
Simple Payback Period: 0.9 Years



Pump Performance (DG House – New Mann)

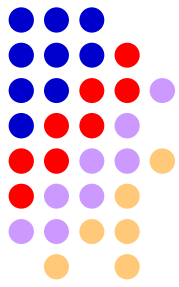
Existing System

No of Pumps in Operation: 1
Actual Water Flow: 68.42 m³/hr
Differential Pressure: 2.3 kg/cm²
Actual Power Consumption: 10.9 kW
Combined System Efficiency: 38.79%
Pump Efficiency: 48.73%

Proposed System

No of Pumps in Operation: 1
New Pump Efficiency: 75%
Combined System Efficiency: 59.7%
New Power Consumption: 7.1 kW

Annual Power Savings: 27,504 kWh
Annual Cost Savings: Rs. 1.14 Lakhs
Investment: Rs. 2.0 Lakhs
Simple Payback Period: 1.76 Years



Pump Performance (DG House – CT1)

Existing System

No of Pumps in Operation: 2

Actual Water Flow: 168 m³/hr

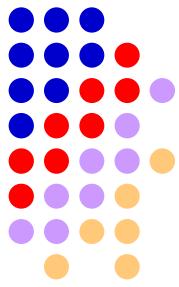
Differential Pressure: 1.7 kg/cm²

Actual Power Consumption: 14.8 kW

Combined System Efficiency: 52.46%

Pump Efficiency: 65.9%

Replacement is not required



Pump Performance (DG House – CT2)

Existing System

No of Pumps in Operation: 3

Actual Water Flow: 121 m³/hr

Differential Pressure: 1.8 kg/cm²

Actual Power Consumption: 20.97 kW

Combined System Efficiency: 28.27%

Pump Efficiency: 35.52%

Proposed System

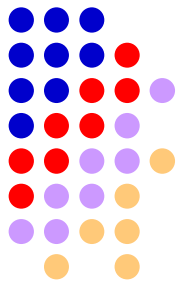
No of Pumps in Operation: 3

New Pump Efficiency: 75%

Combined System Efficiency: 59.7%

New Power Consumption: 9.93 kW

Annual Power Savings: 79,488 kWh
Annual Cost Savings: Rs. 3.29 Lakhs
Investment: Rs. 4.0 Lakhs
Simple Payback Period: 1.22 Years



Cooling Tower – FRP Fan Blades

Existing System

No of Fans: 4 (CT1 Mann & CT2 Mann)
Power Consumption: 12.42 kW

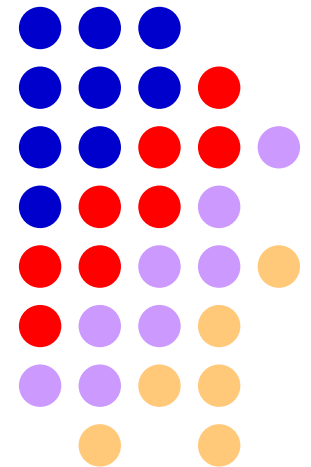
Proposed System

FRP Fan Blades is to be installed
New Power Consumption: 11.18 kW
(10% Savings of Actual Consumption)

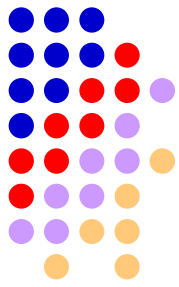
Annual Power Savings: 8942 kWh
Annual Cost Savings: Rs. 0.37 Lakhs
Investment: Rs. 0.60 Lakhs
Simple Payback Period: 1.62 Years

Lighting Survey

- Lux Level Survey
- Outside Area Lighting Replacement

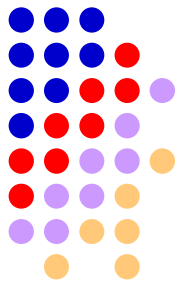


Lux Level Survey



Sl. No.	Area Reference	Existing System			
		Type of Lamp	Watts	Number	Lux Level
1	Main Gangway (Between Production Office & Engine Assembly)	MH	250	5	15-65
2	Main Gangway (Between Display Board & One Crore Mark)	MH	250	2	70-120
3	Main Gangway (Between OH Coveyer & junction towards store))	MH	250	3	50-80
4	Store Gangway (Near QA Lab corner - exit to road)	MH	250	4	34-50-60-100
5	Component Inspection Area	MH	250	5	30-45-60
6	Road Light	HPSV	150	51	20-50
7	Road Light	HPMV	125	52	20-50

Outside Lighting Fixture Replacement



Existing System

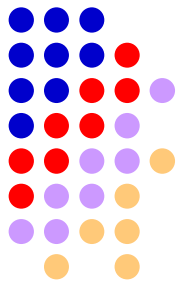
HPSV & HPMV Lights are installed
for Road & Park Lighting
Existing Power Load: 14.15 kW

Proposed System

45W CFL is to be installed
Proposed CFL Load: 4.635 kW
Annual Power Savings: 19,100 kWh
(Assuming that lights are ON for
only 11 hours & glows only for 50%
ON time)

Annual Cost Savings: Rs. 0.79 Lakhs
Investment: Rs. 0.92 Lakhs
Simple Payback Period: 1.2 Years

Savings at a Glance



Option	Savings Rs (Lakhs)	Investment Rs (Lakhs)
Chiller Temperature Setting Improvement	0.96	Nil
Fuel Substitution and Thermic Fluid Heating	40.3	40
FRP Blades for Circulating Air Fans	3.89	8.4
FDV Improvement	10.47	Nil
Installation of Hood for Material Transfer	0.28	0.3
Pump Efficiency Improvement	7.76	9.0
Cooling Tower – FRP Fans	0.37	0.6
Outside Lighting Fixture replacement	0.79	0.92
TOTAL SAVINGS	64.82	59.22

Thank You



**National Productivity Council,
New Delhi**

