

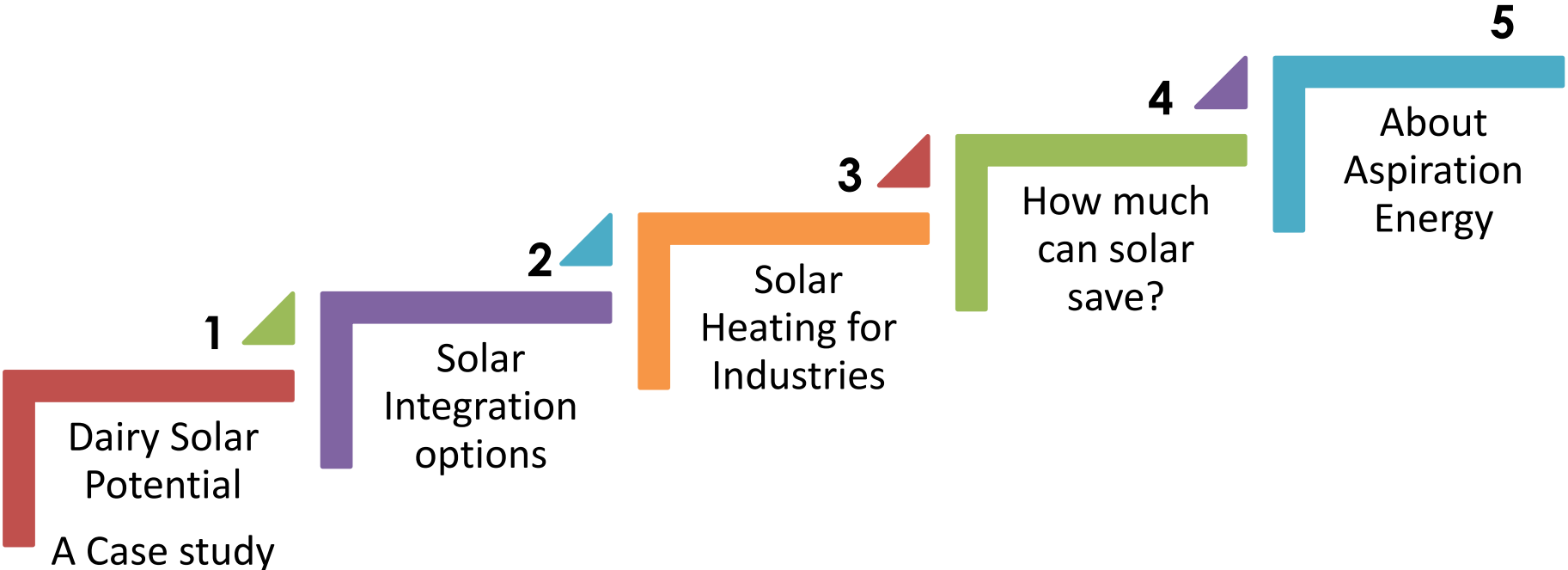


Fast Forward to the
Solar Future!!



Solar Thermal Applications in Dairy Sector

The value we'll get today



Dairy Solar Potential A Case study

Product

- Milk
- Powder
- Ghee & Curd

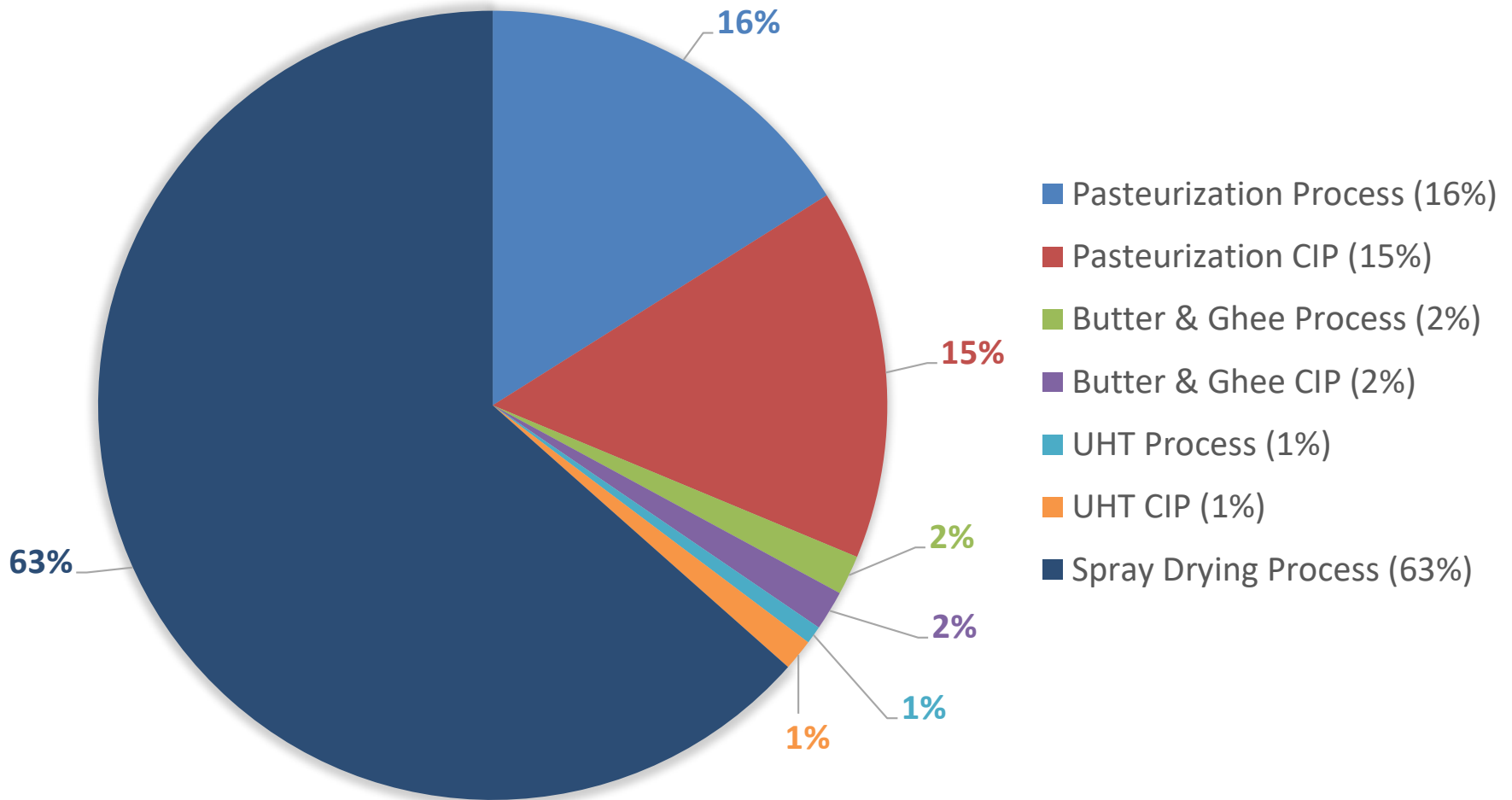
Production

- 3 Shift
- 6 Lakh Litres/day

Steam

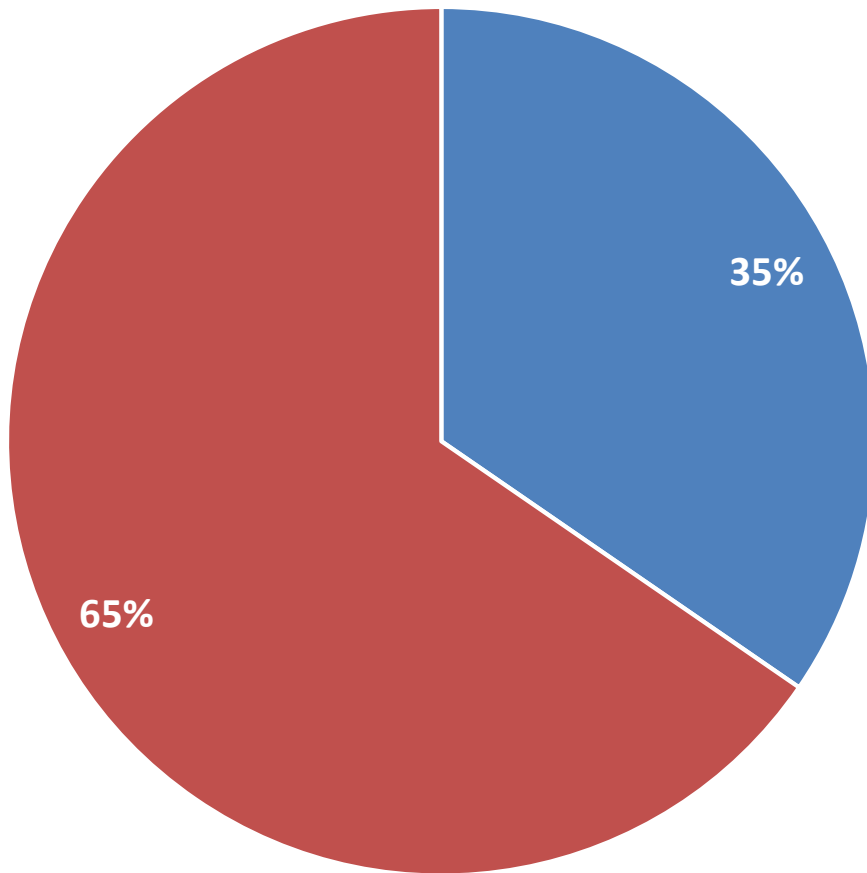
- 164 TPD
- Diesel

Total Steam Consumption



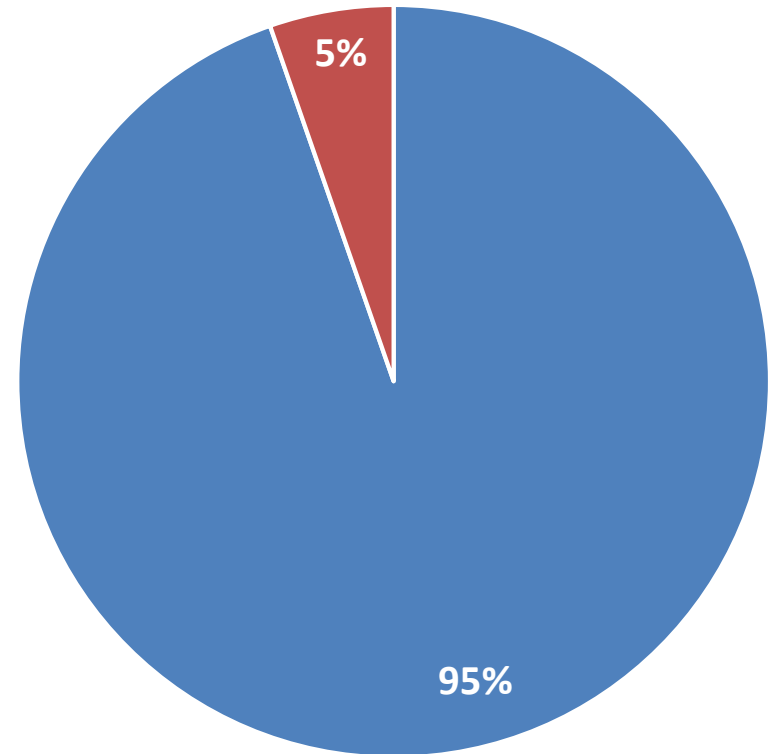
Temperature wise Consumption

With Dryer



■ Temp <100 ■ Temp >100

Without Dryer



■ Temp <100 ■ Temp >100

Steam Consumption in Detail

Process	Total Steam (TPD)	Temp <100	Temp >100
Pasteurization – Plant 1			
Process	9.77	9.77	
CIP	12.55	12.55	
Pasteurization – Plant 2			
Process	16.72	16.72	
CIP	12.53	12.53	
Butter & Ghee			
Process	2.67	0.67	2
Cleaning	2.68	2.68	
UHT			
Process	1.21		1.21
CIP	2.12	2.12	
Spray Drying			
Process	104.64		104.64
Total	164.89	57.04	107.85

Solar Integration options

1. Solar Boiler Feed Water preheating

- Every 10 °C is 1% in Boiler efficiency

2. Solar Process Heating during Sunshine

- Solar for 6 hours + Rest using Boiler

3. Solar Process Heating for 24 hours

- Solar heating using energy storage

Solar Heating for Industries

You can **Save!!** thro

Active Solar Solar Thermal System

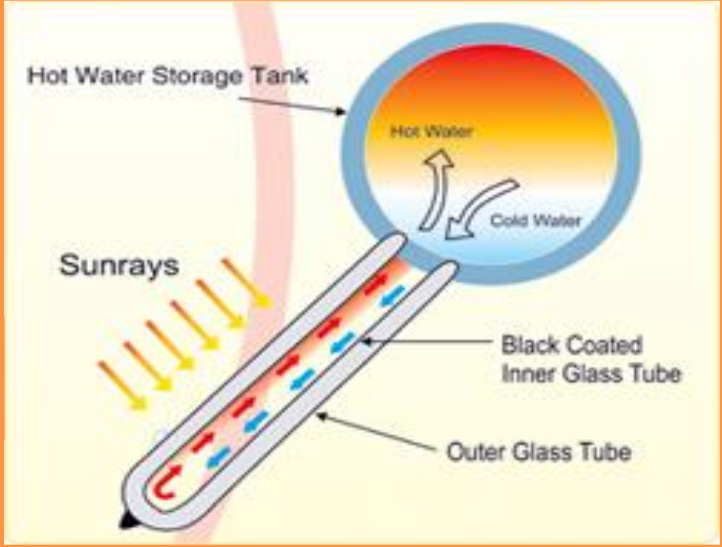


Passive Solar Heat Pump System



Evacuated Glass Tube Collectors

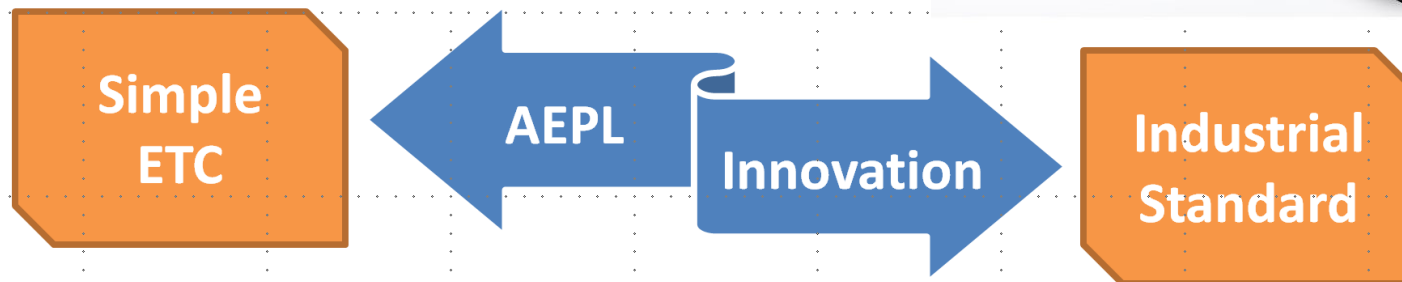
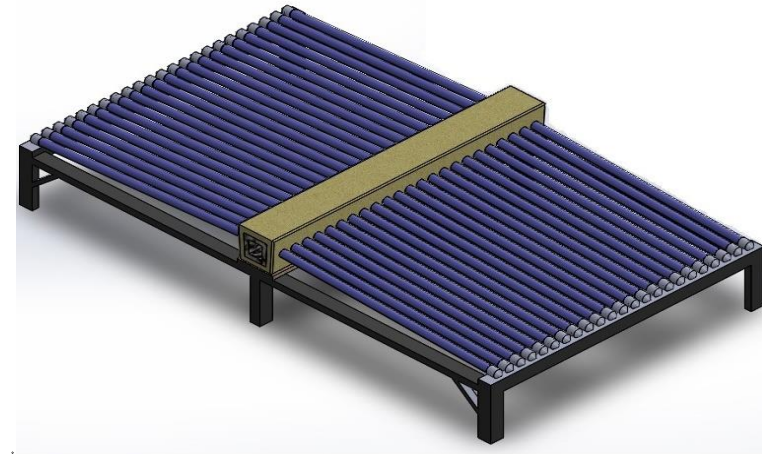
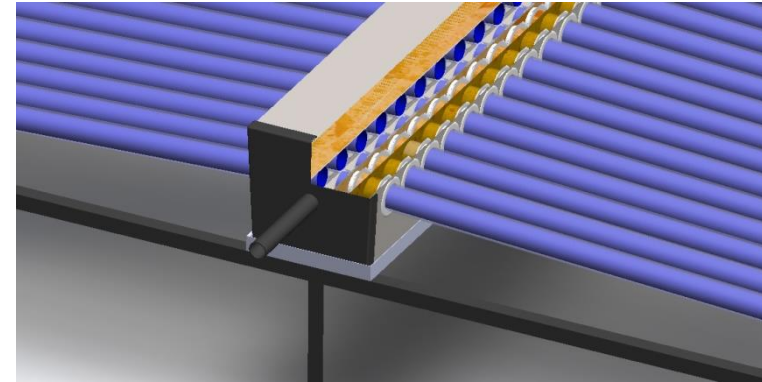
Thermo-siphon type Heat Convection



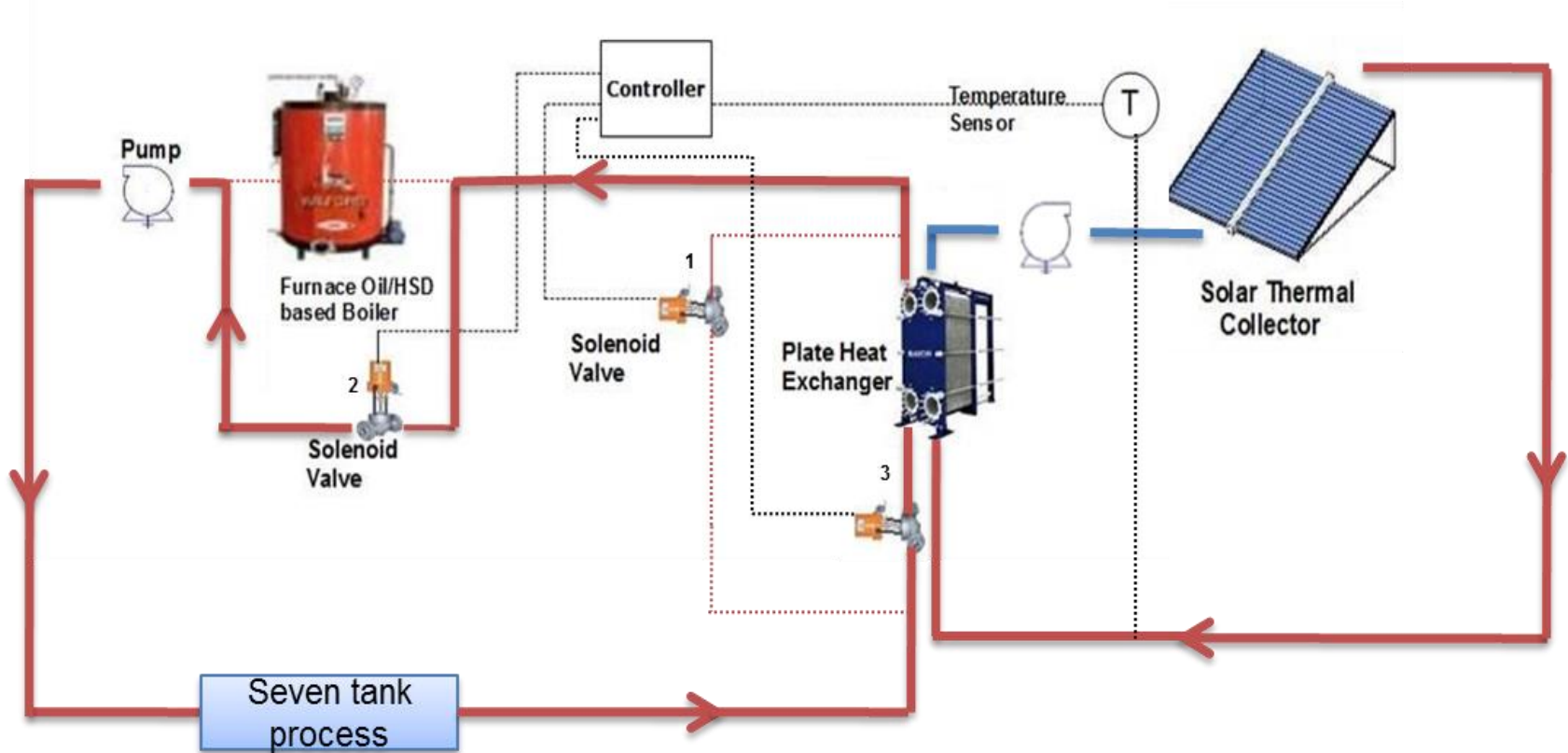
Single Module ETC type Solar Thermal System

We achieve high temperature through incremental innovation to existing ETC (Evacuated Tube Collector) technology

- ETC-HX™ , ETC-U™ & ETC - CPC™
- Integrative Concentration™
- StayLiquid™ : Pressurized
- FlexiFlow™ : Forced circulation & Flow Engineering
- HybriHeat™ : Switches from Solar to Fuel & vice versa based on temperature

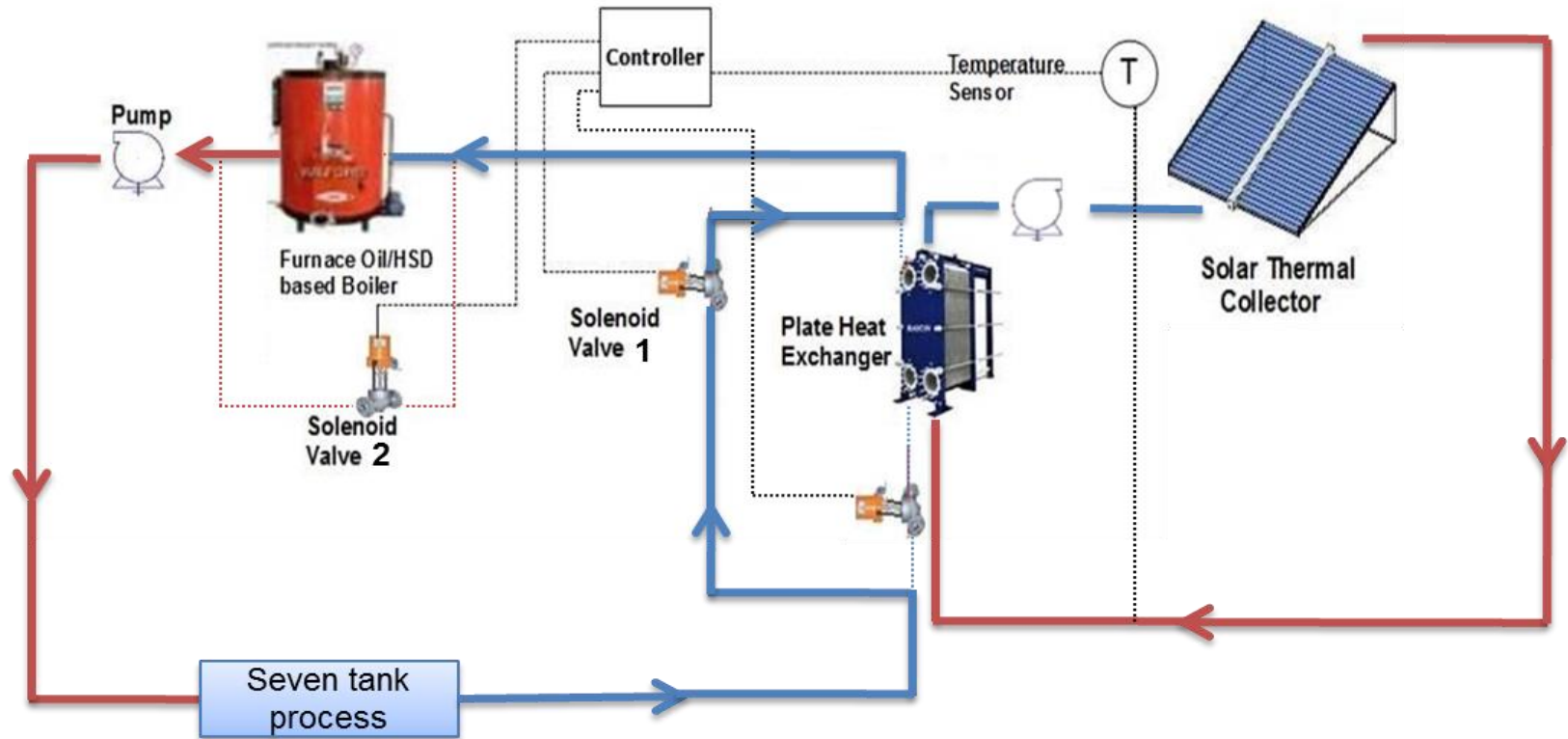


How we Integrate?



During Sunshine hours the heat energy flows as shown through the red line, through solenoid valves 2 and 3 (1 is off)

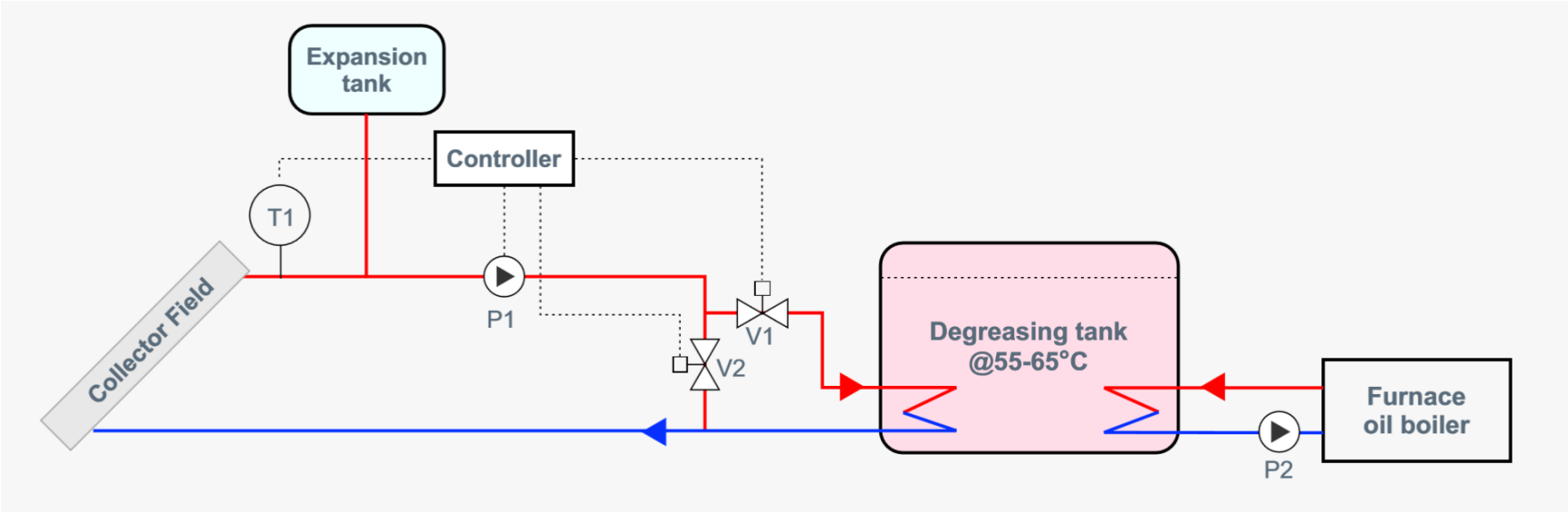
How we Integrate?



During Non-Sunshine hours the heat energy flows as shown through the blue line through solenoid valve 1 (2 and 3 off)



Conventional Heat Source	Thermic Fluid Boiler
Fuel Used	Furnace oil
Application	Pre-treatment
Temperature Range	60-75 °C



Project size	630 KWth
Project type	Auto-Hybrid
Annual carbon abatement	2,80,800 Kg

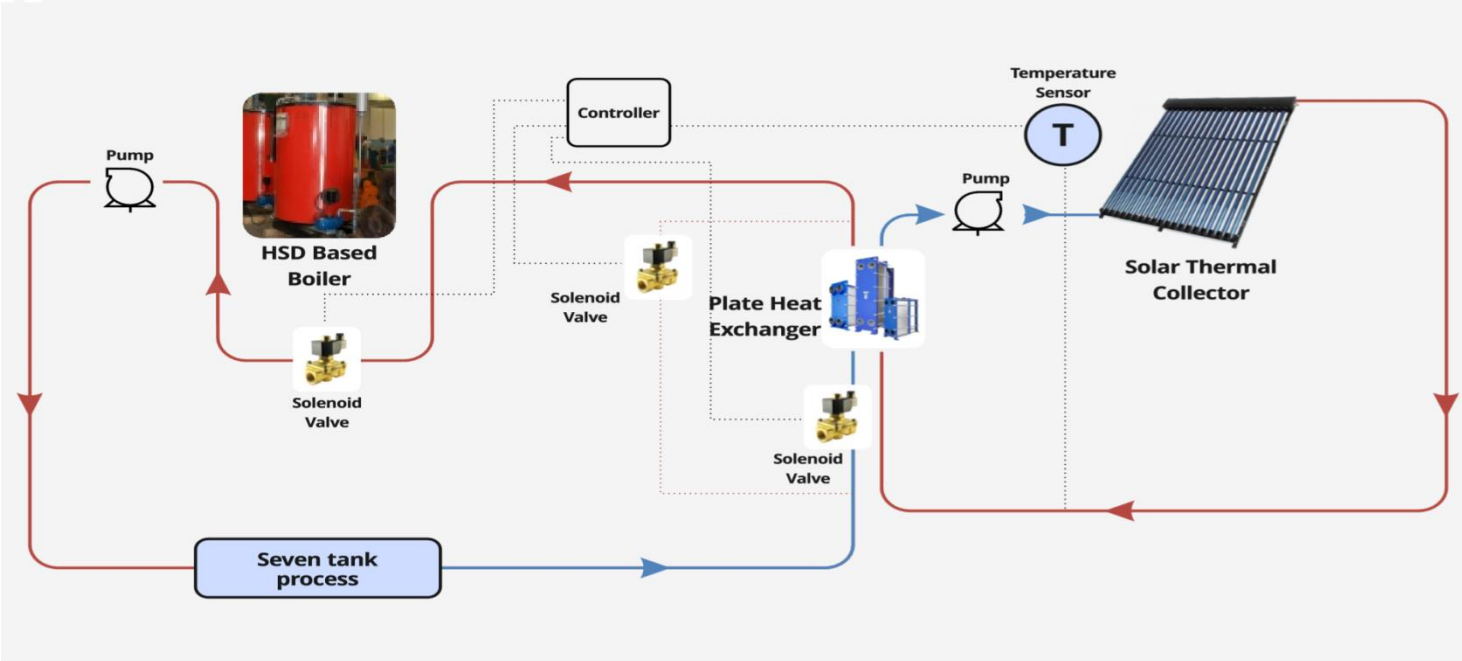
Average Energy delivered per day	3,780 kWh (Promised) 4,200 kWh (Actual)
Average fuel saved per day	363 L (Promised) 425 L (Actual)

630 KW Solar Thermal System

*PPA signed with Wheels India Limited Tenure: 5 Years and O&M by Aspiration Energy



Conventional Heat Source	Hot water generator
Fuel Used	Diesel
Application	Pre-treatment
Temperature Range	60-75 °C



Project size 210 KWth

Project type Auto-Hybrid

Annual carbon abatement 97,000 Kg

Average Energy delivered per day 1,260 kWh

Average fuel saved per day 126 Litres

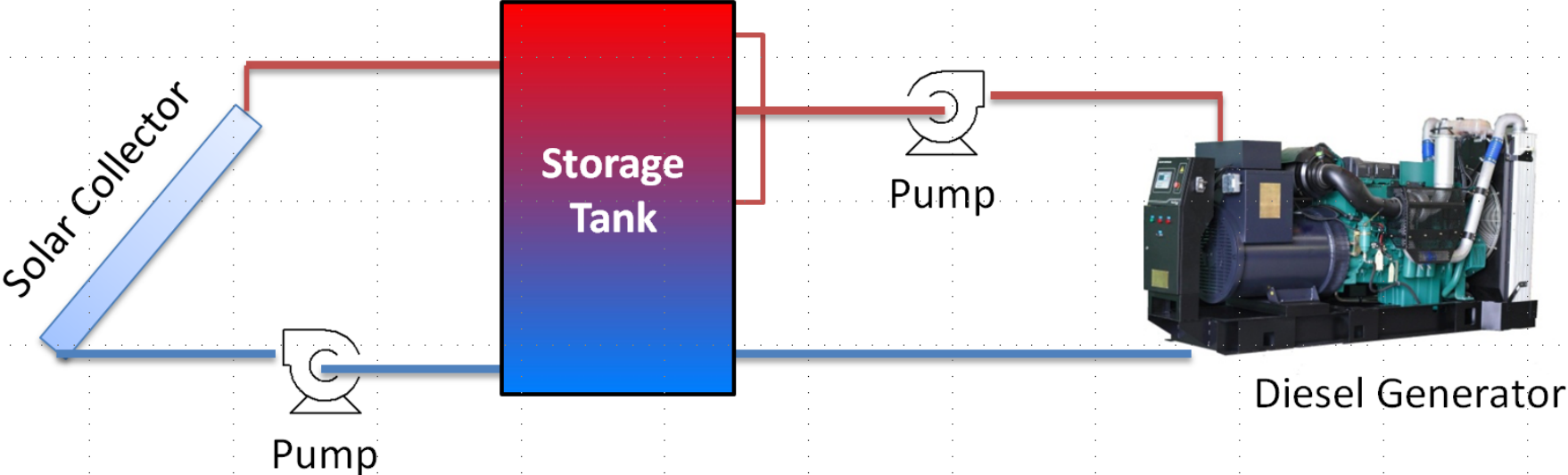
210 kW Solar Thermal System

*PPA signed with Sona Koyo Steerings. Tenure: 5 Years and O&M by Aspiration Energy



Conventional Heat Source	Electrical Heater
Application	Maintaining DG Head temperature
Number of DG sets	4 nos.
Temperature Range	60-75 °C
Electricity Consumption	1200 kWh per day

24 hours Solution using Thermal Batteries

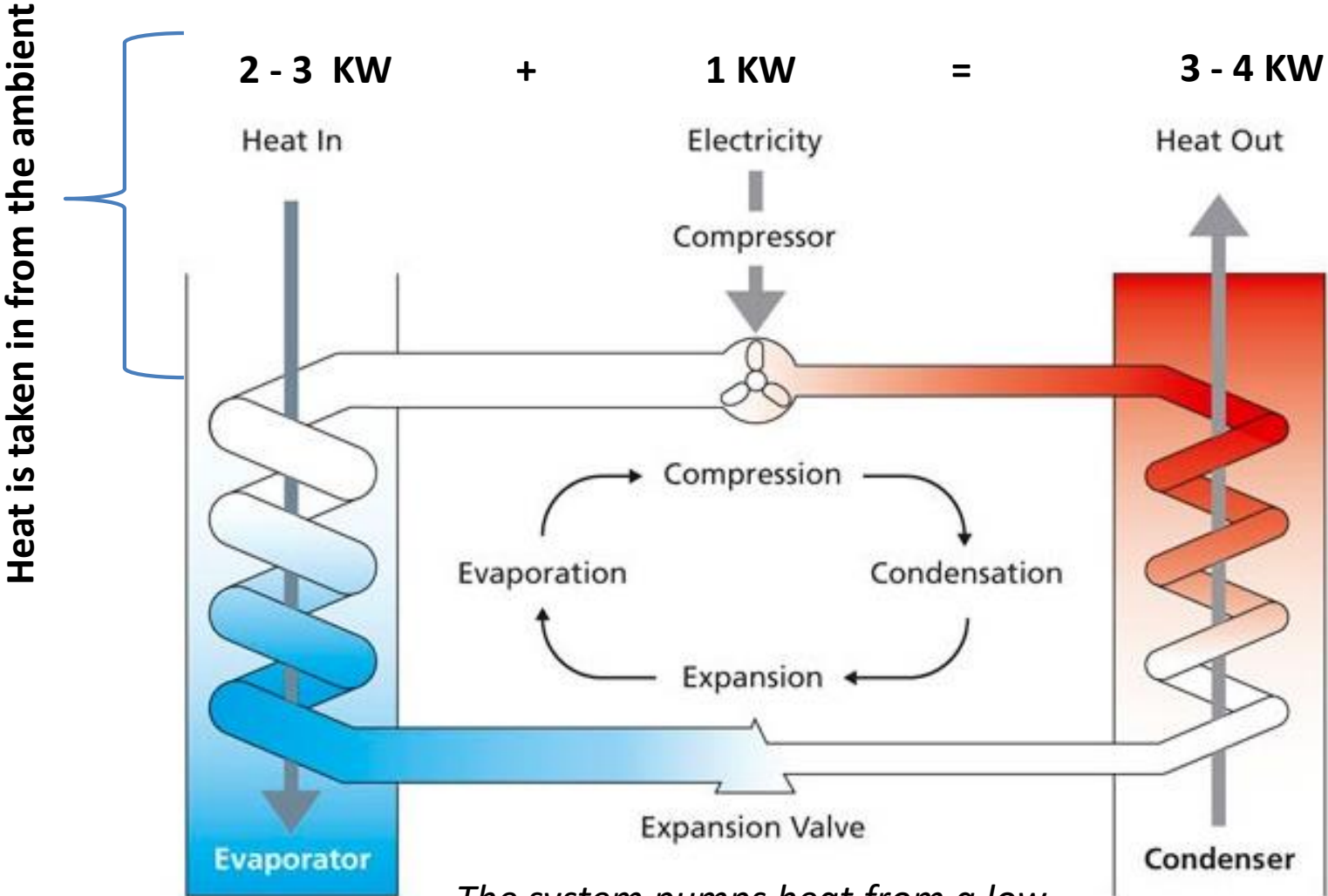


Project size	225 KWth
Project type	Auto-Hybrid
Storage Tank Capacity	30,000 Litres

Projected Unit saving per year	4,20,000 kWh
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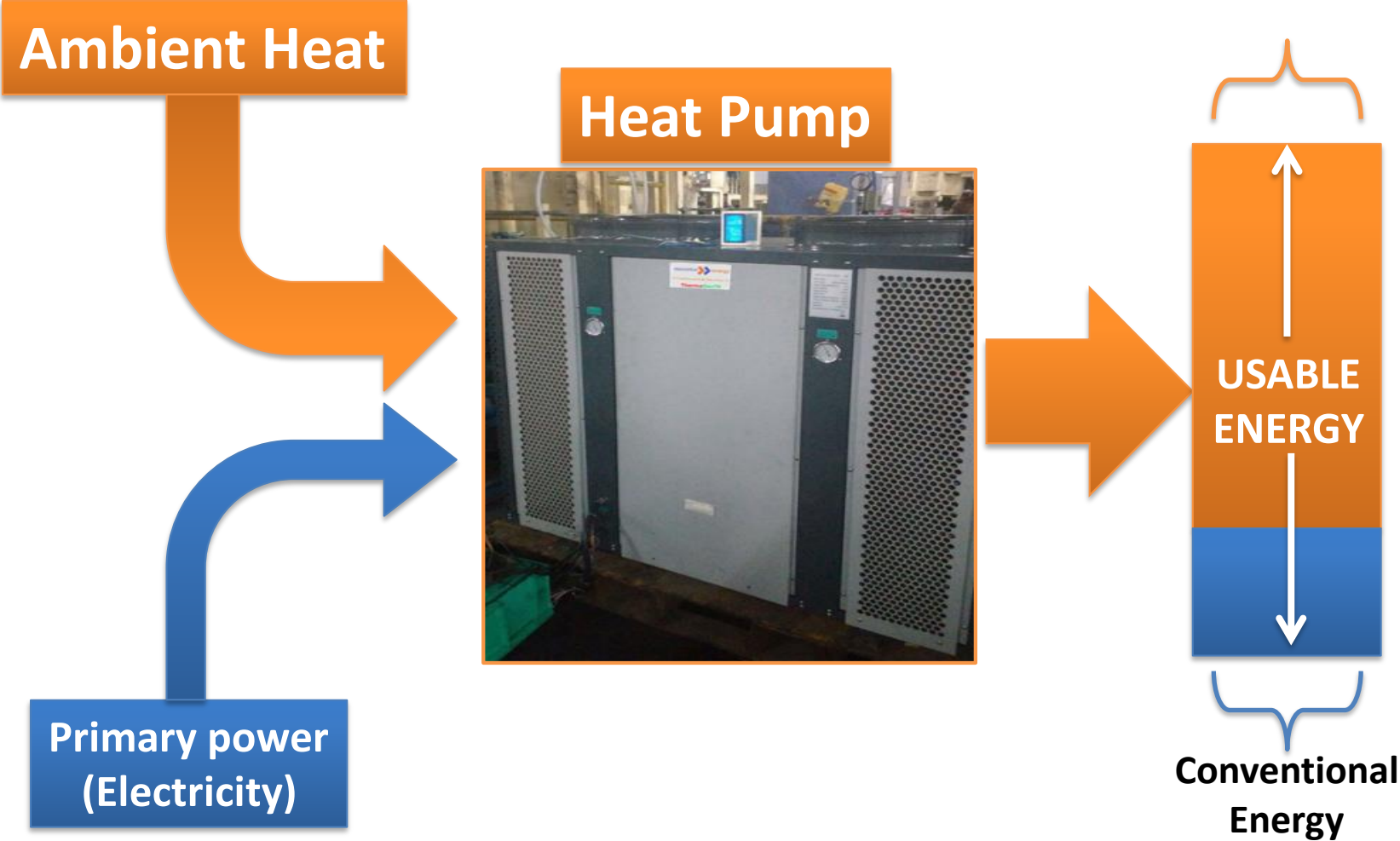
Projected Annual carbon abatement	2,94,000 kg
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Passive Solar – Heat pump



The system pumps heat from a low temperature reservoir to a high temperature

Why Heat pump is Passive Solar?



We achieve high temperature through,

- 90 °C Process temperature using **EVI technology**
- Advanced Refrigerant mixtures for higher temperature with **high COP**

Refrigerant	Critical Pressure	Temperature limit
R134A	41.1 Bar	100 °C
R245FA	37 Bar	153 °C

Heat Pump Calculation Sheet

Refrigerant	r245fa	Units	Units	Units	Units
Inputs					
Condenser		Throttle valve		Evaporator	Compressor
Hot water return	85 C	Pin	1.26 Mpa	Chilled water return	Polytropic eff
Hot water delivery	95 C	Hin = Hout	338.20 kj/kg	Chilled water delivery	Tin
Capacity	121.2 kw	Pout	0.148 Mpa	Capacity	Pin
Approach	5 C	Quality	0.56	Approach	Pout
Sub cooling	1 C	Tout	25 C	Suction gas superheat	vin
Condensing temperature	100 C			Pevap	vout
Condenser outlet	99 C			T_evap	Sin
Latent	134.48 kj/kg			Hin	Tout Ideal
Sensible heat	22.42 kj/kg			Hout	Ideal work
					Actual work
					Hout
					Tout actual
					Compressor work
Mass flow	0.77 kg/s				
Mass flow	2781.02 kg/hr				
CP water	4.21				
Hot water flow rate	2.88 kg/s				
	10363 lph				
COP	2.72				



ASHOK LEYLAND



Existing Process

Conventional Heat Source	Electrical Heater
Application	Engine Head washing
Temperature Range	50-60 °C
Electricity Consumption	24 kWh per hour

After Heat Pump

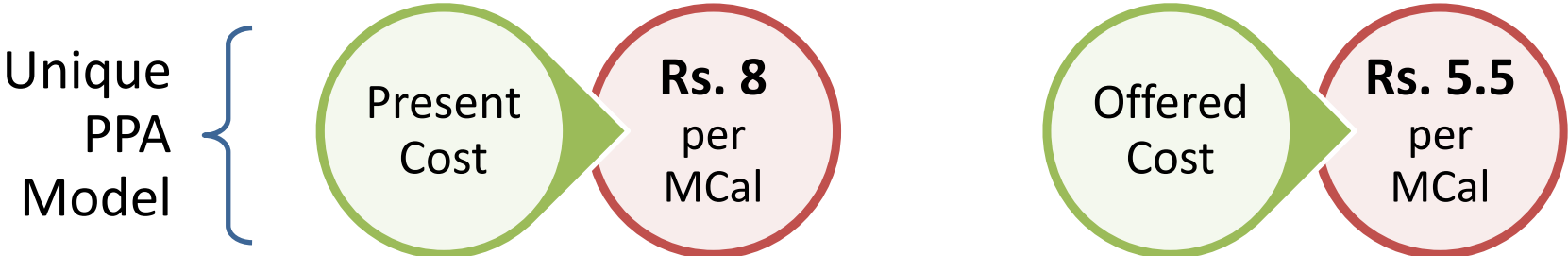
Project size	28 kWth
Present Consumption	12 kWh per hour
Units saved per year	86,400 kWh
Annual Carbon Abatement	73, 440 kg



Lucas-TVS Limited

90 °C Heat Pump – Under Commissioning

Project Size	160 kW
Conventional Heat Source	SKO Fired Thermic Fluid Boiler
Application	Pre-Treatment
Temperature Range	70 - 90 °C
ZERO Investment from Customer	





90 °C Heat Pump – Under Commissioning

Project Size	260 kW
Conventional Heat Source	LPG Fired Hot Water Generator
Application	Pre-Treatment
Temperature Range	70 - 90 °C
Projected Payback - < 2 Years	

How much can Solar Save?

How much can Solar Save?



ACTIVE SOLAR

Wheels India is saving **1,27,500 Litres** of Furnace Oil which amounts to **51 Lakhs** per Year



ACTIVE SOLAR

Sona Koyo Steering is saving **37,800 Litres** of Diesel which amounts to **18.9 Lakhs** per Year



PASSIVE SOLAR

Ashok Leyland is benefited **< 1 year Payback**

Solar during Solar Sunshine hours

- Typical Condensate Recovery Factor : **60%**
- $(164.89 \text{ TPD}) \div 24 \times 6 = 41.22 \text{ Tonnes}$. 40% = **16.5 T in 6 hours**
- We need to pre-heat **2.75 TPH and $\Delta T = 30 \text{ C}$**
- This amounts to approx. **5 lakh kcal/day** from Solar
- Needs about **400 Sq.m** roof top area
- Simple payback* ~ **2.6 years – Solar Thermal** (6 hrs/day and 300 days)

Solar for 24 hours

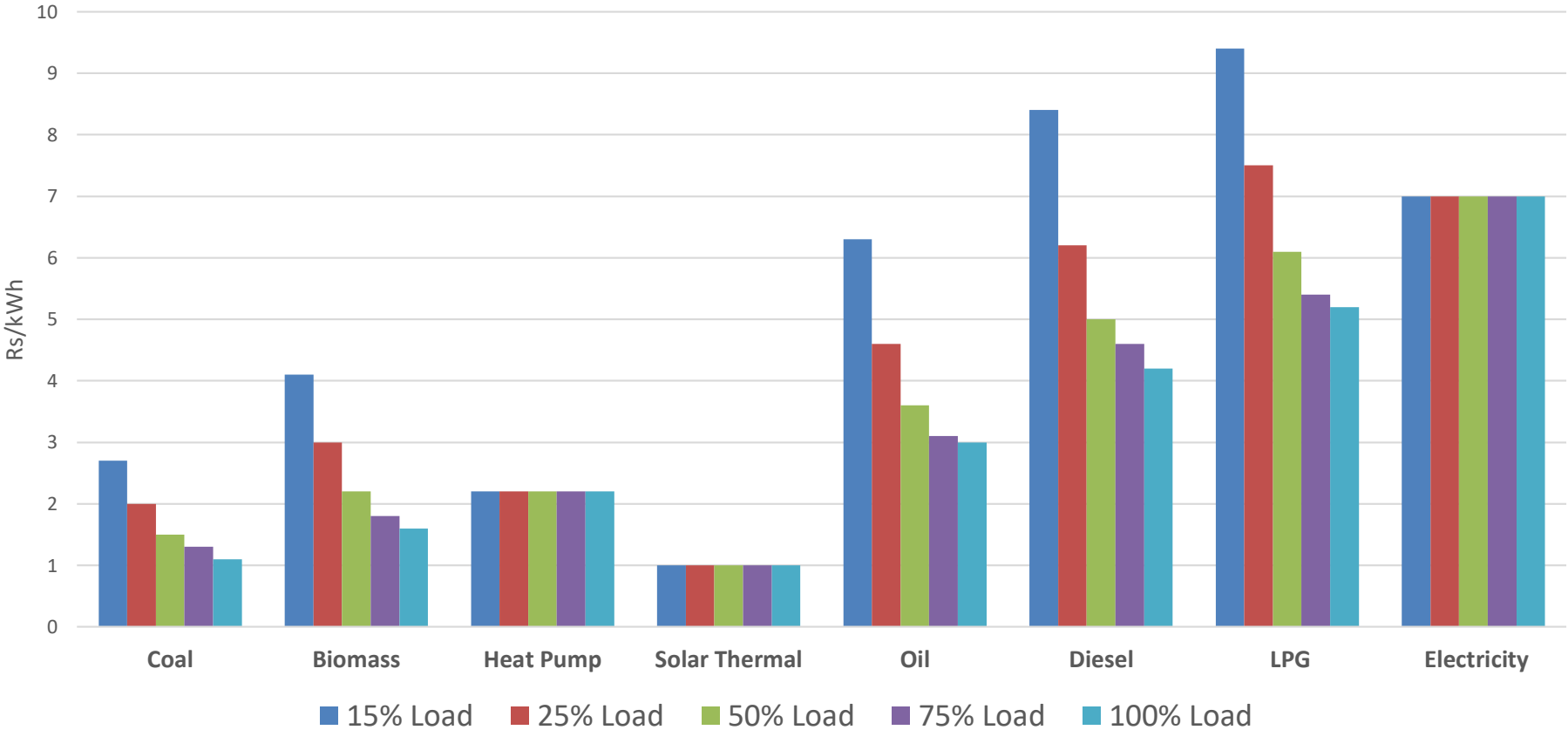
- This amounts to approx. **20 lakh kcal/day** from Solar
- Needs about **1500 Sq.m** roof top area
- Simple payback* ~ **3 years** (24 Hrs 300 days)

Solar for Process heating

- 57.04 TPD = 376 Lakh kcal/day = **15.6 Lakh kcal/hr**
- Energy to be supplied by Solar = **94.11 Lakh kcal** in 6 hours
- Roof area required = **6120 Sq.m**
- Savings = **3.5 lakh liters of Diesel**
- Simple payback*
 - **3.23 years – Solar Thermal** (6 hours x 300 days)
 - **1.2 years – Heat Pump** (24 hours x 330 days)

***Cost Assumption**
HSD - 54 Rs/L

Actual Cost per kWh



Cost Assumption

HFO - 23Rs/L | HSD - 44 Rs/L | LPG - 40 Rs/kg | Coal - 5 Rs/kg | Biomass - 5 Rs/kg

About Aspiration Energy

- Leader in Industry scale solar thermal plants with over 2 MW installation and industrial heat pump with over 500 kW
 - Rooftop solar installation for 40 – 120 °C industrial processes
 - India's First 95 °C Heat pump
 - Replace fossil fuel and reduce carbon emission with clean green solar energy
 - Technical expertise for hybridization
- Unique PPA model for solar industrial heating
- Prestigious customers





सत्यमेव जयते

Ministry of New and Renewable Energy
Government of India

National award winner from MNRE – UNDP for implementing large scale Solar Thermal ESCO projects through their “Pay-as-you-save” scheme. – Project : Wheels India Ltd

“Climate Solver 2013” award for GHG Reduction through their Decentralized Solar Thermal System offerings for Industries.



Confederation of Indian Industry

- Recognized by CII for “Most Innovative Energy Saving Product”
- Chosen by the German Agency for International Co-Operation (GIZ) and GFI Institute of Solar Thermal systems for the SOPPRO India project.

“Innovation in Business Model” for successfully rolling out ETC technology as heat based ‘Energy as a service’ model .



*Be the proud
pioneer and save
the future...*



>> Fast Forward to the Solar Future!! >>

Contact us @

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