

Startup/Industrial prospective for the upcoming eco-friendly technology in India

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Current Scenario

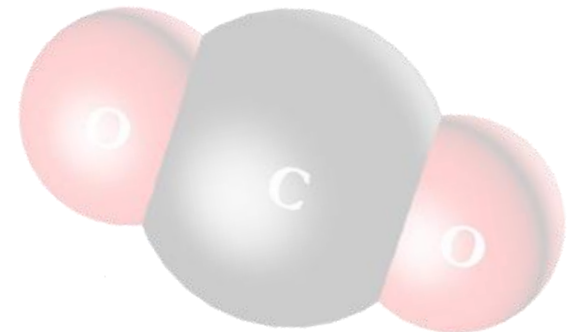
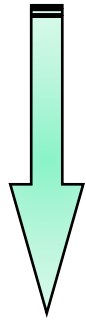
Solution and Motivation

R744 heat pump under development

INDEE+ installations

Collaboration opportunities

Acknowledgments



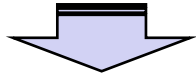
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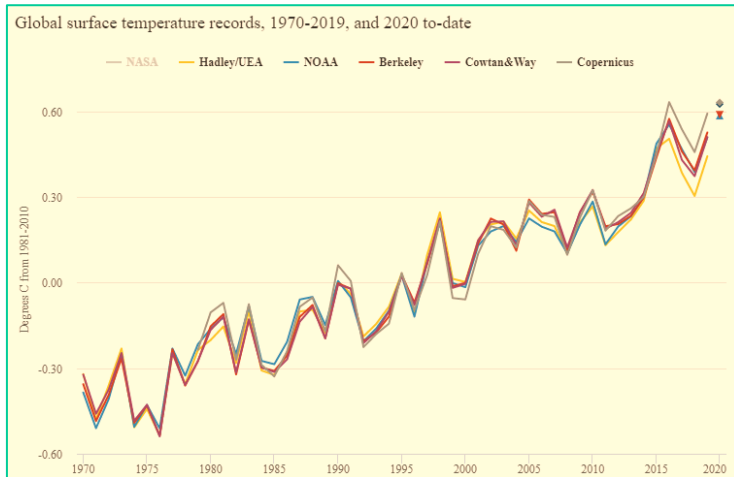
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Need of the Hour

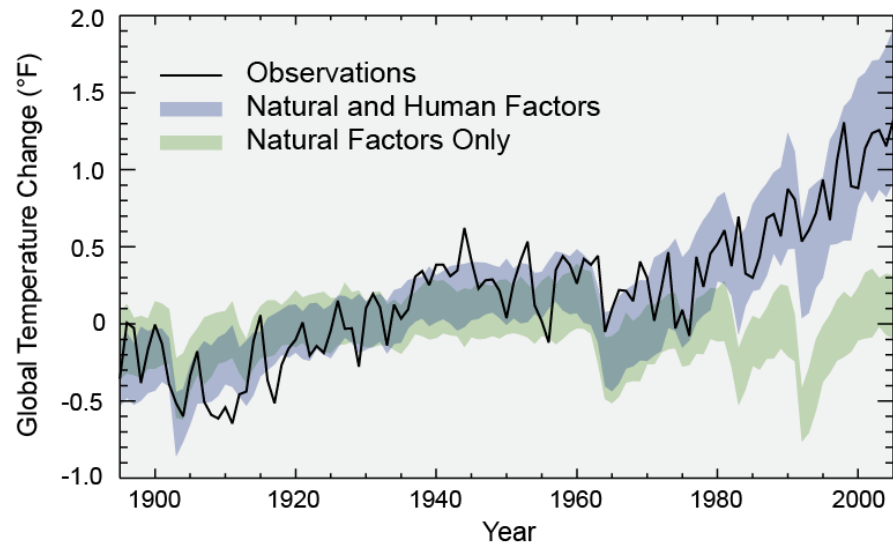


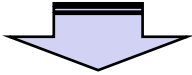
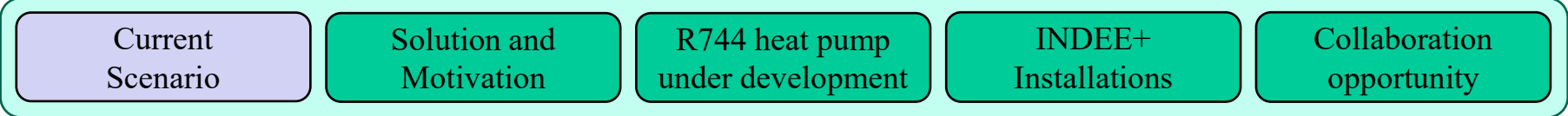
- Recent climate changes, however, cannot be explained by natural causes alone.
- Rather, it is extremely likely that human activities have been the dominant cause of that warming.

<https://www.weforum.org/> and EPA

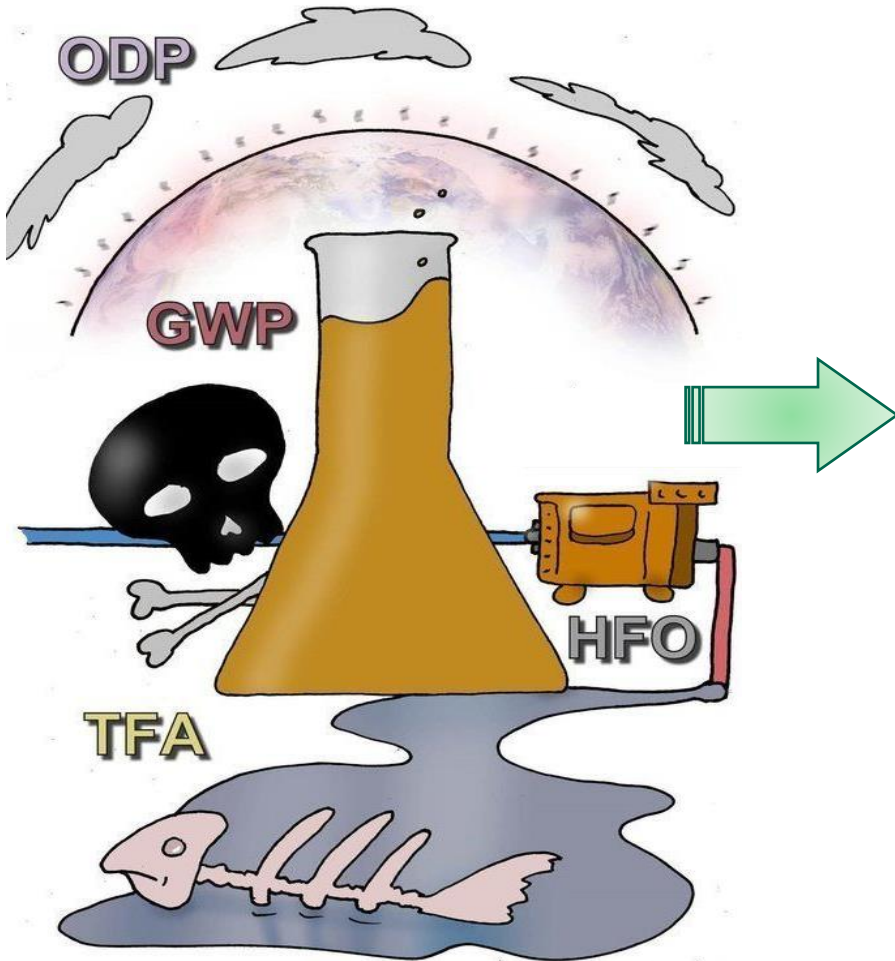
The temperature anomalies changes relative to the 1981-2010 average temperature for each year since 1970, along with the average over the first nine months of 2020.

Separating Human and Natural Influences on Climate





Problem >> Key



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- Most car manufacturers
 - Europe, Korea, Japan and the US
- System and component suppliers
- Institutes and universities all over the world
- Related industries are either developing or are already in production with CO₂.
 - Residential / commercial hot water systems
- Commercial and industrial refrigeration
 - stationary, supermarkets
- US Army is developing in both stationary and wheeled vehicles
- Helicopter and airplane air conditioning and refrigeration
- Transport refrigeration



motive

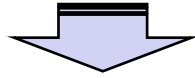
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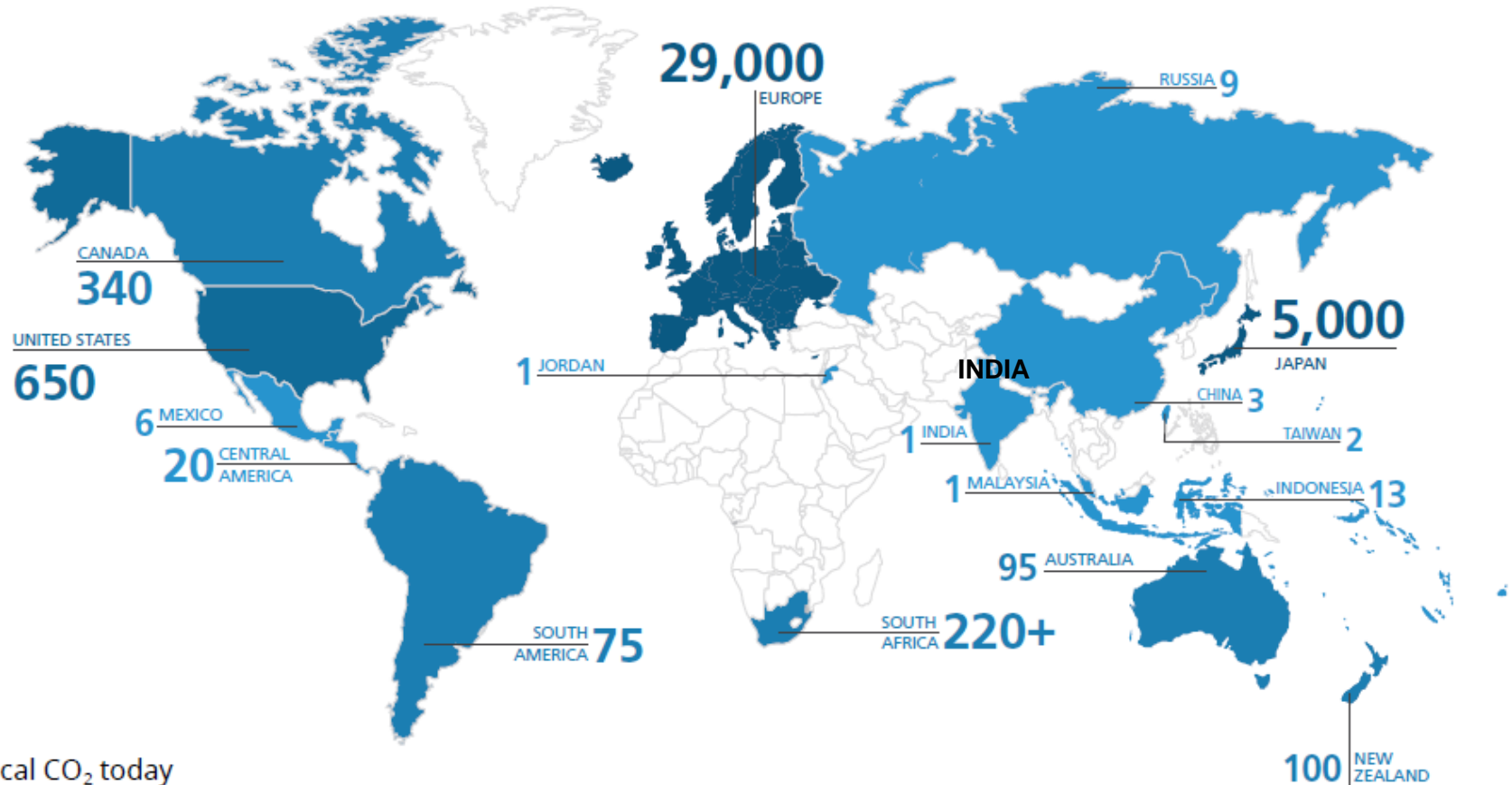
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CO₂ transcritical installations in the world

sheccoBase 



Transcritical CO₂ today

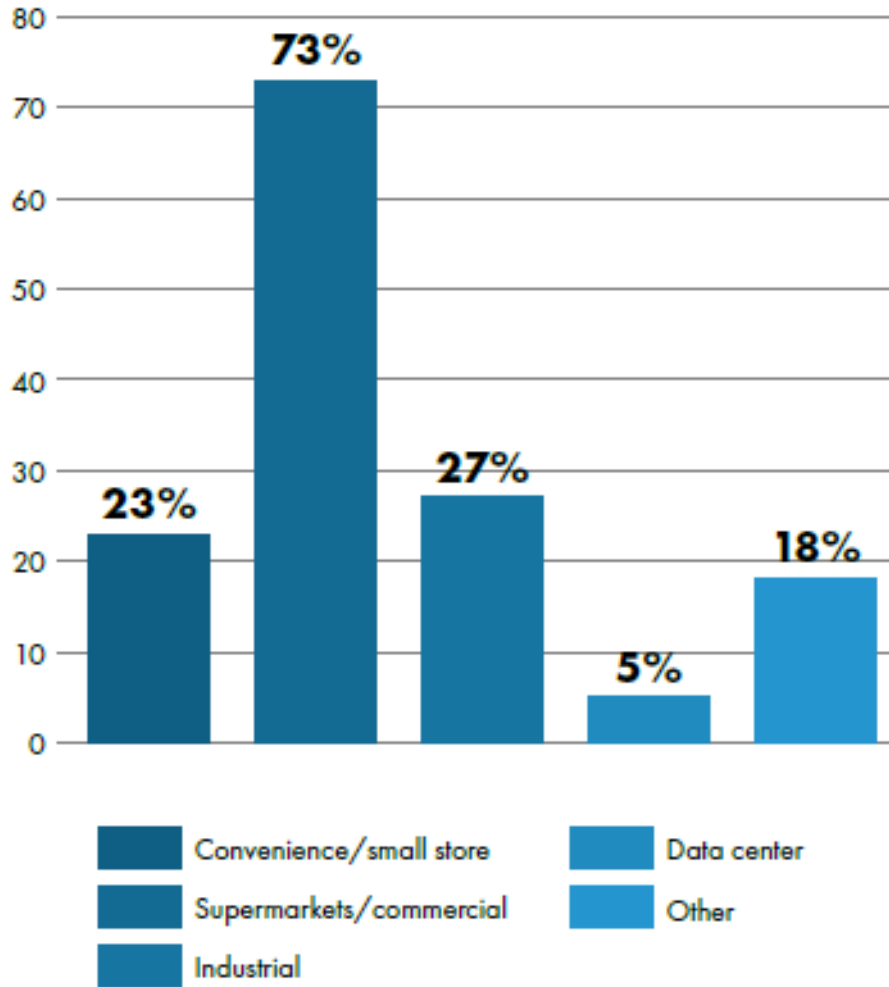
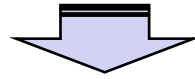
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Transcritical CO₂ in Commercial Refrigeration Around the World

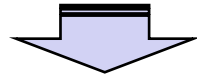
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INDEE: CO₂ supermarket cooling test-rig

Cooling Capacity
33 kW

AC Evaporator 20 kW
MT Evaporator 10 kW
LT Evaporator 3 kW

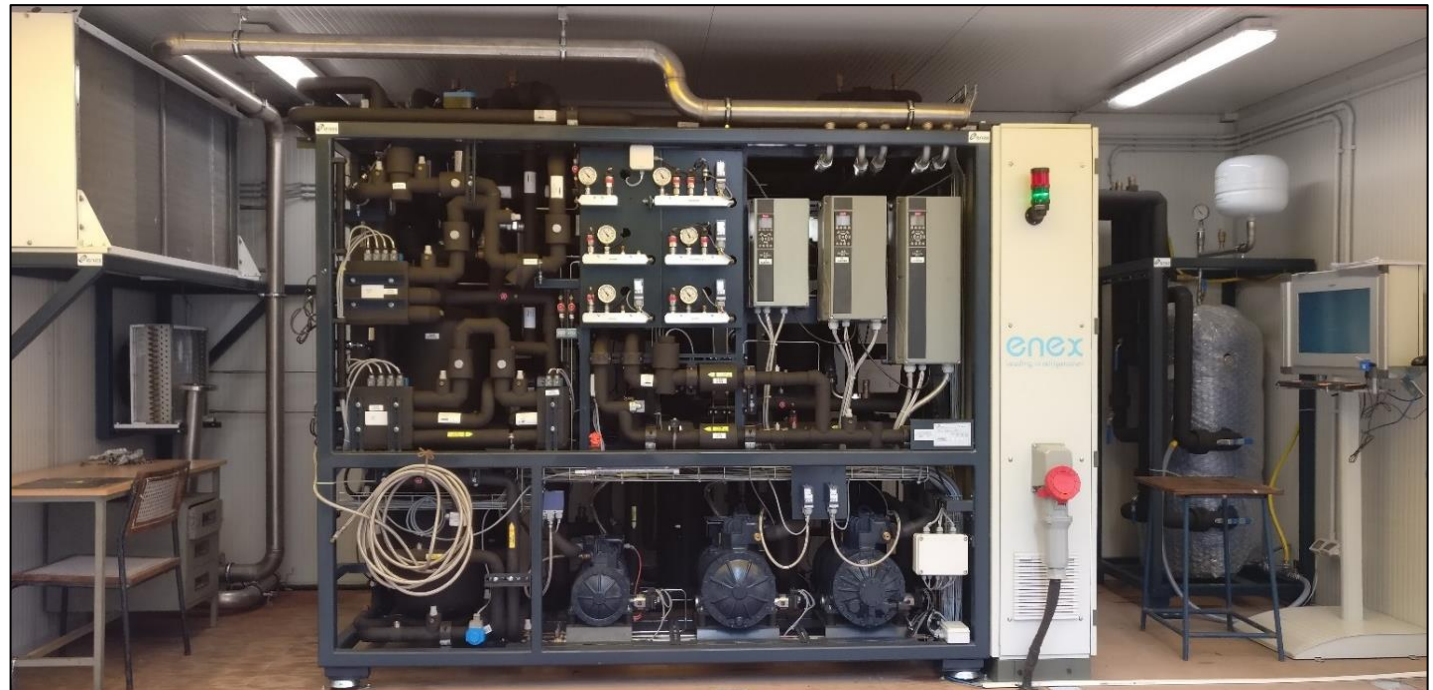
Ejectors:
High Ejection Ratio
Low Ejection Ratio
Liquid Ejector

Gas cooler (Air Cooled)

Heat Recovery

IHX

Sub cooler



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Akshay Patra Foundation

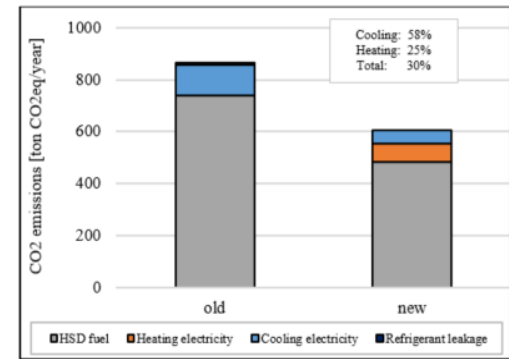
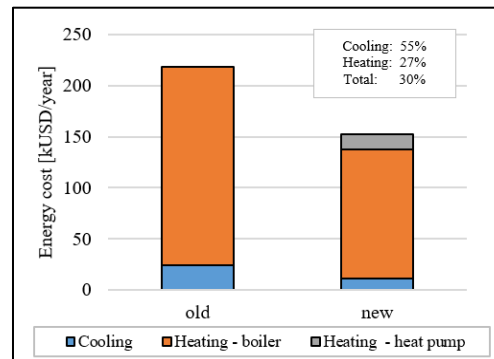
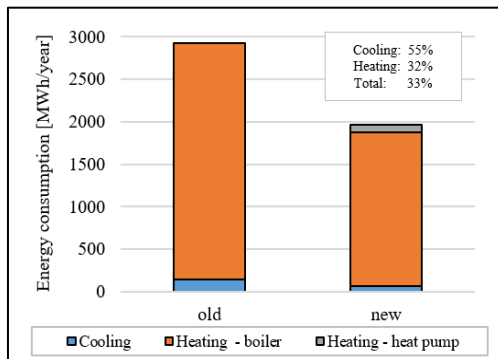
Mid-Day Meal Scheme in government schools and government-aided schools. Aims at countering **malnutrition** and **supporting the right to education** of socio-economically disadvantaged children.

- Each cauldron has a capacity to cook at least **500 litres of rice** and up to **3000 litres of dal**.
- The Bengaluru kitchen supplies mid-meals to **551 schools**, on **27 routes** covering a radius of **50 km**.



Internal view of Akshaya Patra's kitchen

Energy, Economical and Environmental Benefits with the Proposed R744 system



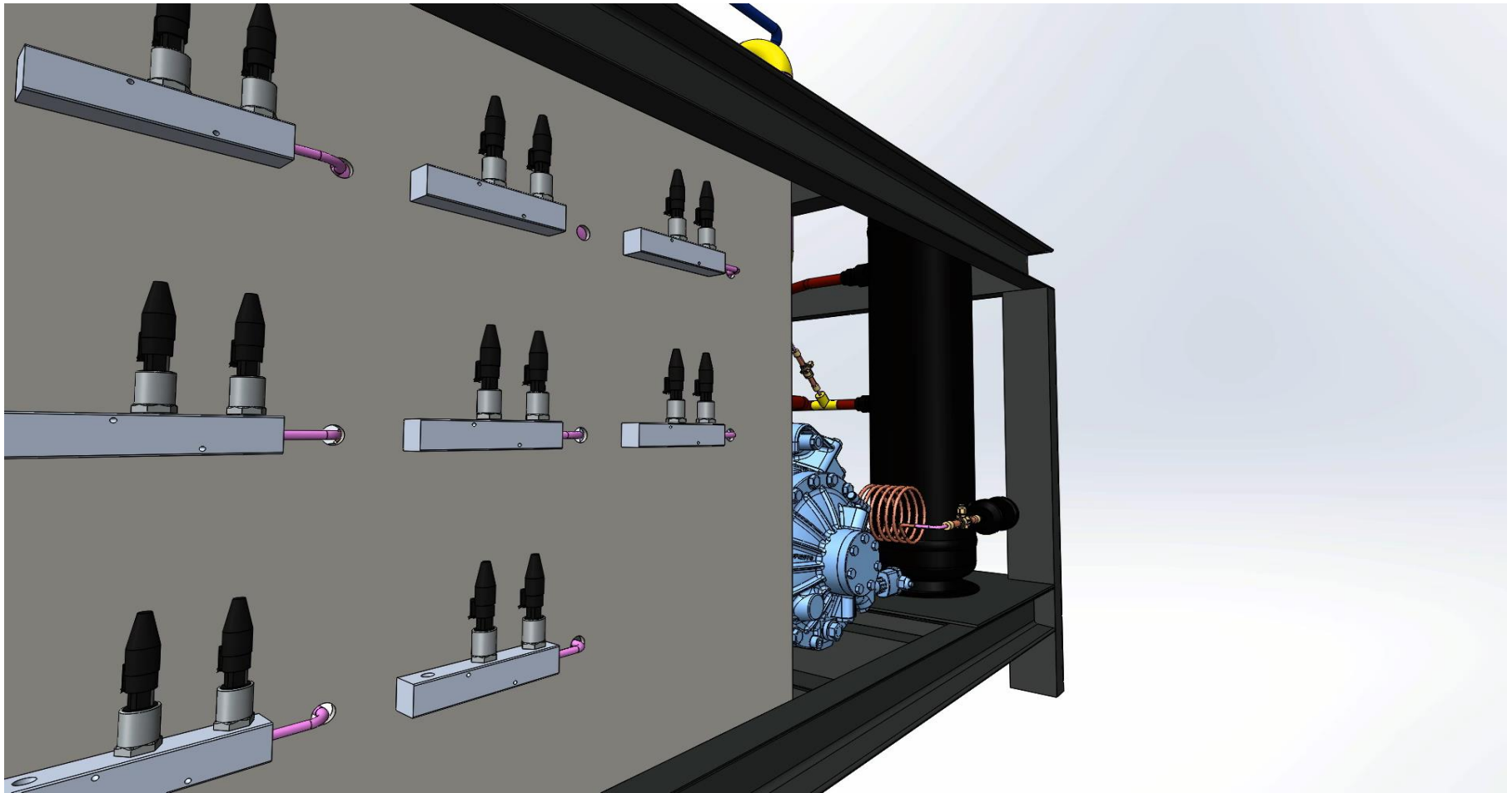
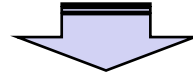
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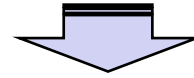
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Components Status

Heat Exchangers

Evaporators

Medium Temperature

Low Temperature

Receiver/Separator

Oil Separator



Compressor

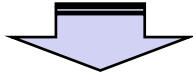
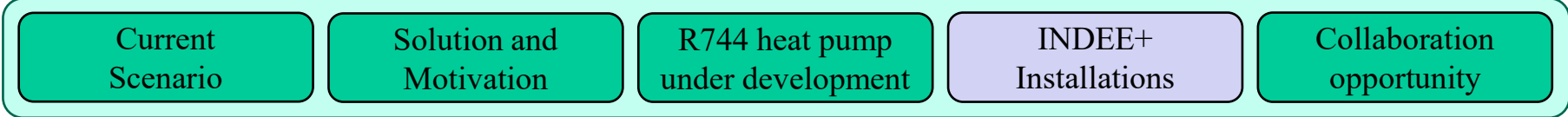


Sensors and Controls

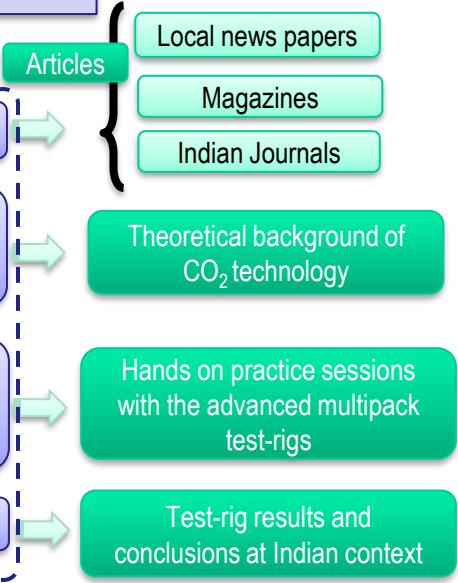
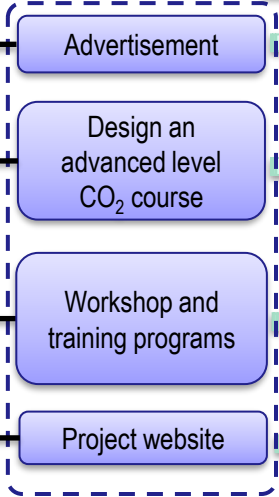
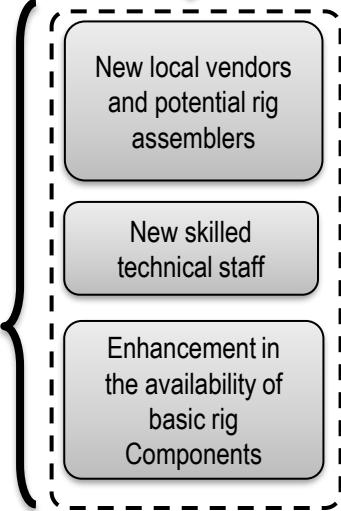
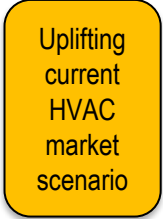
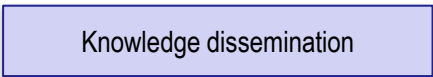
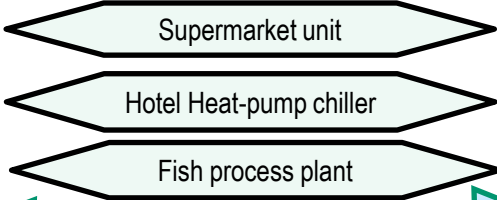


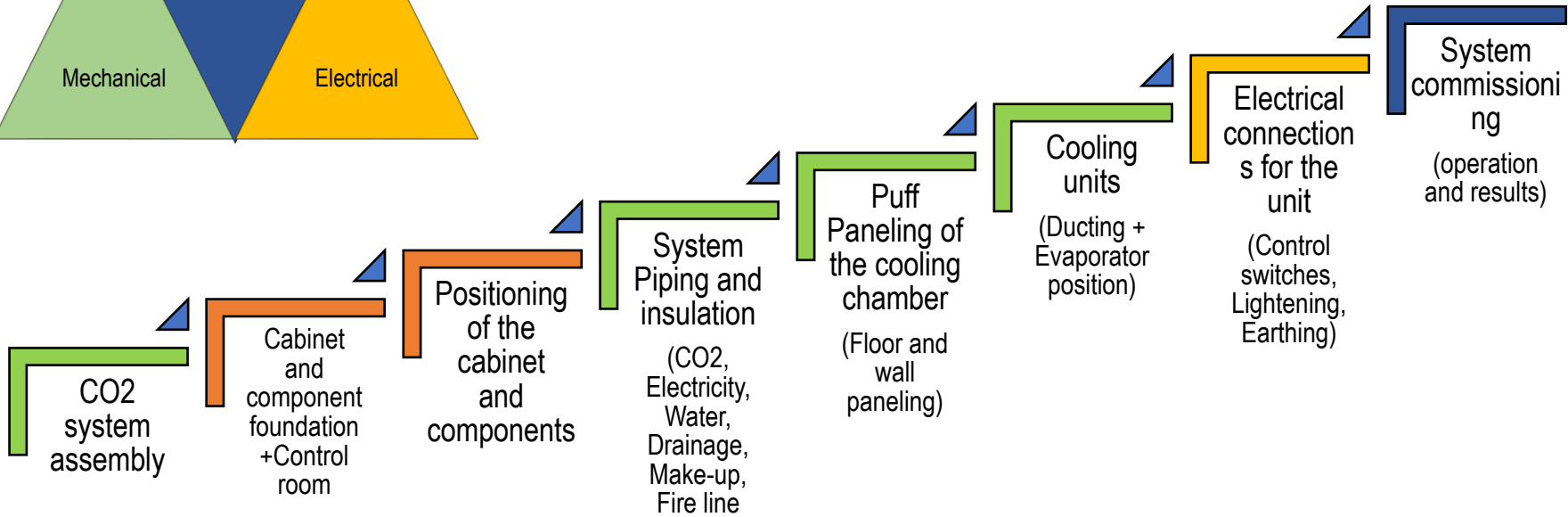
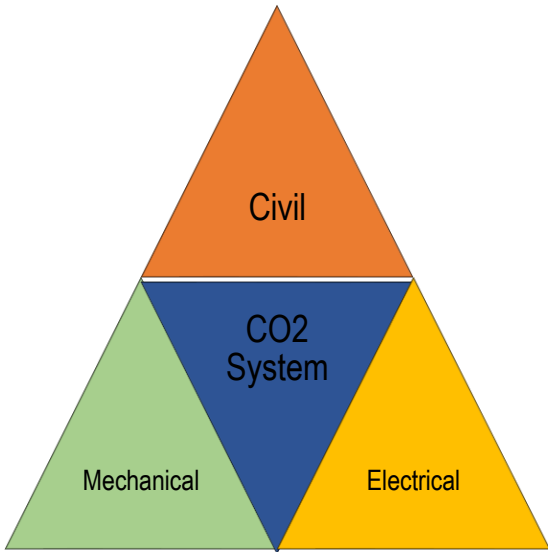
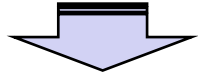
Assembly and Testing





Demo Sites





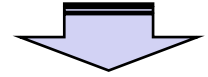
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Industrial Collaboration for INDEE+

3 Demo-sites



OFFICINE MARIO DORIN SINCE 1918
DORIN
INNOVATION



SUMMARY

- ✓ Replacing the HCFC air-conditioning units with the CO₂ heat pump offers more than 50% reduction in power consumption for the space cooling system and almost 60% reduction in GHG emissions.
- ✓ By implementing the heat pump for producing hot water to the cooking process reduces the kitchens total energy consumption (HSD fuel) of more than 30% and the CO₂ emissions with 25%. Steam boilers must still be applied for raising the water temperature to boiling point and keep it boiling during cooking.
- ✓ A CO₂ heat pump producing simultaneously hot and cold water is an extremely efficient way of supplying both heating and cooling needs, especially if they occur at the same time. However, by installing hot and cold-water storage tanks, the mismatch in both load and time can be balanced.
- ✓ Possible collaboration with Indian Industries to develop the three upcoming installation of the CO₂ cooling and heating units

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ACKNOWLEDGMENT