



ATMOSPHERE ASIA - BANGKOK
6TH SEPTEMBER 2017 - LOW CARBON HEATING & COOLING



PRESENTED BY
JMM-LIKIDO PTE LTD
STUARTCOX@LIKIDO.NET



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PROBLEMS TO BE SOLVED

2

OUR CLIMATE IS CHANGING FAST. THE CAUSE IS AN OLD, BROKEN ENERGY SYSTEM THAT POLLUTES OUR AIR AND WATER, DRIVES INEQUALITY AND DESTROYS PRICELESS LANDSCAPES...

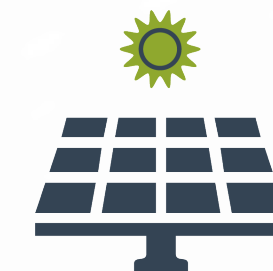
'GREENPEACE'



GREAT IMPROVEMENT



LITTLE HAS CHANGE

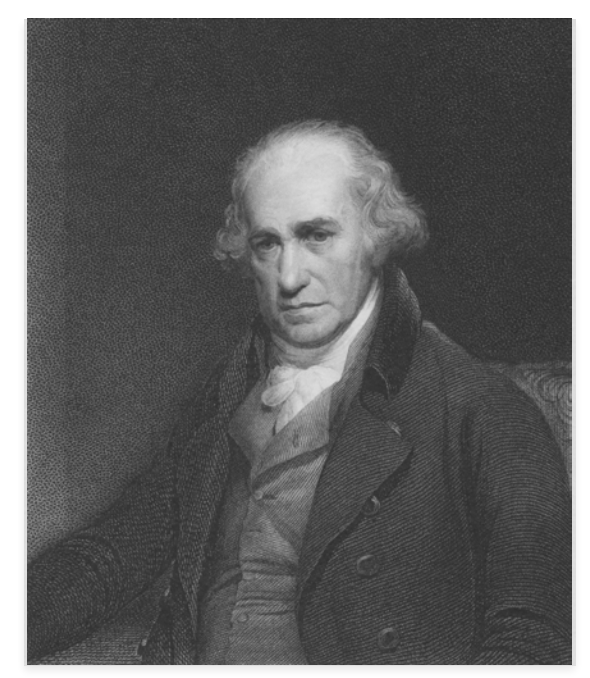
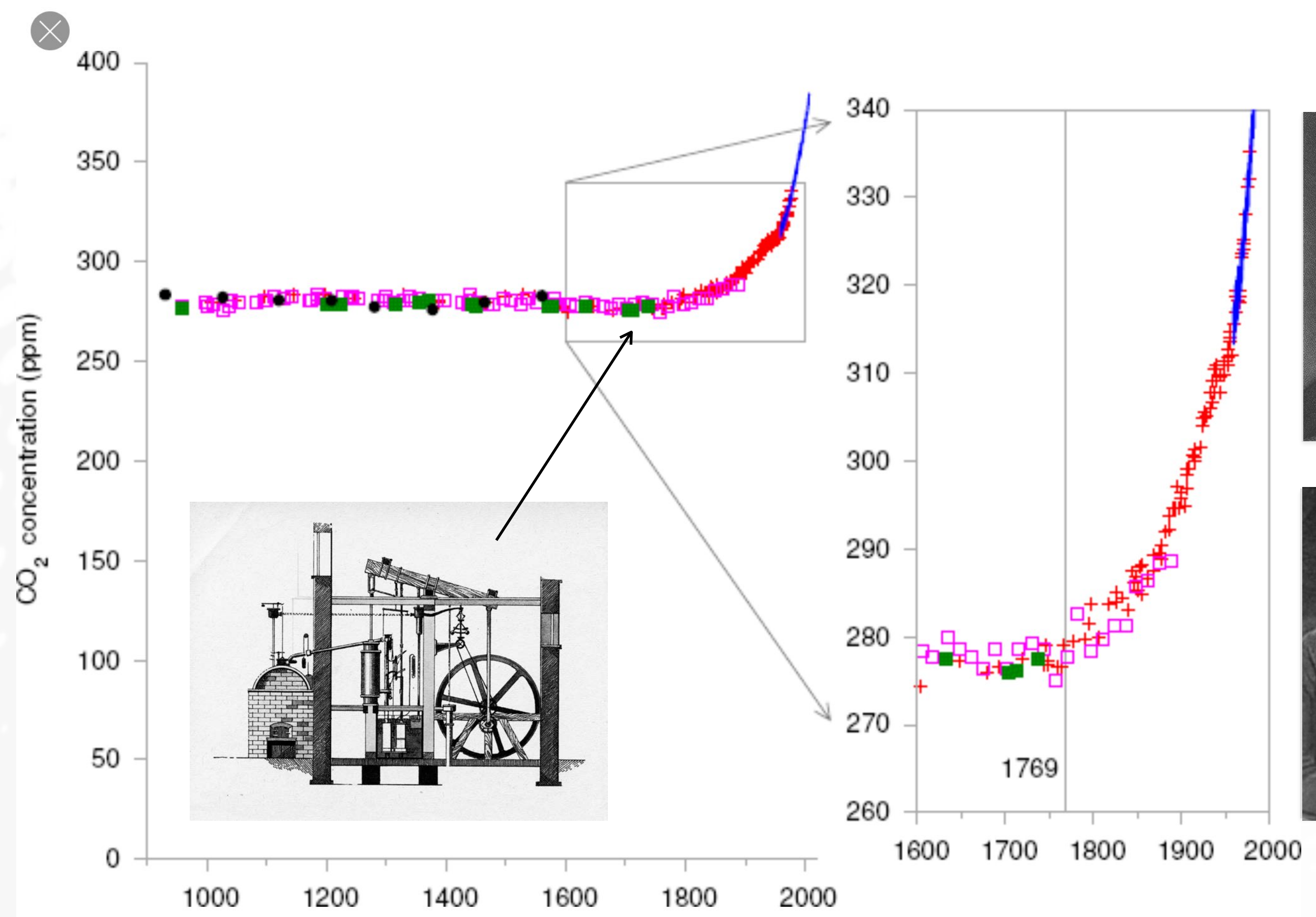


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PROBLEMS TO BE SOLVED - DEMAND SIDE

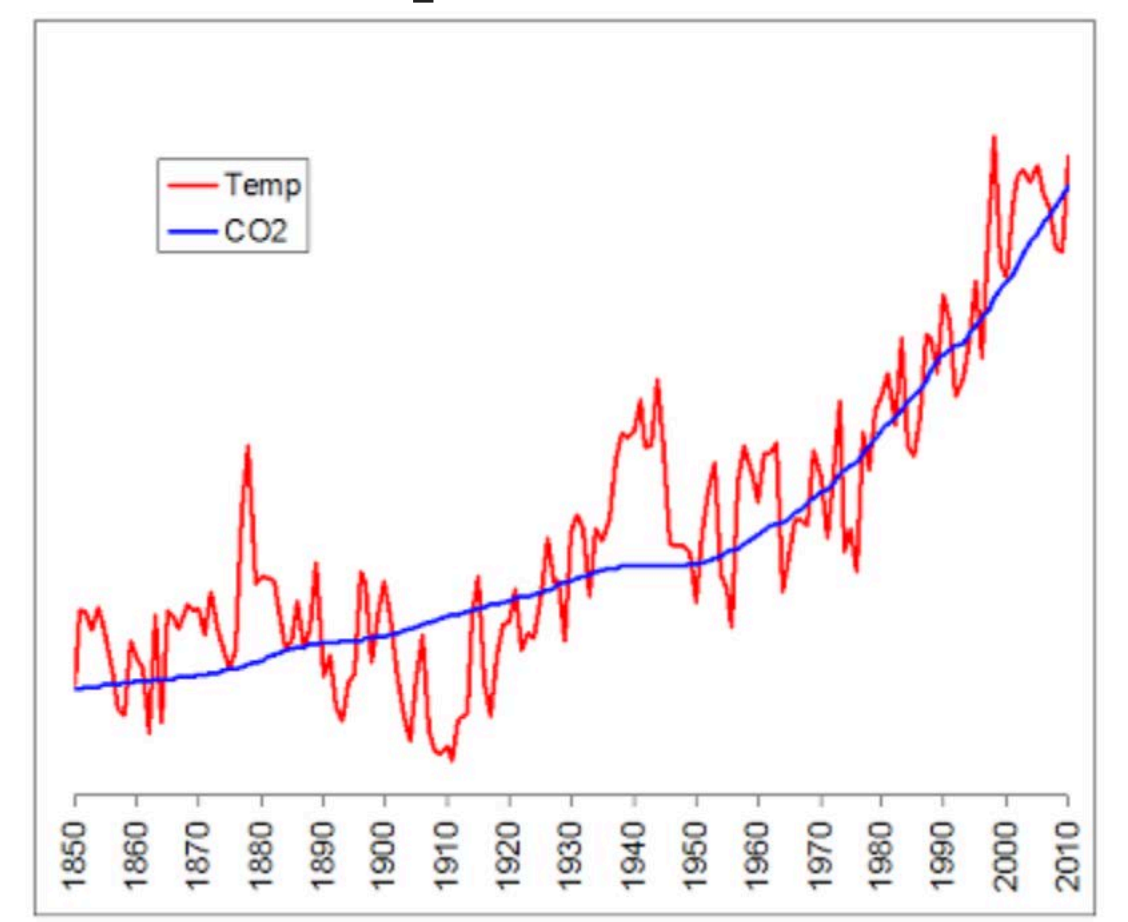


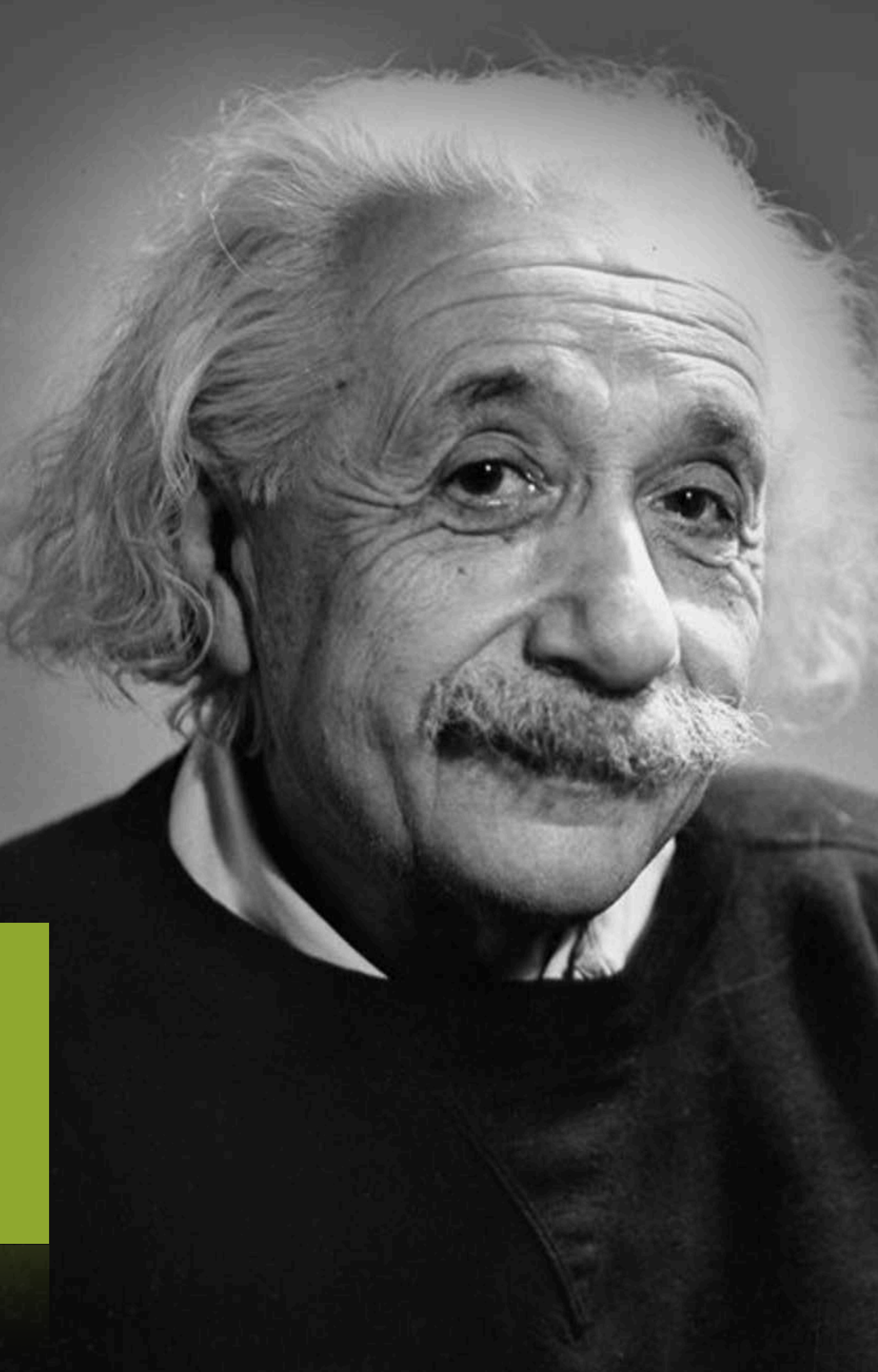
JAMES WATT



MATTHEW BOULTON

GLOBAL TEMPERATURES TRACKING CO₂ EMISSIONS





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PROBLEMS TO BE SOLVED



4

“ENERGY CANNOT BE CREATED OR DESTROYED, IT CAN ONLY BE CHANGED FROM ONE FORM TO ANOTHER - EINSTEIN”



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PROBLEMS TO BE SOLVED



**THERMAL ENERGY REPRESENTS A
SIGNIFICANT PROPORTION OF
GLOBAL ENERGY CONSUMPTION; 43%
OF WHICH IS CONSUMED BY
INDUSTRIAL PROCESSES.**

30-60%
ENERGY
GENERATED IS
WASTED





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PROBLEMS TO BE SOLVED



CURRENTLY THE WORLDS ANNUAL \$3BILLION COOLING TOWER MARKET, DISCHARGES LOW GRADE ENERGY TO ATMOSPHERE WITHOUT RECOVERY.

\$3.0
BILLION/YEAR

Cooling tower market discharges low grade energy to atmosphere without recovery.



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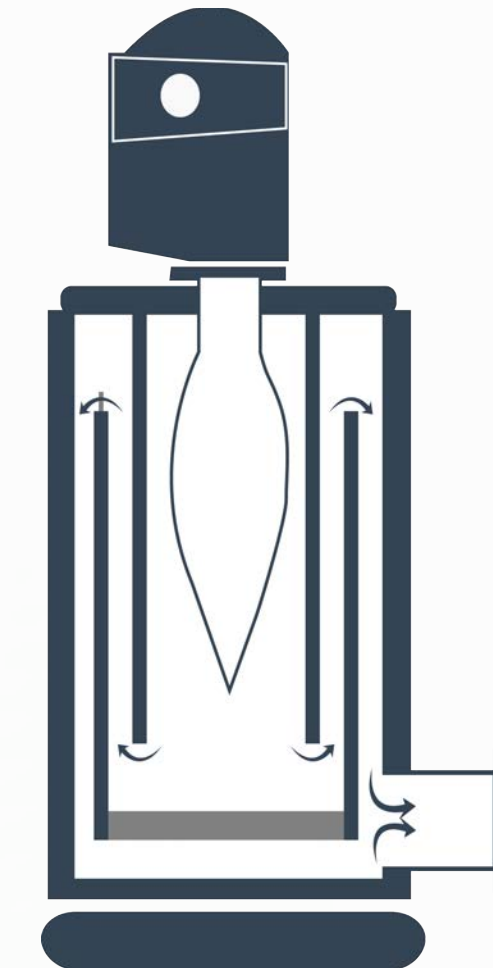
QUESTION 1.



7

**AS REFRIGERATION EXPERTS WOULD WE
BUY A SYSTEM WITH A COP OF JUST
COP = 0.80 ?**

OUR CUSTOMERS DO...



THEY ARE CALLED BOILERS

AVERAGE EFFICIENCY < 80%



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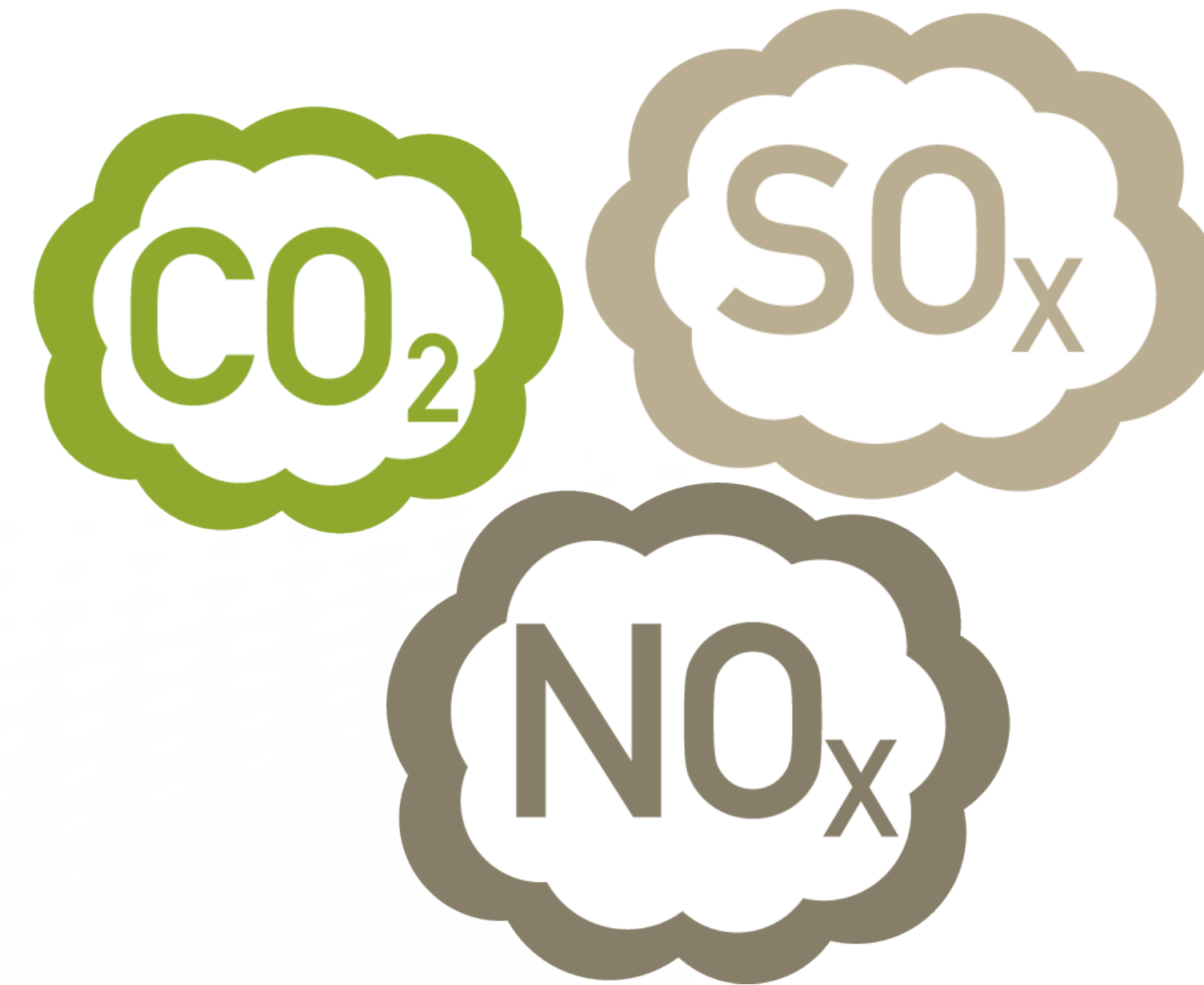
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PROBLEMS TO BE SOLVED

**COMBUSTION IS AN “IRREVERSIBLE”
PROCESS; HEATING OR POWER
GENERATION VIA COMBUSTION IS A
VERY INEFFICIENT SYSTEM, WITH
THERMAL EFFICIENCIES BETWEEN
65-85%.**

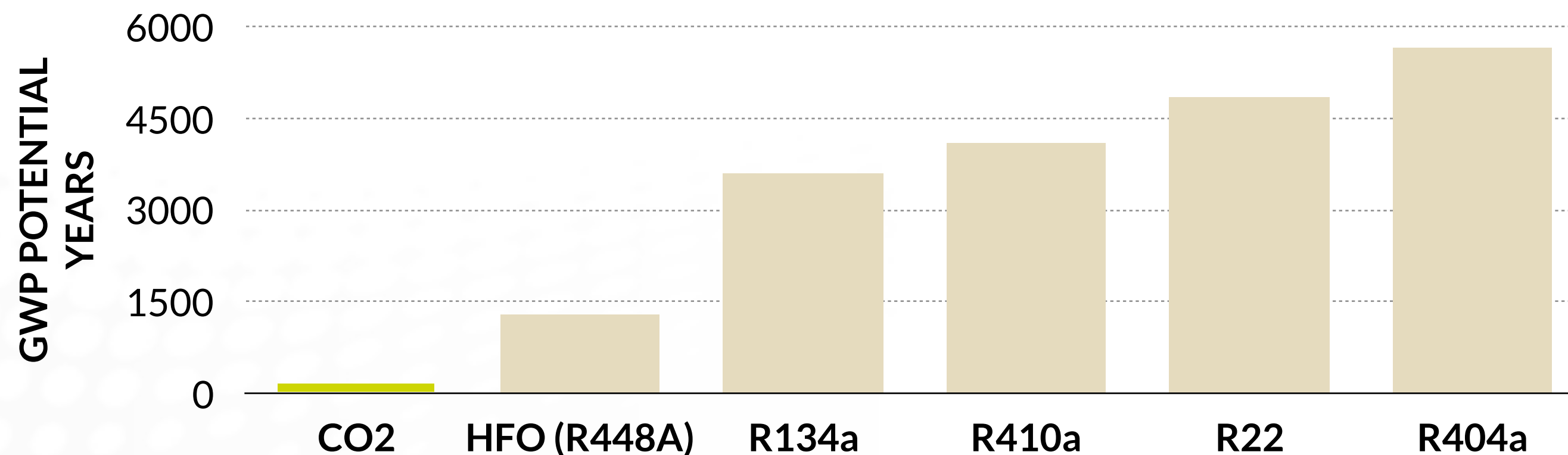
MAX 85%
BOILER EFFICIENCY
Combustion is very
inefficient, thermal
efficiencies
between 65-85%.





HFCS ARE OFTEN MISLEADINGLY PORTRAYED BY THEIR MANUFACTURERS AND USERS TO BE 'ENVIRONMENTALLY FRIENDLY' BECAUSE THEY DO NOT DEplete THE OZONE LAYER. HOWEVER, THEY ARE HIGHLY POTENT GREENHOUSE GASES AND CONTRIBUTE SIGNIFICANTLY TO CLIMATE CHANGE. THE ARE ALSO VERY EXPENSIVE.

HFCS ARE NOT AN ENVIRONMENTAL ALTERNATIVE TO ANYTHING!



PROBLEMS TO BE SOLVED



WHEN HFO-1234YF BREAKS DOWN IN THE ATMOSPHERE IT PRODUCES TRIFLUOROACETIC ACID (TFA). TFA IS TOXIC TO AQUATIC ECOSYSTEMS.

WHILE TFA IS A COMMON BY-PRODUCT WHEN OTHER HFCS BREAKDOWN, HFO-1234YF PRODUCES 4 TO 5 TIMES AS MUCH TFA THAN THE SAME AMOUNT OF HFC-134A DOES



HFOs: the new generation of F-gases

Greenpeace Position Paper
October 2009

With the agreed phase out of CFCs and HCFCs under the Montreal Protocol, political work is now turning its attention to the strong negative impacts of HFCs on the climate and discussion is taking place on the next set of alternatives. The chemical industry is promoting new substances it calls 'Hydrofluoroolefins' or HFOs.

Chemically, HFOs are HFCs, but due to the negative connotations that HFCs have acquired, this new class of chemicals has been marketed under a different name. This is part of a marketing strategy to portray these new HFCs as having a low impact on the climate while glossing over their negative environmental effects. As set out below, these new HFCs have real and dangerous environmental and health impacts.

Greenpeace has four main arguments against HFOs, the fourth generation of F-gases:

- I. HFOs present an unnecessary risk to the environment and human health
- II. HFOs are only a short-term fix
- III. Natural refrigerants are the best available technology and offer the long-term solution; HFO development will only delay their deployment.
- IV. Greenpeace does not want to see history repeating itself; after three subsequent generations of destructive chemical products it is time to opt for the only acceptable alternative: natural refrigerants

Greenpeace seeks the phase out of all F-gases, which present a growing threat to the environment. Greenpeace is not against the development of alternatives, but until our concerns about HFOs can be proven otherwise, the precautionary principle should prevail. Safer, cheaper and readily-available alternatives already exist for all applications, and given this fact, we favour the deployment of natural refrigerant and oppose the continuing dependence on synthetic refrigerants.

In order to prevent dangerous climate change, global greenhouse gas emissions need to peak by 2015, and start declining rapidly thereafter, reaching as close to zero as possible by mid-century. In order to achieve these ambitious objectives Greenpeace will support every sustainable means of doing so, in line with the precautionary principle and therefore without compromising the health and vitality of our planet or future generations. Greenpeace will continuously assess the sustainability of new technologies based on newly-available information.





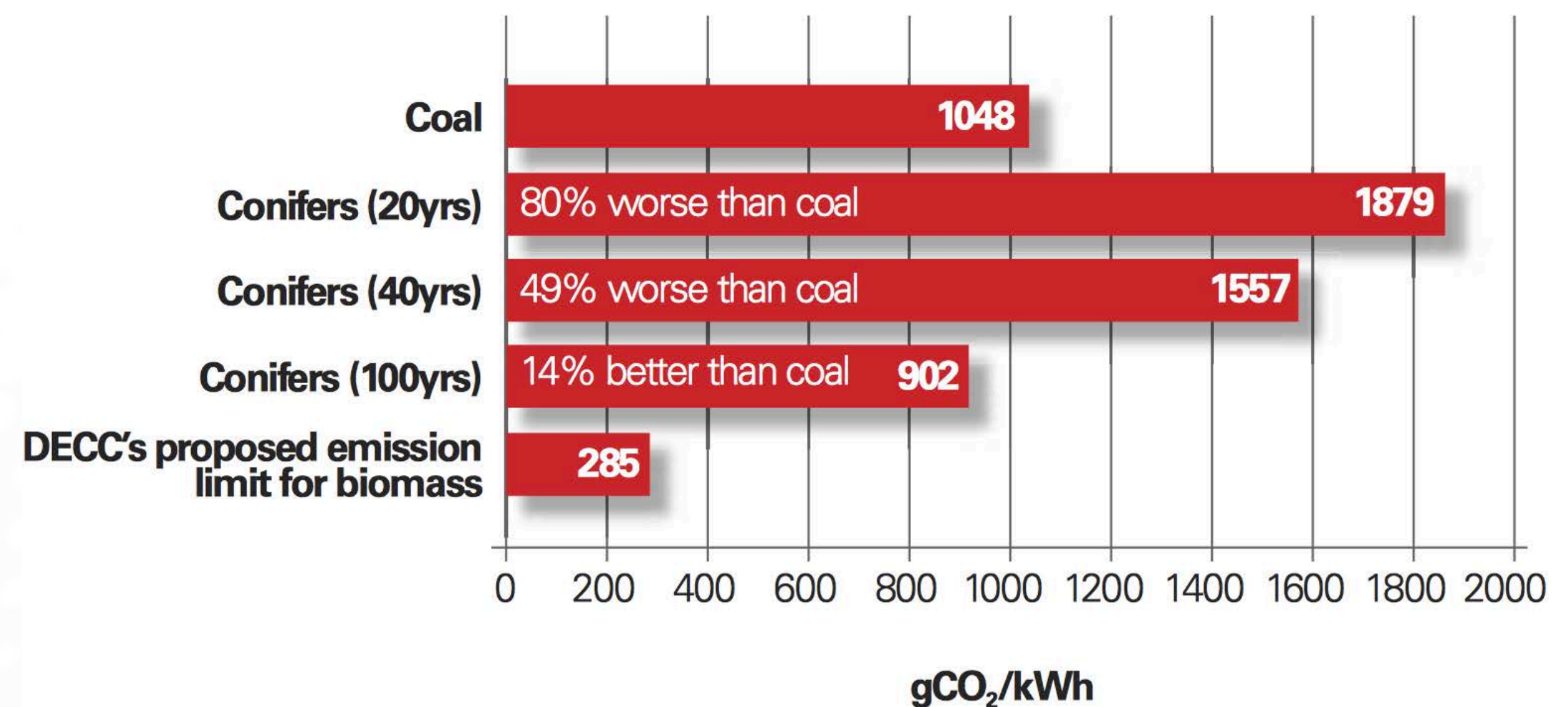
DIRTIER THAN COAL?



PROBLEMS TO BE SOLVED

THE USE OF WOOD FOR ELECTRICITY GENERATION AND HEAT HAS GROWN RAPIDLY IN RECENT YEARS, BUT ITS REAL IMPACT ON THE CLIMATE AND ON FORESTS IS CONTROVERSIAL.

ONLY AFTER 100 YEARS DOES ELECTRICITY GENERATION FROM CONIFER TREES PERFORM BETTER THAN COAL



**So whats the
solution....?**





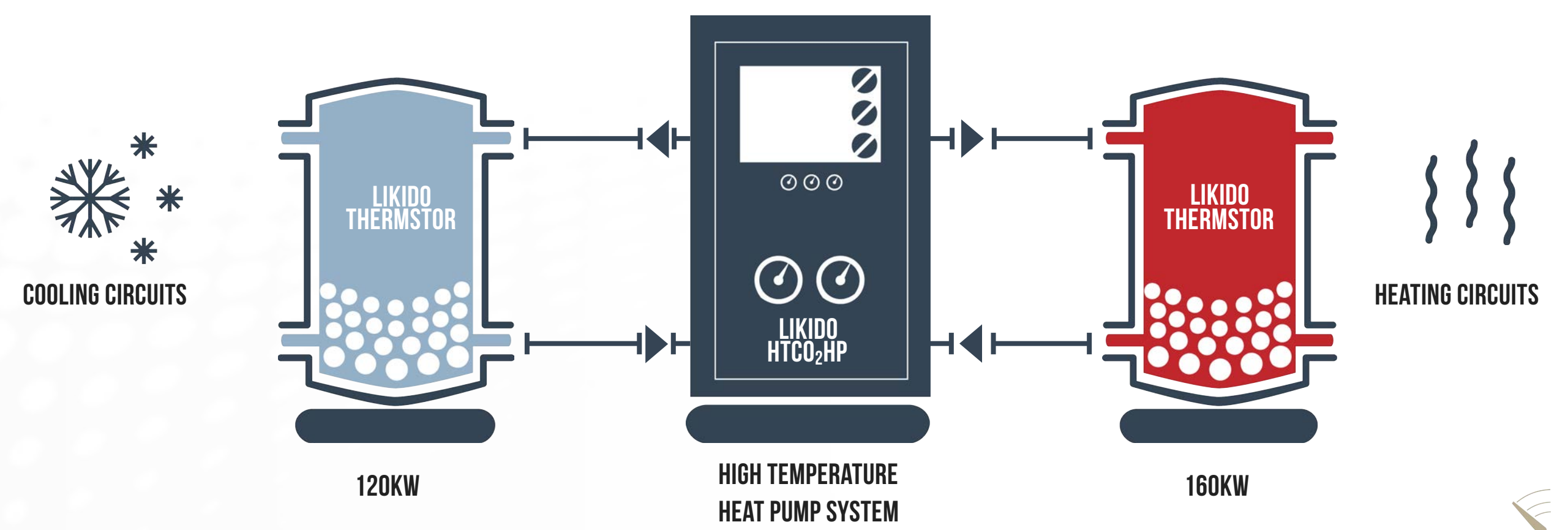
JMM LIKIDO PTE LTD.

OUR SOLUTION

JMM-Likido Pte Ltd., is a joint venture between JMM Vision Pte Limited and Likido Ltd. JMM Vision, have unrivalled expertise in industry specific applications such as Hotels & Resorts, Refrigerated Logistic Warehouse, Food & Beverage, sectors.

Likido Ltd has developed a novel technology from its Malaysian, UK and HK bases. Likido's super-critical, high temperature, CO₂ based industrial heat pump (HTCO₂HP) are a disruptive technology that harvests low grade waste energy into high grade heating and low temperature cooling; recycling 75% of the energy normally lost to drain or atmosphere.

LIKIDO
WORKS
IN HIGH AND TROPICAL
AMBIENT TEMPERATURES
Likido has solved the issue of CO₂ being able to be used safely, in high ambient climates without the need for a secondary back-up cooling system



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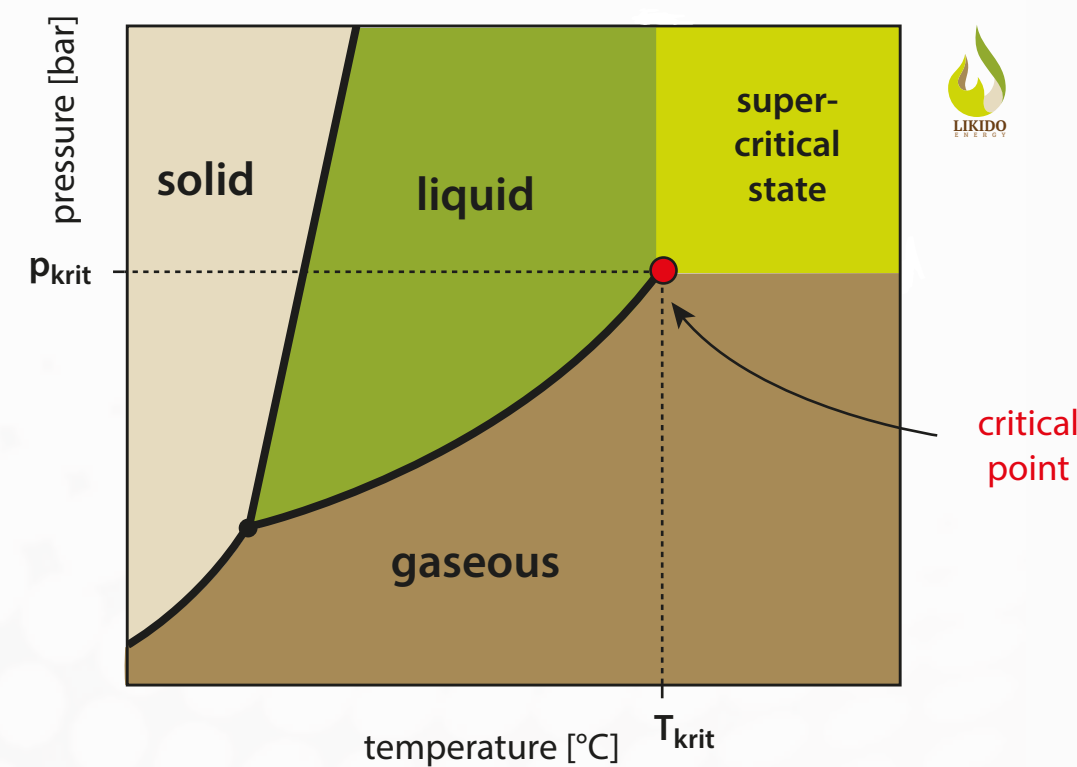
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CORE TECHNOLOGY

Likido's core technology is a novel form of heat pump technology that employs **super-critical, high-pressure CO₂** as the working fluid, to enable the highly efficient recovery of low grade heat from air, water, or thermal waste streams, for use in high grade heating or cooling applications.



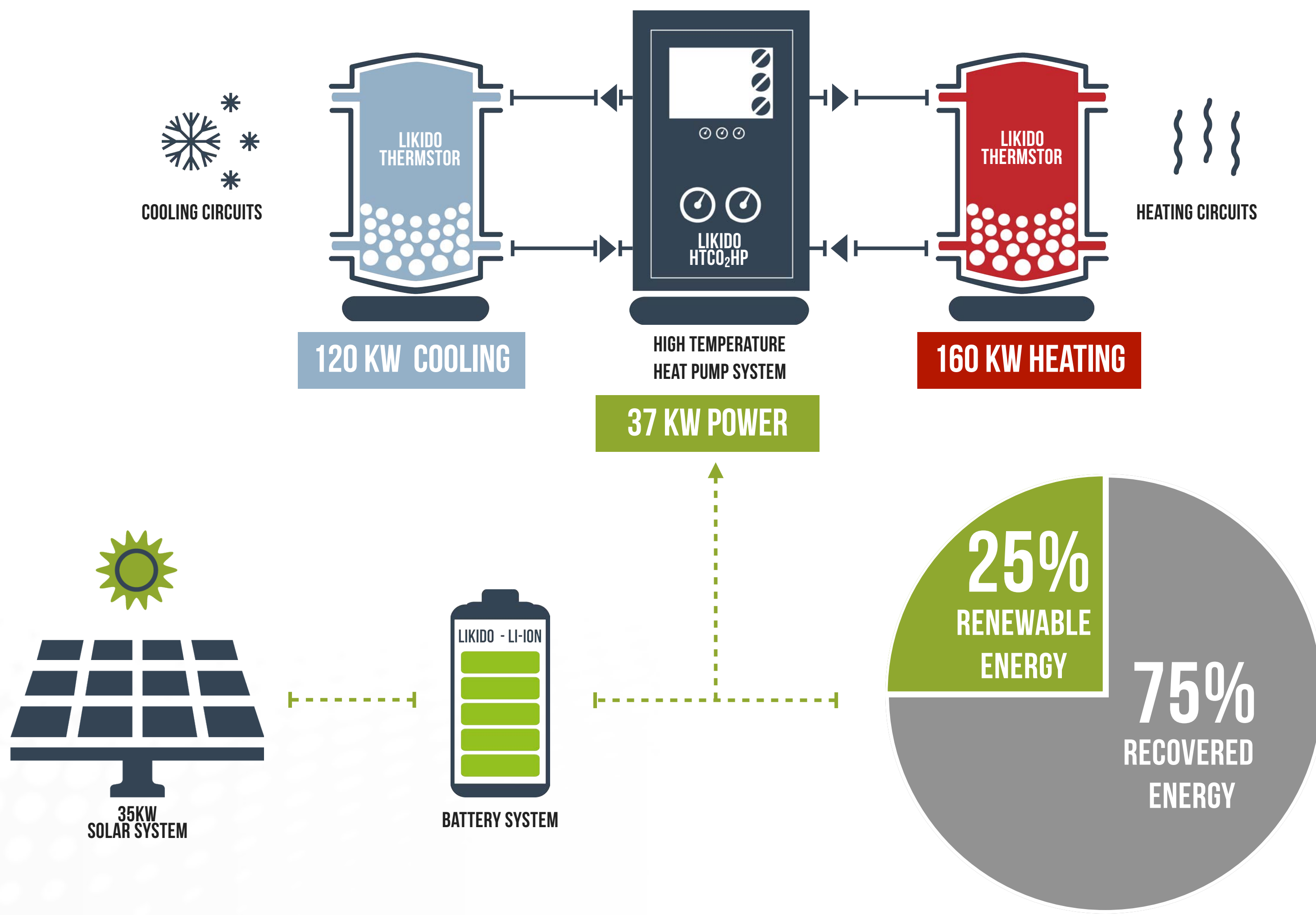
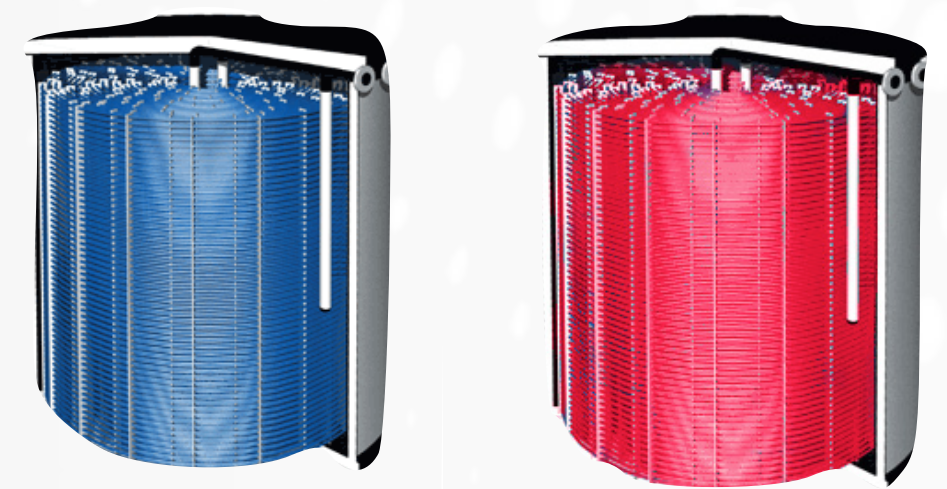
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CORE TECHNOLOGY

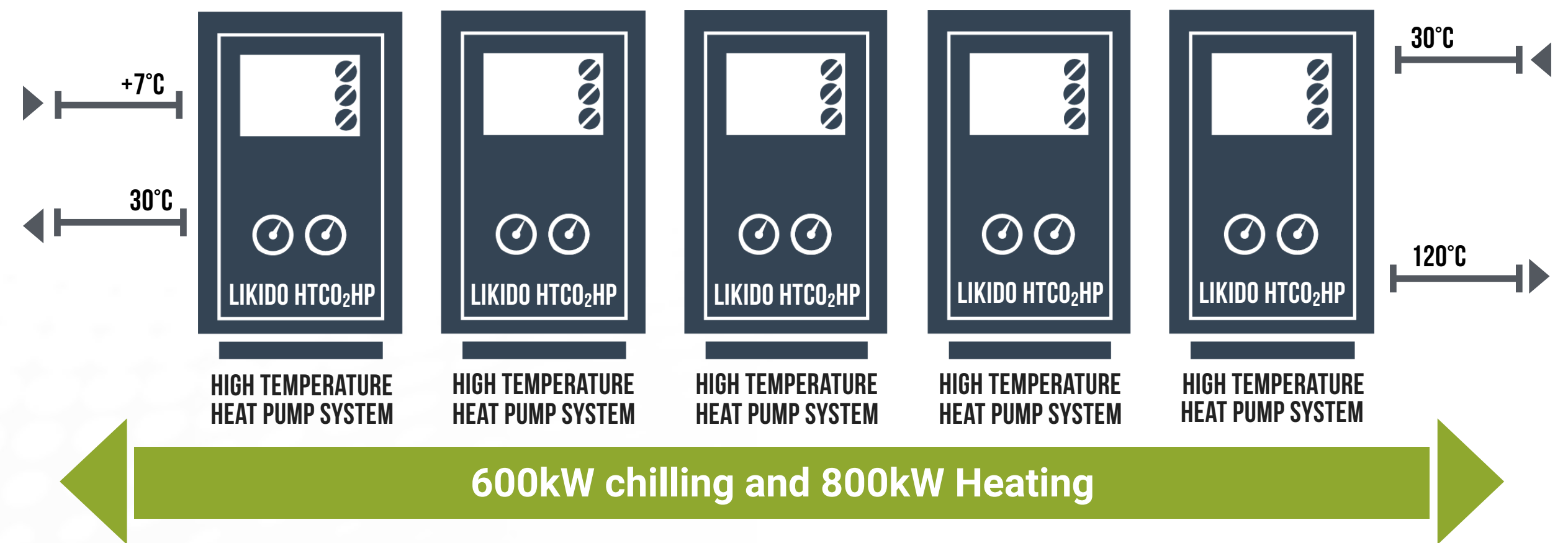
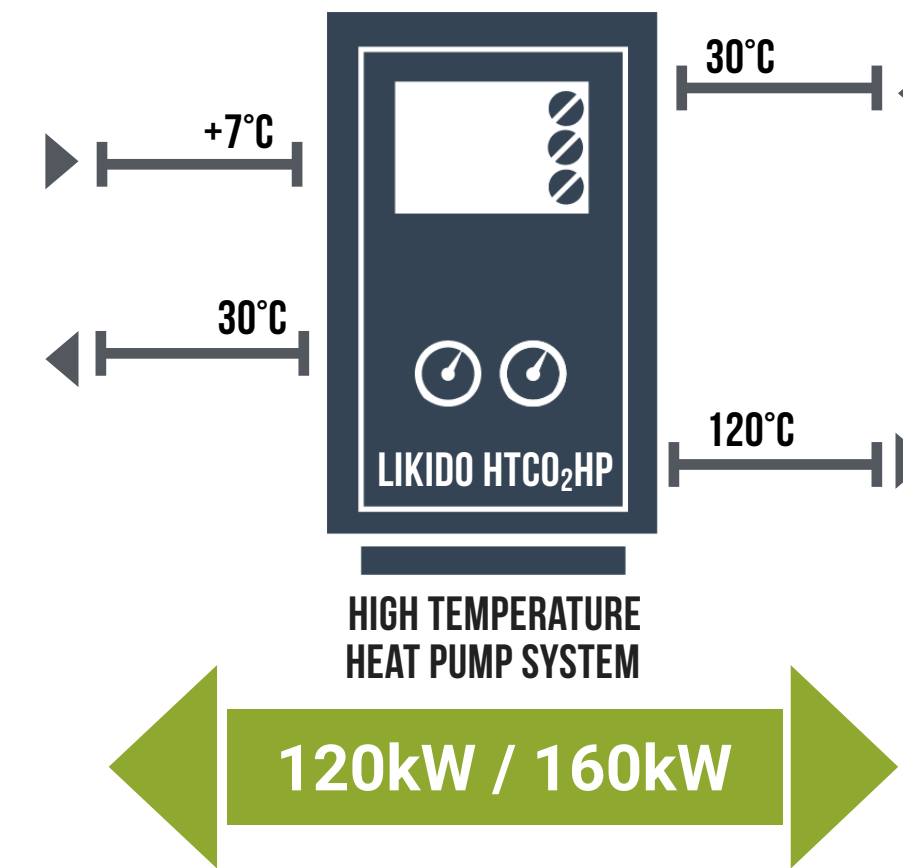
Likido's innovation provides the answer to a vast and validated demand and overcomes the perceived, financial, technical and environmental barriers that have thus far hindered the wide use of heat pumps. The system which is low cost, easily integrates with existing utilities and enables customers to increase fossil fuel derived energy efficiency by over 75% and reduce the surface area of renewable energy sources such as wind and solar.





JMM LIKIDO PTE LTD.

OUR SOLUTION



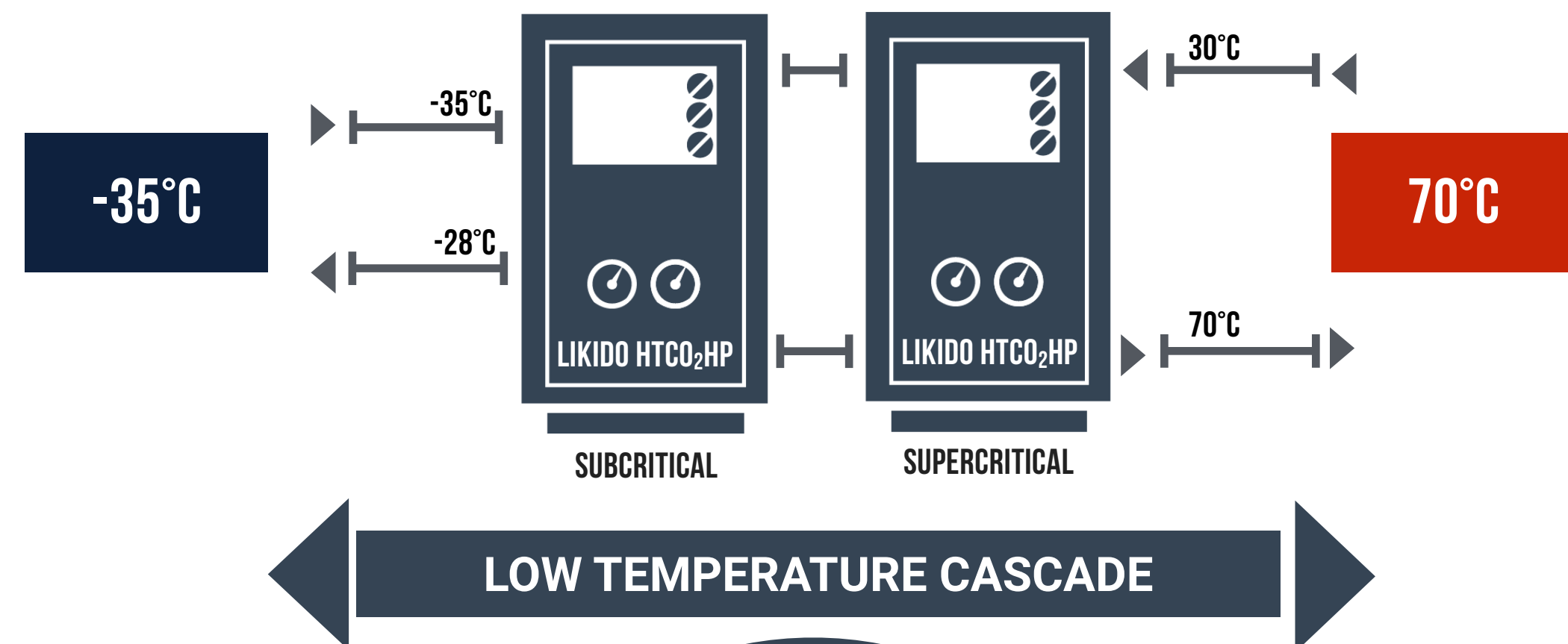
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-35°C
NATURAL
REFRIGERATION
SYSTEMS
100% CO₂

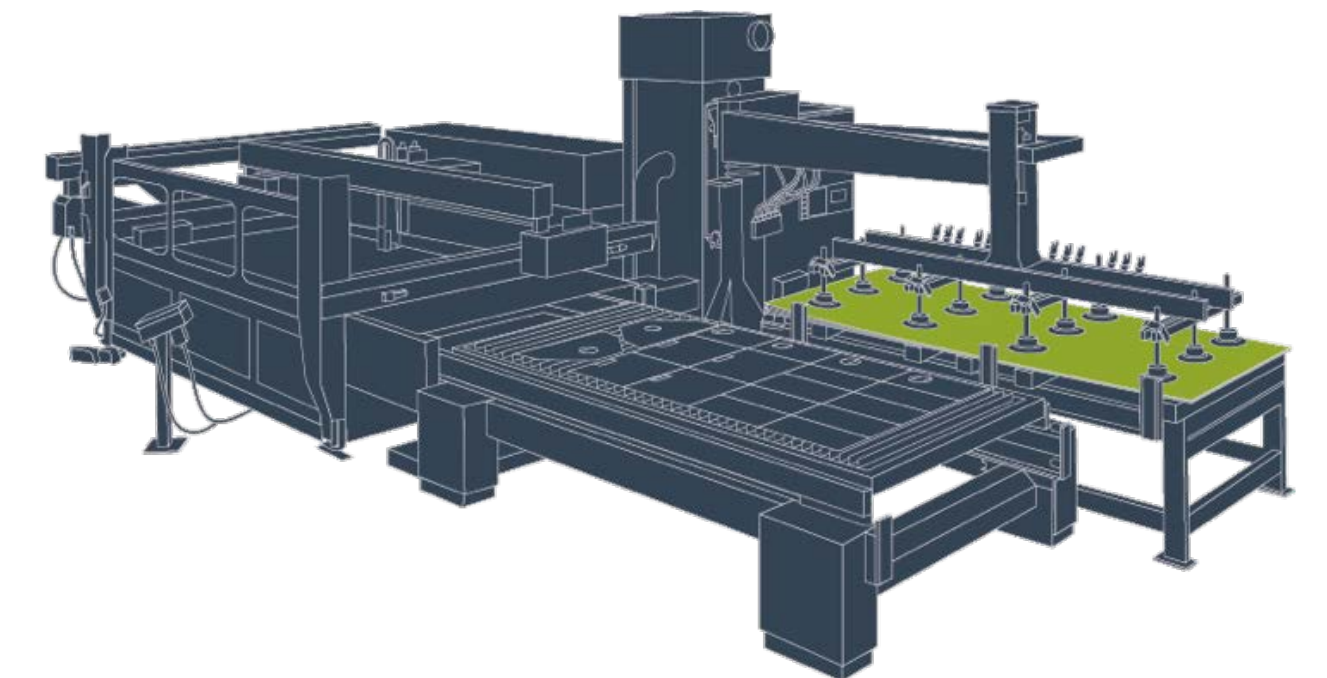
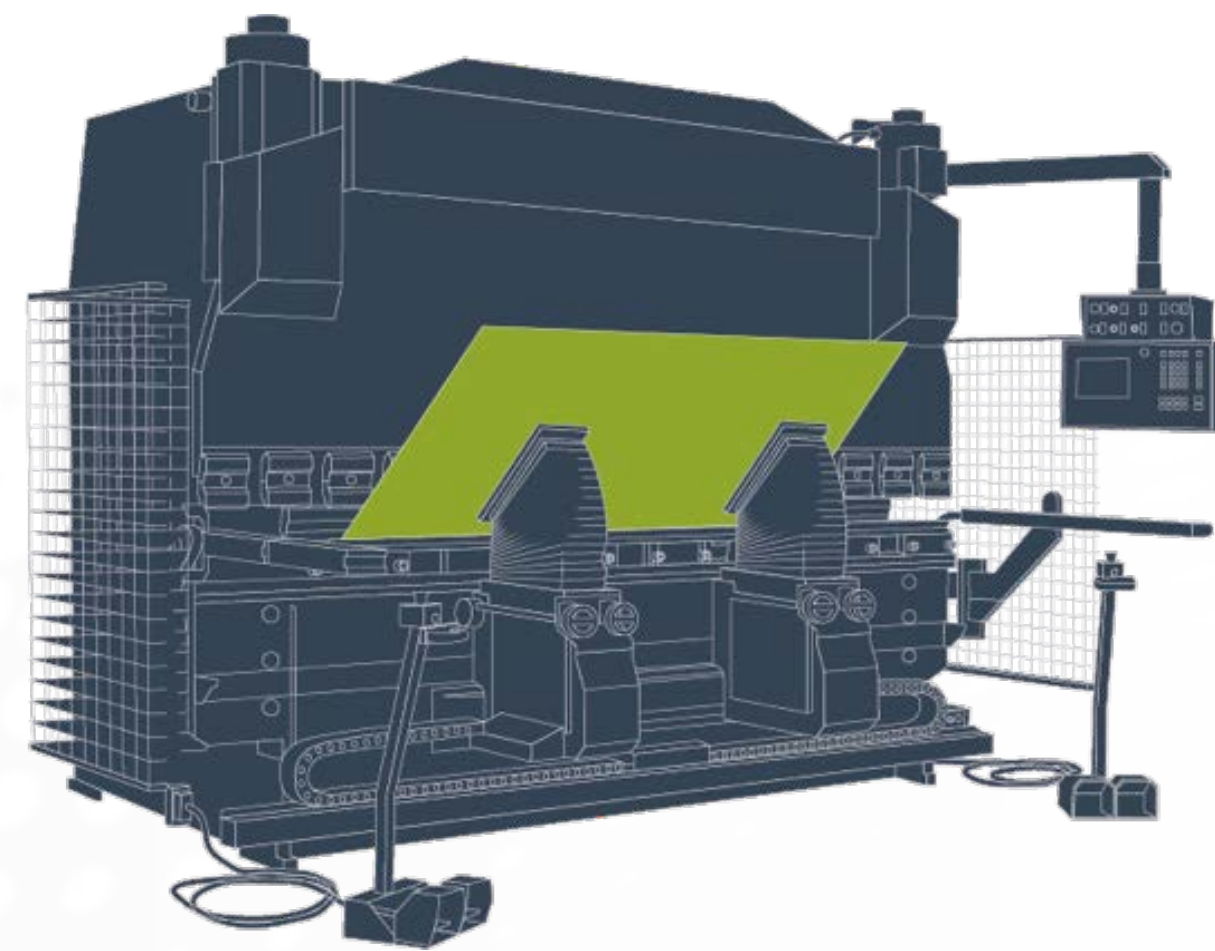




JMM LIKIDO PTE LTD. OUR SOLUTION

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Likido Shd Bhd., was founded in Malaysia to serve the global market and provide a high tech, volume manufacturing base to supply units flat packed [CKD] for local assembly in the world markets via an exclusive distribution network - **Hotels and Resorts are serviced by JMM Likido Pte Limited.**



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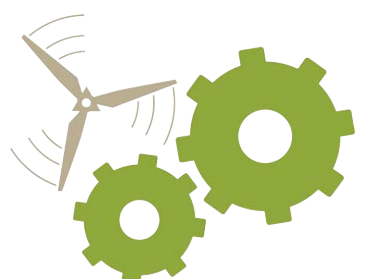
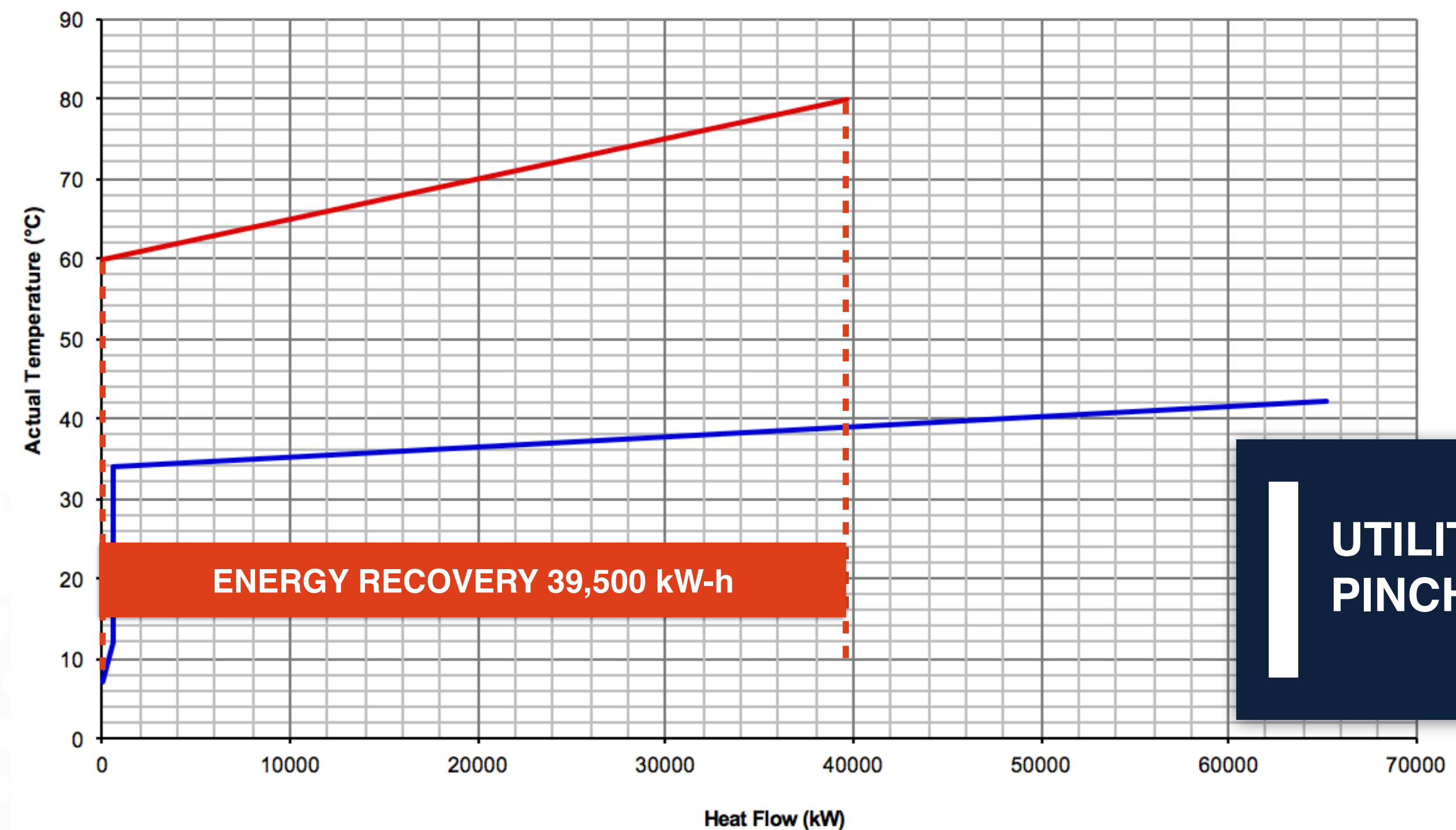




HOW TO DETERMINE ENERGY SAVING POTENTIAL

Pinch Analysis is a recognised method for determining the “potential” heat recovery possibilities in a system or network of heat exchangers.

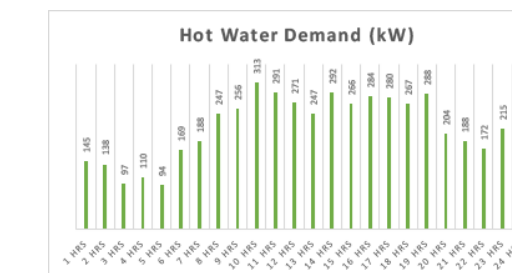
HOT AND COLD COMPOSITE CURVES





Hot water demand in a hotel depends on a variety of factors like the number of rooms, occupancy ratio, amenities provided and star rating. In addition to the rooms, it is necessary to provide hot water to the restaurants, kitchens, laundry as well as the swimming pools. Hotels use a lot of hot water, even an energy efficient hotel shower-head will still deliver 9.4 litres per minute of water. Statistics suggest we spend around 8 minutes showering, that's 75 litres per shower. To demonstrate the energy savings of using Likido®ONE in a hotel that uses traditional hot water heating via electric or fossil fuel boiler, chiller and cooling tower we present the following case study.

LOCATION - MALAYSIA	Details	Units
Number of Rooms:	300	
Occupancy Rate	80	%
Air Conditioning Load / Room	5	kW-h
Hotel Hot Water Usage:	5258	kW-Day
Hot Water Usage:	160	kW-h
Initial Water Temp:	25	°C
Final Water Temp:	60	°C



Cost of Fuel / MMBTU	\$6.01	MM/BTU
Cost of Fuel / kW - NATURAL GAS	\$0.025	kWh
Cost of Water	\$0.64	m³

Cost of Electrical - Peak	\$0.061	kW/h
Cost of Electrical - Off Peak	\$0.045	kW/h
Cost of Electrical - Average Price	\$0.053	kW/h

HOT WATER BOILER DETAILS		
Hot Water Production	4,150	l/h
Heat Load [Net]	164	kW-h
Electric Load on Burners	5.5	kW-h
Hot Water Heater	Natural Gas	
Heater Efficiency	75%	%
Heating Load [Gross]	220	kW-h
Fuel Consumption / Hour (CV =10.4kW/m³)	21	m³/hr
Energy Consumption / Year	1,917,454	kW
Energy Consumption / Year	6,544	MMBtu's/year

TOTAL "HOT WATER" ENERGY COSTS		
CO ₂ Emissions [0.266/kWh]	510,043	kg CO ₂ E
RUNNING COST SUB TOTAL	\$47,936	-Year

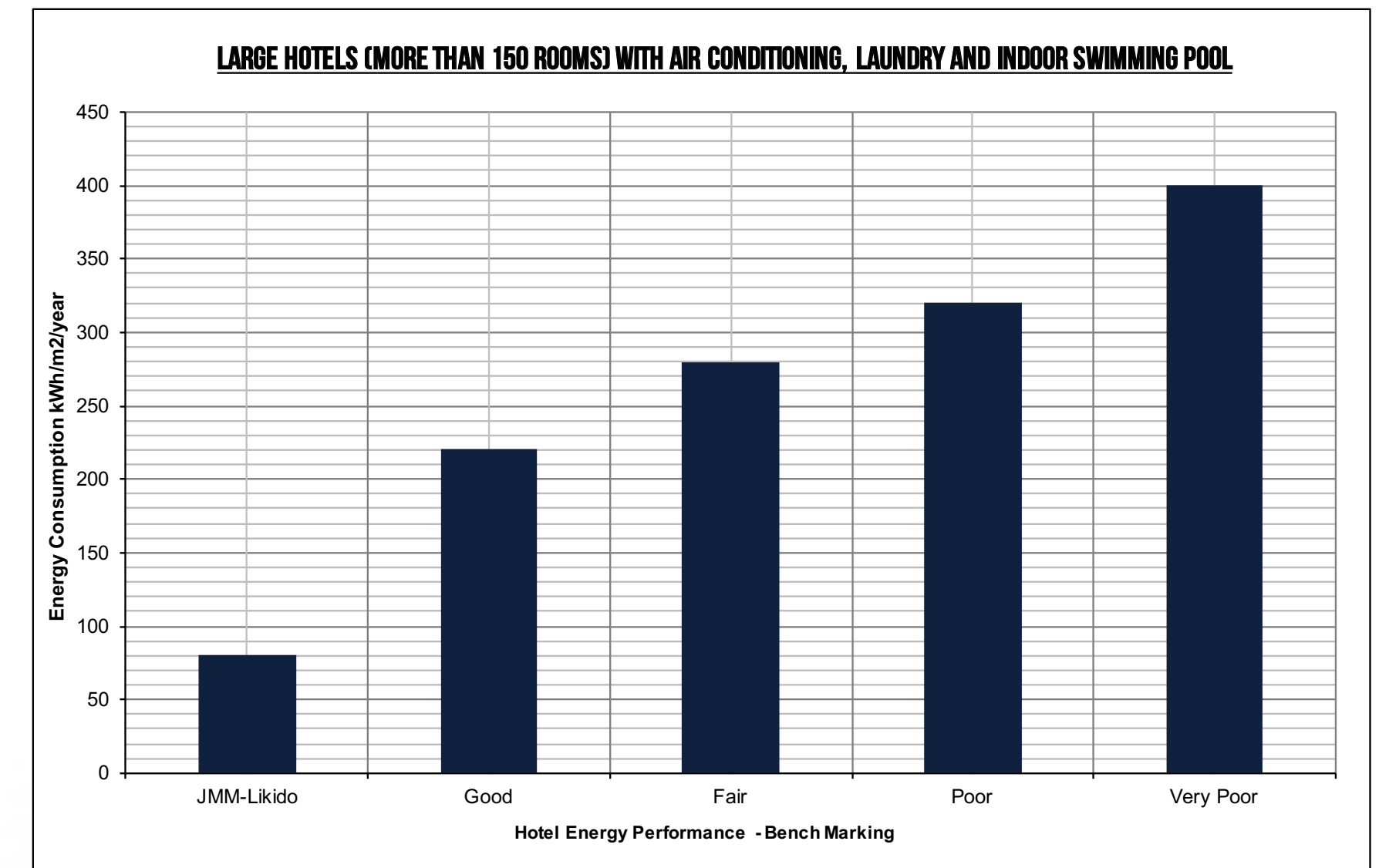
"FREE COOLING CONTRIBUTION"		
Total Cooling Load from Likido	17,500	l/h
Chilled Water Flow Temperature	7	°C
Chilled Water Inlet Temperature	12	°C
'Free Cooling' From Likido	120	kW-h
'Free Cooling' From Likido / Year	1,027,208	kW-Year

TOTAL "COOLING" ENERGY COSTS		
Energy Consumption - Existing Chillers	447,406	kW-Year
Carbon Emissions @ 0.544/kWh	243,389	kg CO ₂ e
RUNNING COST SUB TOTAL	\$23,713	-Year

COOLING TOWER DETAILS		
Cooling Tower Heat Rejection	200	kW
Inlet Temperature to Chiller	46	°C
Outlet Temperature to Tower	33	°C
Cooling Tower Flow Rate	14,000	kg/h
Wet Bulb Temperature	26.8	°C
Drift Rate	0.005	%
Evaporation Rate	1.68%	%
Concentrations	3	
Electric Power (FANS & PUMPS)	18	kW

COOLING TOWER ENERGY SAVINGS		
Energy Saving - Cooling Tower	1,764,672	kW-Year
Electric Savings	\$8,340	
Water Savings = 0.4m³/h	\$2,236	
Water-treatment / Year (ASHREA)	\$802	
RUNNING COST SUB TOTAL	\$11,378	-Year
TOTAL COST	\$83,027	USD

LIKIDO ENERGY COSTS		
Likido®ONE Energy Consumption	36	kW-h
Heat Output (Hot Water)	165	kW-h
Heat Output (Chilled Water)	128	kW-h
Hot Water Production	4,150	l/h
Chilled Water Production	17,500	l/h
Energy Consumption / Year	319,576	kW-Year
RUNNING COST - TOTAL	\$16,938	-Year
TOTAL COST SAVING	\$66,089	USD
COST REDUCTION =	80%	





COOLING TOWER RUNNING COSTS

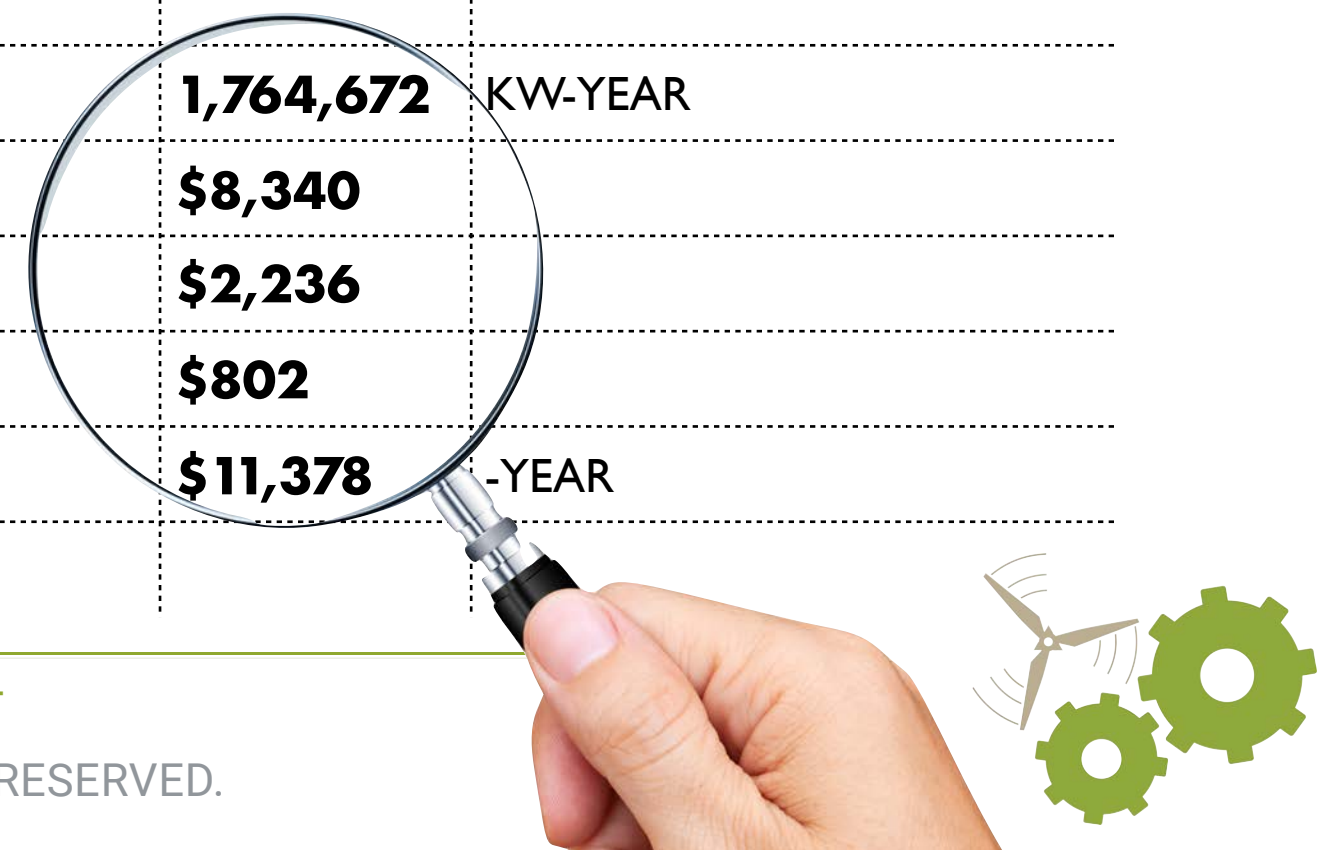
Cooling towers can be found in most industrial processing plants, hospitals, power generation plants and all buildings such as hotels, office blocks and shopping malls requiring air conditioning. Whilst there is a lot of debate and innovation on improving the efficiency of the cooling tower itself, rarely if ever is consideration given to try and recover the energy extracted from a building or process that the cooling tower discharges to atmosphere.

COOLING TOWER

COOLING TOWER DETAILS		
COOLING TOWER HEAT REJECTION	200	KW
INLET TEMPERATURE TO CHILLER	46	°C
OUTLET TEMPERATURE TO TOWER	33	°C
COOLING TOWER FLOW RATE	14,000	KG/H
WET BULB TEMPERATURE	26.8	°C

COOLING TOWER ENERGY SAVINGS

ENERGY SAVING - COOLING TOWER	1,764,672	KW-YEAR
ELECTRIC SAVINGS	\$8,340	
WATER SAVINGS = 0.4M3/H	\$2,236	
WATER-TREATMENT / YEAR (ASHREA)	\$802	
RUNNING COST SUB TOTAL	\$11,378	-YEAR



UTILITY COSTS

WATER COST \$	0.64	US\$/m ³
WASTE WATER COST	0.15	US\$/m ³
ELECTRICITY COST \$	0.053	kW-h
NATURAL GAS COST \$	0.025	kW-h
	6	US\$/MMBTU
ASHREA WATER TREATMENT COST	14	US\$/RT
HOURS RUNNING HOURS	8000	HOURS





HOT WATER BOILER RUNNING COSTS

UTILITY COSTS

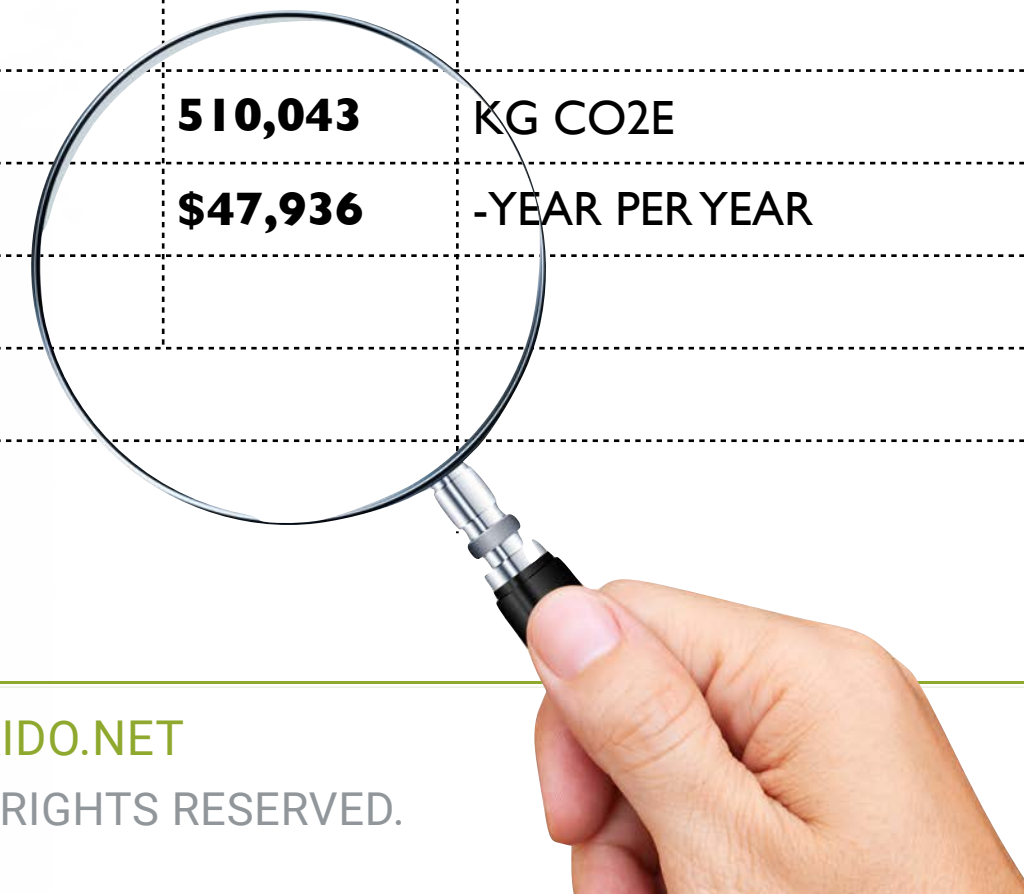
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HOURS RUNNING HOURS	8000	HOURS

HOT WATER BOILER DETAILS

HOT WATER PRODUCTION	4,150	L/H
HEAT LOAD [NET]	164	KW-H
ELECTRIC LOAD ON BURNERS	5.5	KW-H
HOT WATER HEATER	NATURAL GAS	
HEATER EFFICIENCY	75%	%
HEATING LOAD [GROSS]	220	KW-H
FUEL CONSUMPTION / HOUR (CV =10.4KW/M3)	21	M3/HR
ENERGY CONSUMPTION / YEAR	1,917,454	KW
ENERGY CONSUMPTION / YEAR	6,544	MMBTU'S/YEAR
HOT WATER BOILER DETAILS		
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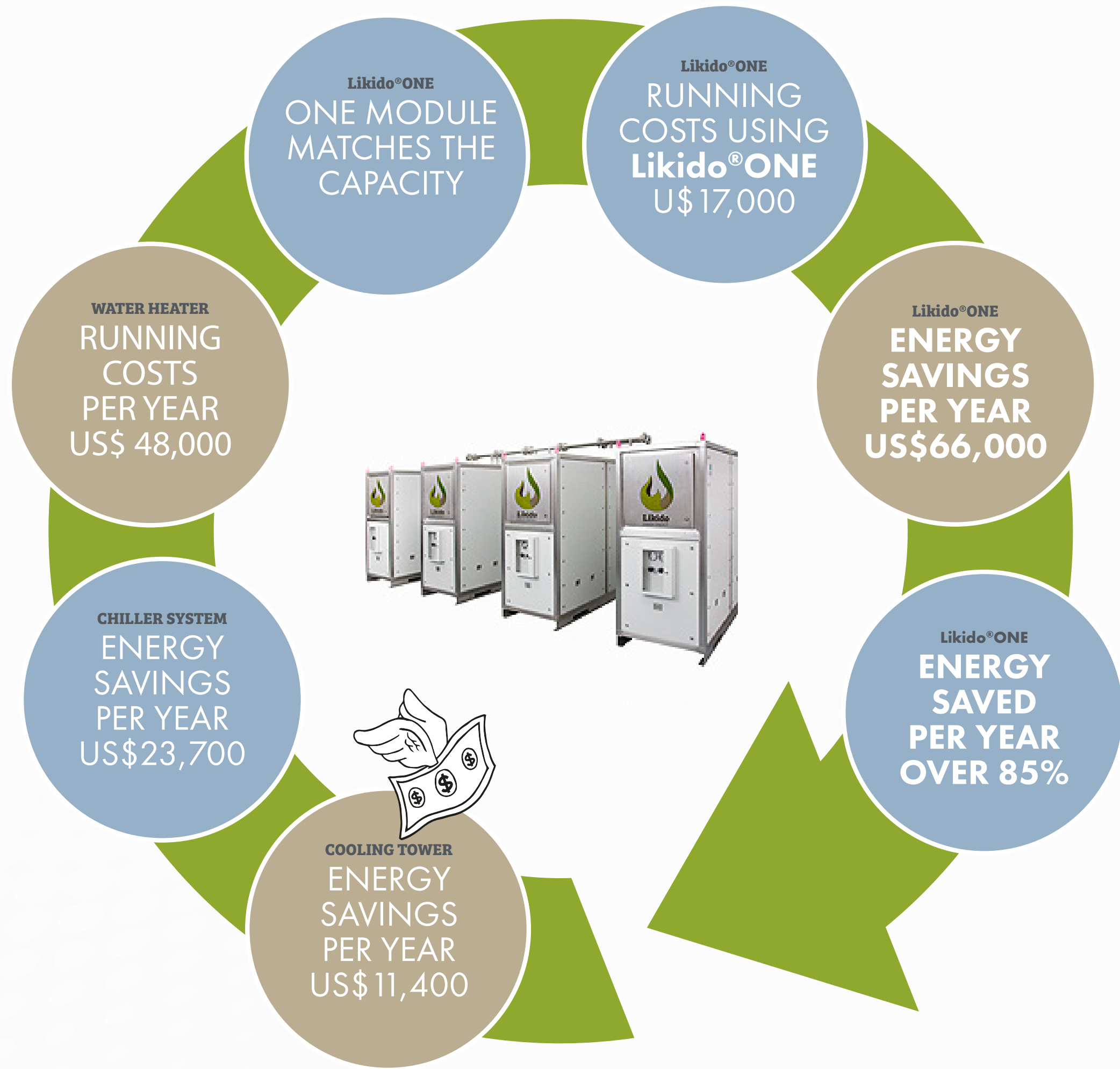
TOTAL "HOT WATER" ENERGY COSTS

CO2 EMISSIONS [0.266/KW]	510,043	KG CO2E
RUNNING COST SUB TOTAL	\$47,936	-YEAR PER YEAR
TOTAL "HOT WATER" ENERGY COSTS		





JMM LIKIDO PTE LTD. CASE STUDY - HOTEL KL





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CASE STUDY



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**CONTROLLING ENERGY USE OFTEN
MAKES CONDITIONS MORE
COMFORTABLE FOR GUESTS AND
CUSTOMERS – AND COMFORTABLE
CUSTOMERS WILL BE ENCOURAGED TO
RETURN.**



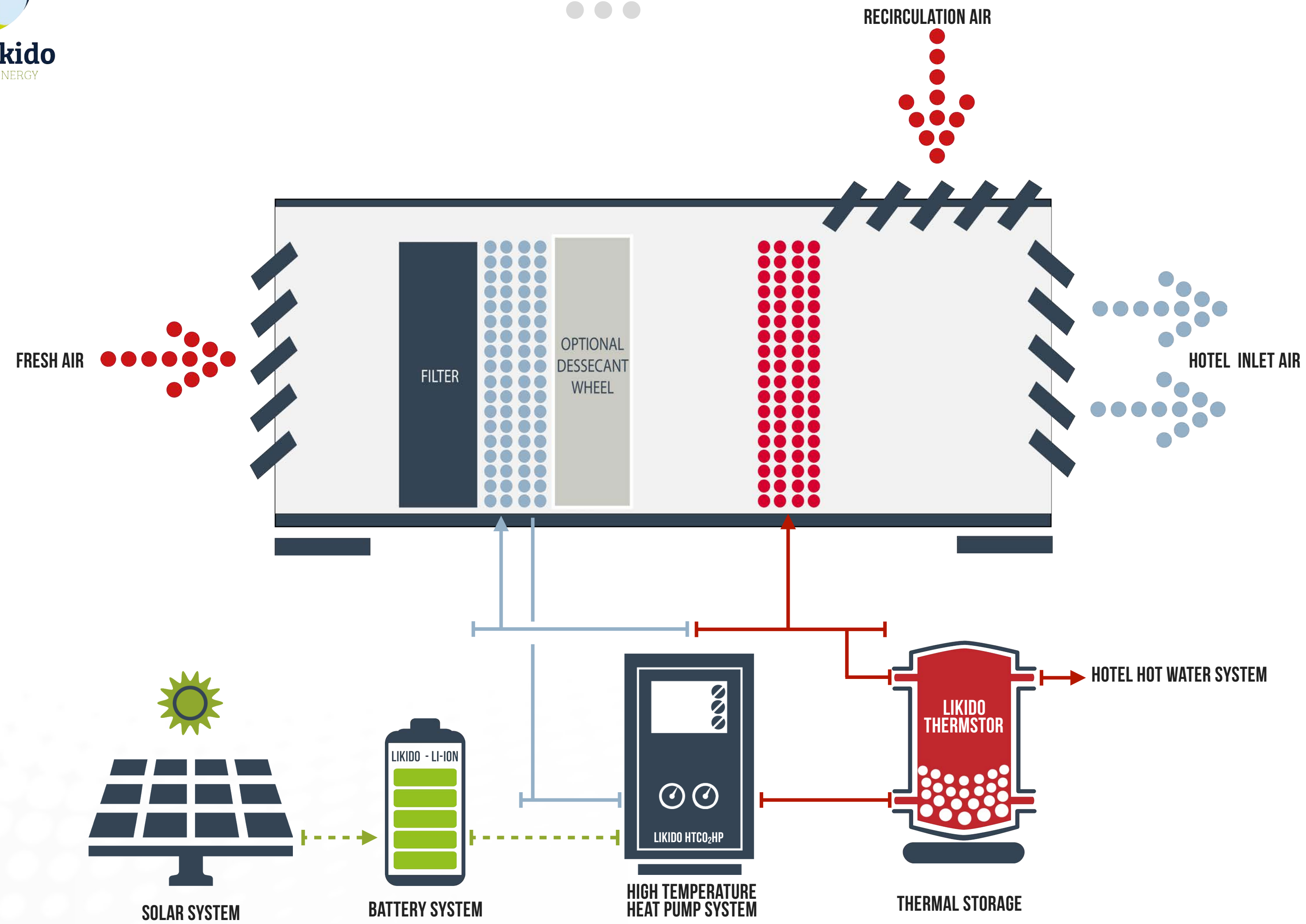
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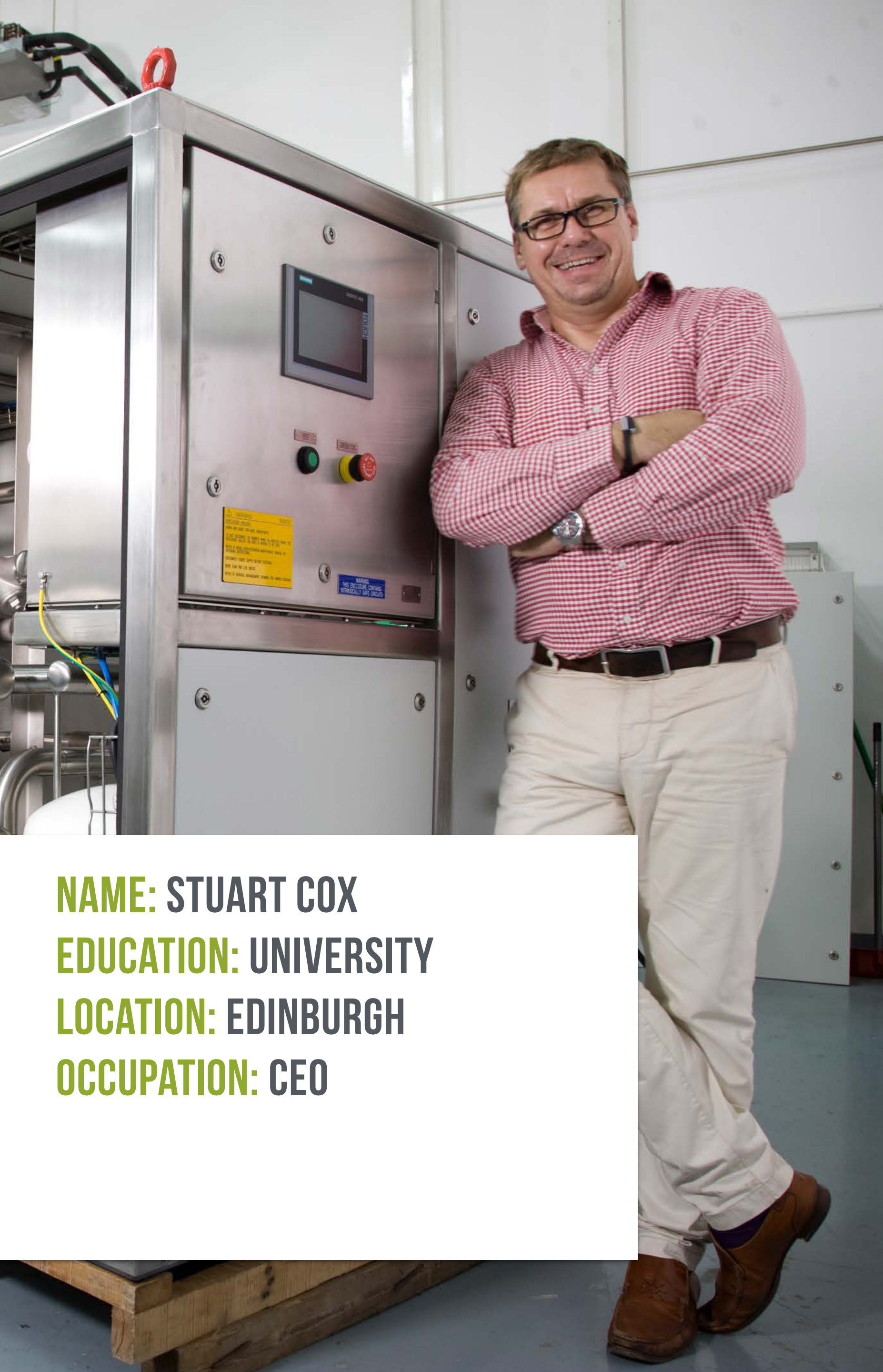
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CASE STUDY - HOTEL KL





NAME: STUART COX
EDUCATION: UNIVERSITY
LOCATION: EDINBURGH
OCCUPATION: CEO



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THANK YOU
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