

HOW WE COOL INDOOR SPACES AND WHAT SUSTAINABLE ALTERNATIVES WE HAVE

What is space cooling?

It is defined as the amount of heat that needs to be removed from indoor air to cool the space and ensure the thermal comfort of the enclosed area's occupants.

Why is it important?

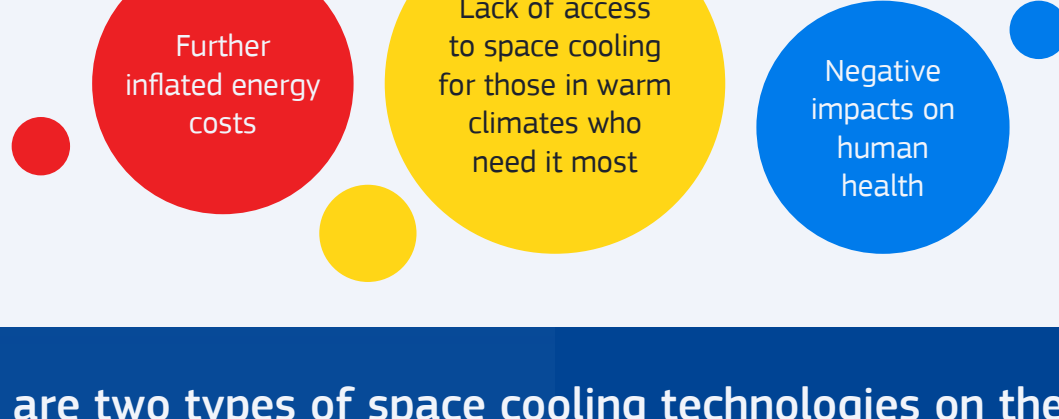
With summer heat waves rising in frequency and intensity, the energy consumption from space cooling is drastically increasing every year.



→ 2050

Global energy demand for space cooling is projected to triple by 2050 without action being taken.¹

We will face negative consequences if we do not address energy efficiency.



There are two types of space cooling technologies on the market

PASSIVE

Do not require use of mechanical or electrical devices.

Some examples

BLINDS



BUILDING INSULATION

combined with proper ventilation*



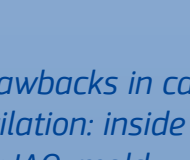
GREEN ROOFS/WALLS



WATER BODIES



WIND CATCHERS



* Drawbacks in case of lack of ventilation: inside overheating, poor IAQ, mold.

ACTIVE

Require external energy, e.g. air conditioning systems.

Solutions already on the market



VAPOUR COMPRESSION

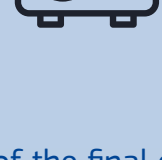


99%

EU market breakdown

1%

THERMALLY DRIVEN HEAT PUMPS



- Almost 99% of the final energy consumption for space cooling in the current European market is covered by vapour compression systems.
- Around 1% is covered by thermally driven heat pumps.²

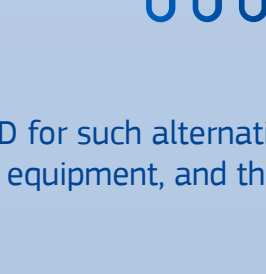
Are there alternative solutions?

Many less energy-intensive technologies have been conceived over the years, but they have not been developed to the point of being a viable competition.

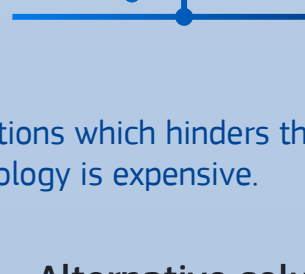
SOLAR COOLING SYSTEMS



REVERSIBLE GROUND SOURCE HEAT PUMPS



DISTRICT COOLING SYSTEMS



Moreover, there is lack of R&D for such alternative solutions which hinders the competitiveness of such equipment, and the technology is expensive.

Energy Input

Electrical

Mechanical

Acoustic

Magnetic

Chemical

Hydraulic

Thermal

Natural

Alternative solutions

- Thermoelectric
- Thermionic
- Thermotunnel
- Electrocaloric
- Electrochemical
- Pulse tube
- Ejector
- Vortex tube
- Stirling/Eric(c)son cycles
- Reverse Brayton
- Bernoulli cycle
- Elastomeric effect
- Critical flow cycle
- Membrane heat pump
- Thermoacoustic
- Magnetocaloric
- Dessicant
- Heat of reaction
- Potential energy use
- Transcritical thermal compression heat pump
- Natural convection
- Natural conduction
- Freeze/melt cycle
- Evaporative cooling
- Enthalpy recovery

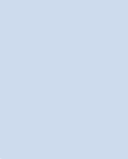
Source: ² <https://data.europa.eu/doi/10.2833/799633>

There are many challenges and opportunities in the cooling sector!

There are many possible alternatives to conventional solutions, but there is a lack of information regarding



potential cost



applicability

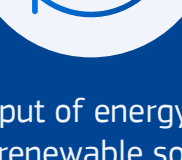


efficiency benefits

What should be done?



Alternative technologies should be developed and tested to make them more efficient and competitive on the market.

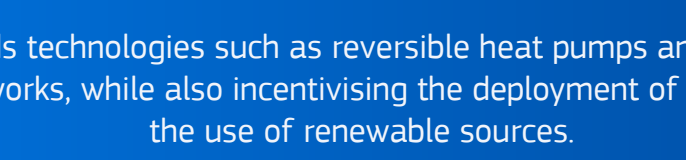


The input of energy from local renewable sources should increase, and renewable cooling equipment (e.g. solar cooling systems) should be boosted in buildings.



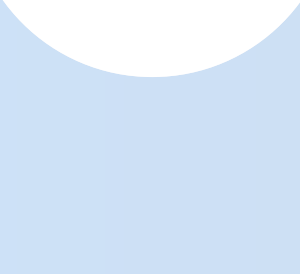
Incentives and subsidies for cooling should be enhanced at local, national level, and EU level.

In 2021 and for the first time in history, the European Commission established a methodology for calculating the quantity of renewable cooling and district cooling that can be counted towards EU renewable energy targets.³ The methodology set a threshold below which or above which cooling systems respectively cannot be or can be considered renewable.



This rewards technologies such as reversible heat pumps and free cooling by district cooling networks, while also incentivising the deployment of solar cooling and thereby the use of renewable sources.

Several EU funded projects are working in this context, to develop tools and raise awareness about the alternatives for space cooling technologies.

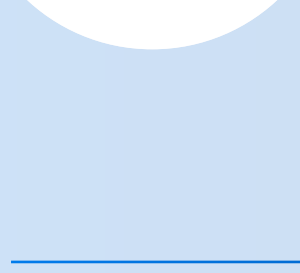
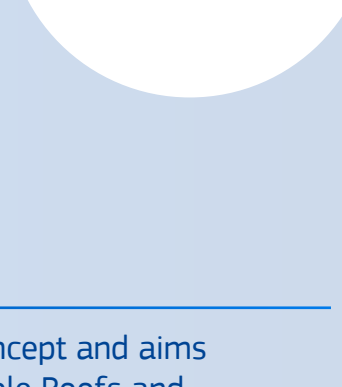


COOLLIFE

promotes innovative space cooling technologies and the use of available local renewable energy supply, developing open-source tools for decision-making, planning, design, and implementation processes.
> <https://coollife.revolve.media>

COOLING DOWN

aims to address the contribution of renewable cooling technologies such as geothermal and solar thermal sources.
> <https://gogeothermal.eu/projects/cooling-down-project>



LIFE SUPERHERO

promotes innovative building passive cooling concept and aims to diffuse the use of the Ventilated and Permeable Roofs and HEROTILE-based roof in existing and new buildings.
> <https://www.lifesuperhero.eu>

COOLTORISE

aims to reduce summer energy poverty incidence among European households, improving their indoor thermal habitability conditions and reducing their energy needs during the hot season.
> <https://cooltorise.eu>

