International Energy Agency

# Net Zero by 2050: opportunities for innovations in heating and cooling in buildings

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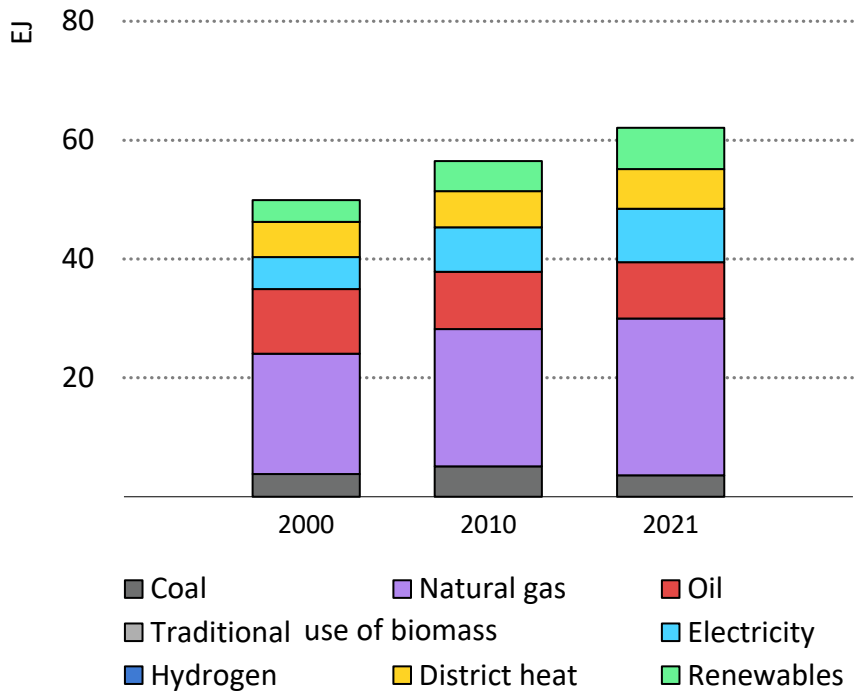
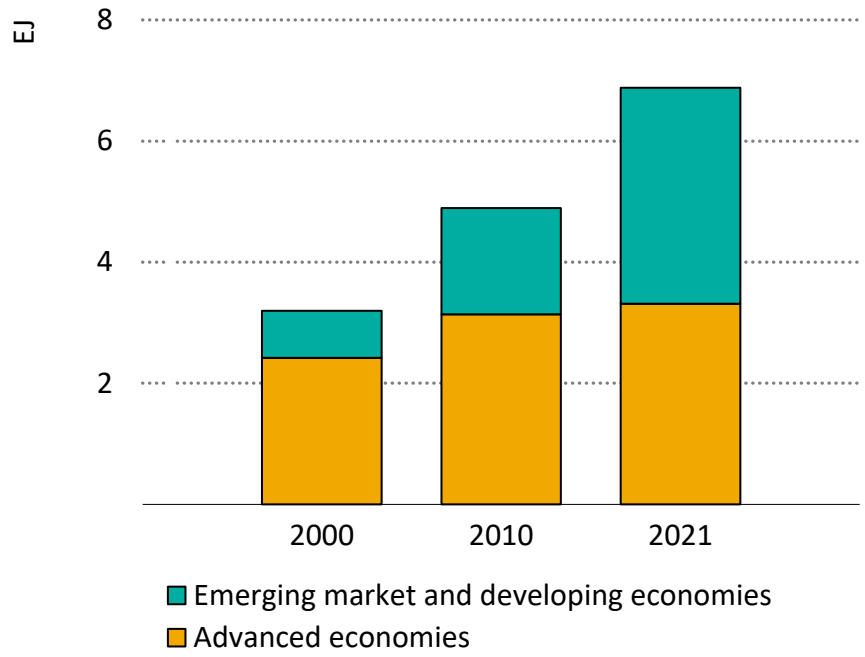
20th April 2023, 1:00-3:30 pm (CET), Climate Neutral Heating and Cooling: RD&D needs and perspectives for international collaboration

# Heating and cooling are facing different challenges

Heating consumptions by source, 2000-21




Space cooling consumptions, 2000-21



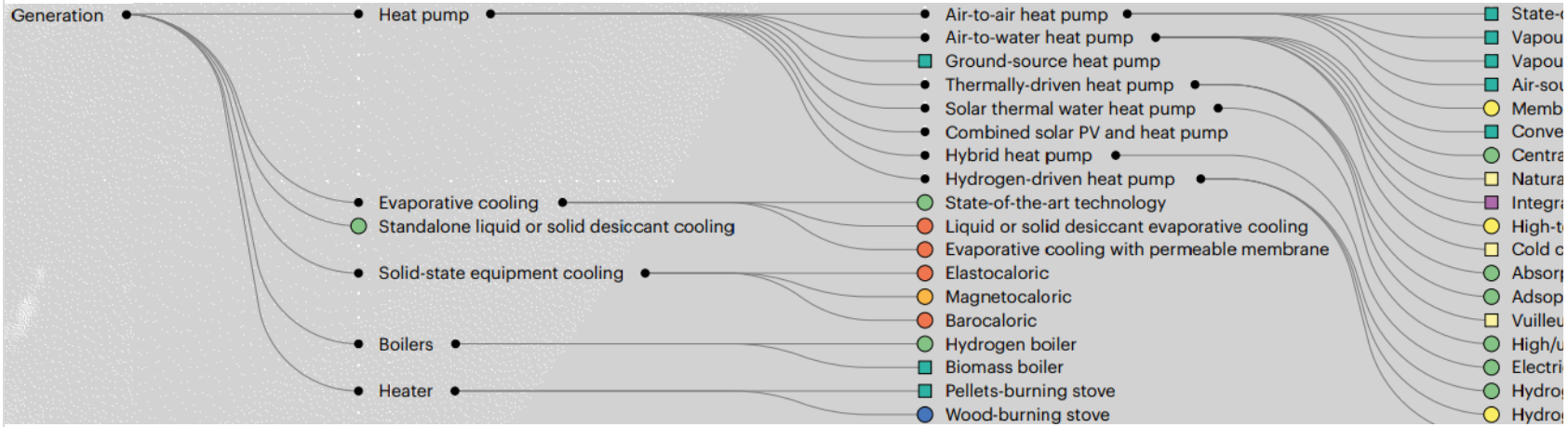

**Fossil fuels directly supply over 60% of heat in buildings and many existing buildings have low energy performances, while space cooling demand is rising quickly and many who needs it cannot afford it**

# There are common measures which benefit both heating and cooling

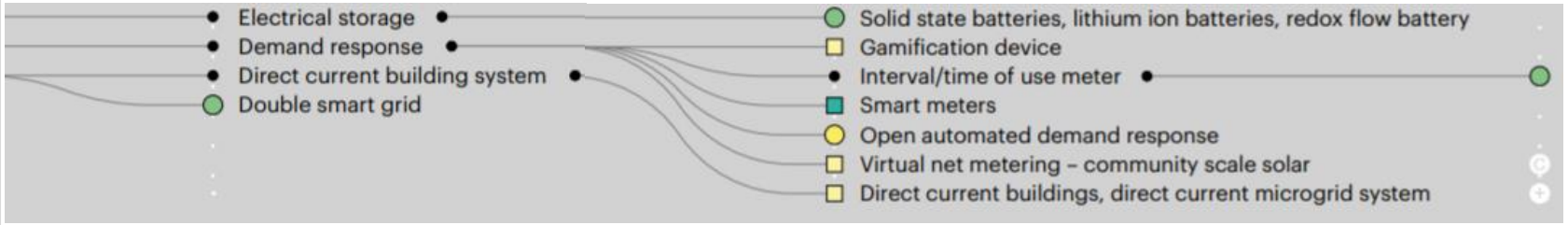

Net Zero by 2050 Scenario

# The ETP Clean Energy Technology Guide

## Heating and cooling generation in buildings




## Building integration technologies




## Technology Readiness Levels (TRLs)

**Concept**

1 — Initial idea
Basic principles have been defined

2 — Application formulated
Concept and application of solution have been formulated

3 — Concept needs validation
Solution needs to be prototyped and applied

**Small prototype**

4 — Early prototype
Prototype proven in test conditions

**Large prototype**

5 — Large prototype
Components proven in conditions to be deployed

6 — Full prototype at scale
Prototype proven at scale in conditions to be deployed

**Demonstration**

7 — Pre-commercial demonstration
Prototype working in expected conditions

8 — First of a kind commercial
Commercial demonstration, full-scale deployment in final conditions

**Early adoption**

9 — Commercial operation in relevant environment
Solution is commercially available, needs evolutionary improvement to stay competitive

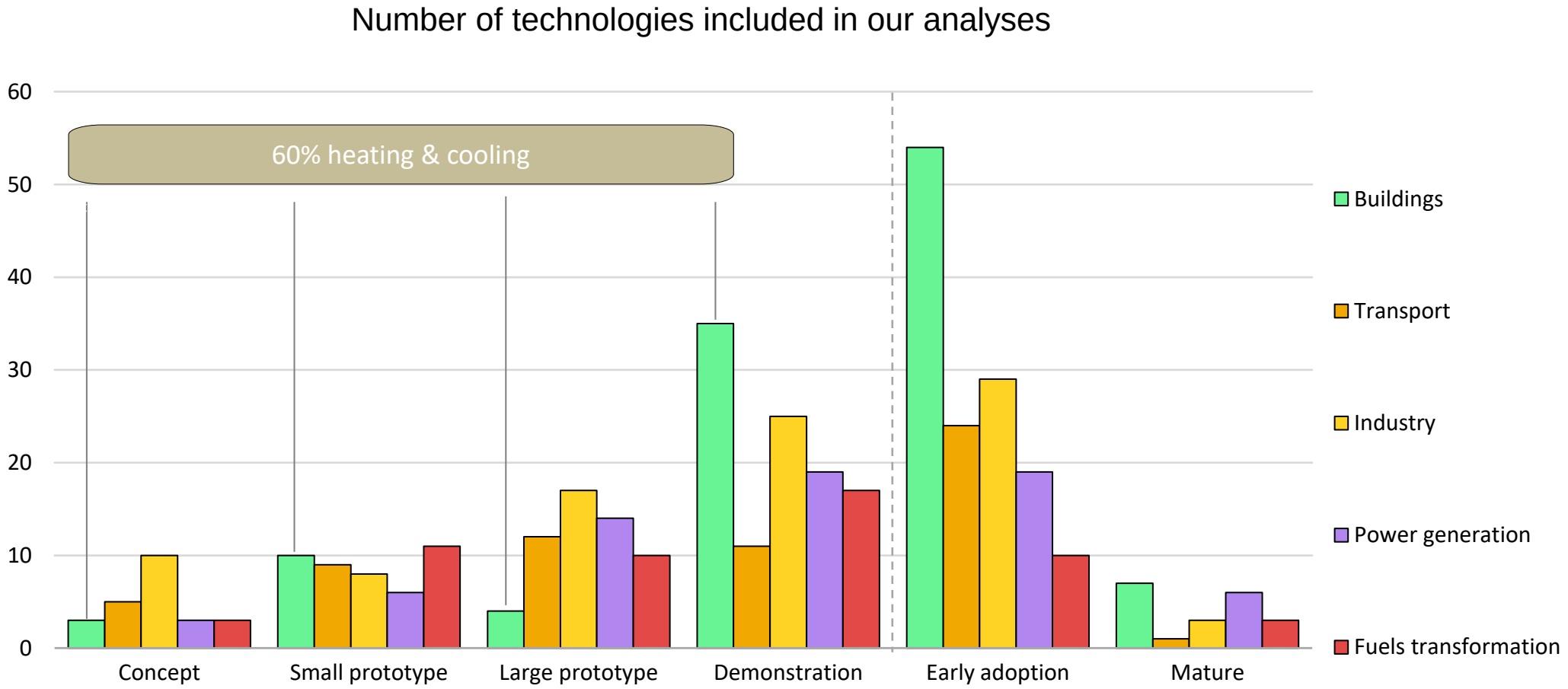
10 — Integration needed at scale
Solution is commercial and competitive but needs further integration efforts

**Mature**

11 — Proof of stability reached
Predictable growth

**Mapping technology portfolio and technology readiness level help understand where improvements in cost and performance are needed, and where cross-sectoral interaction are important**

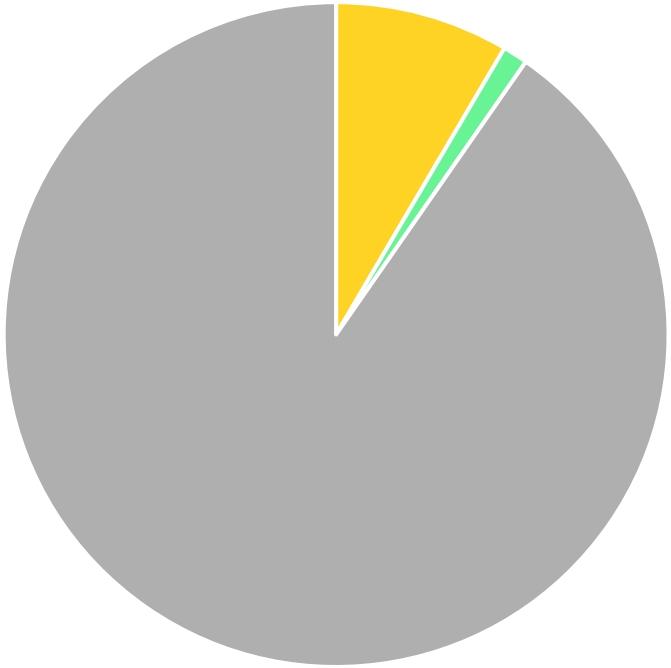
# Is innovation needed in buildings?




**Many of the technologies needed to decarbonize the buildings sector are already available, but innovation is needed to adapt products to hard-to-reach market segments and anticipate power sector and infrastructure needs**

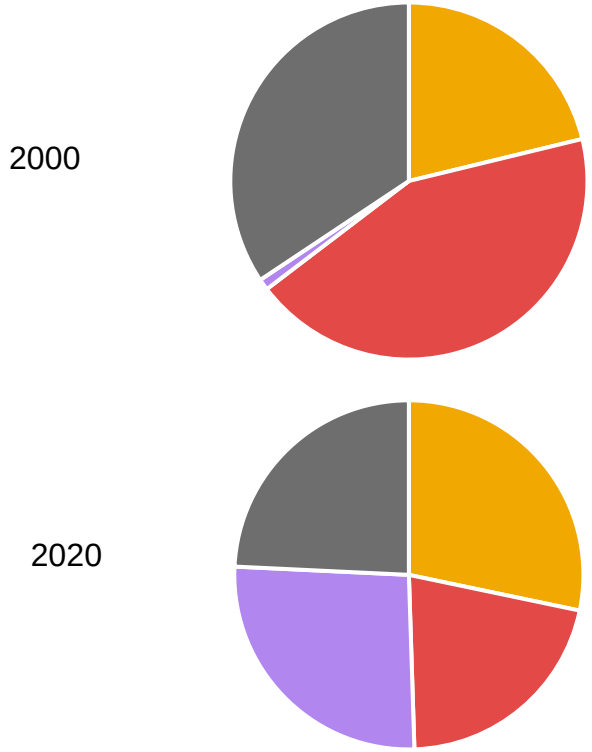
# Innovation trends: IEA Energy Technology Patents Data Explorer

Share of buildings in clean energy patents
2019-20



Buildings - energy efficiency
Buildings - renewables integration
Other clean energy

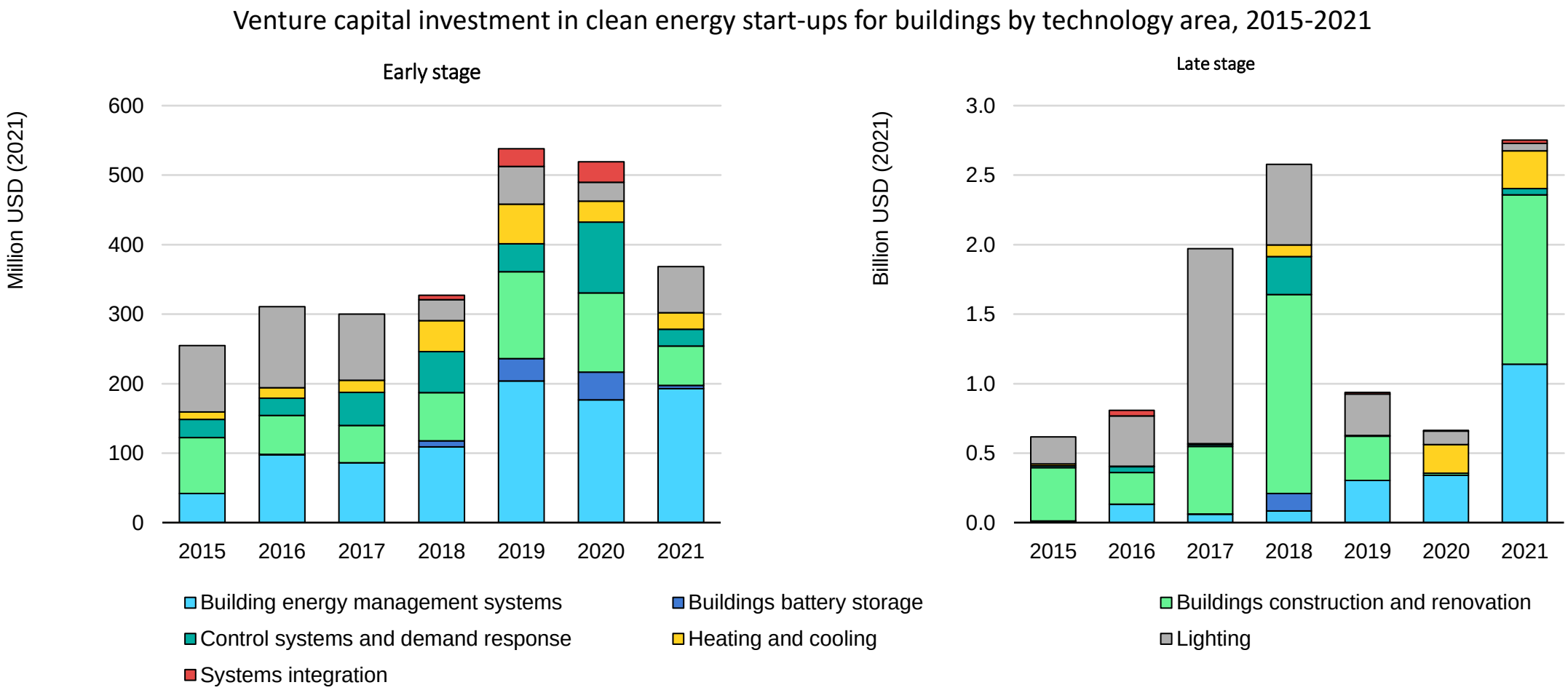
Share of buildings clean energy patents by region




North America
Europe
China
Other Asia

**Only around 10% of clean energy patents can be associated to buildings sector technologies. The share of China of buildings sector patents increased from 1% in 2000 to about 25% in recent years**

# Innovation trends: VC investment in clean energy start-ups




**Companies designing or developing building envelopes raised large amounts of growth capital, but much less activity was recorded in heating and cooling technologies.**

# The IEA Technology Collaboration Programme (TCP)

- More than 6 000 experts worldwide to advance the research, development and commercialisation of energy technologies
- Two products released in 2022/2023 by IEA TCPs related to buildings sector innovation
  - Joint IEA-TCPs report "Technology and Innovation Pathways for Zero-carbon-ready Buildings by 2030". Ongoing activities by TCPs, what's next and recommendations
  - 2022 Future Buildings Forum Think Tank Workshop. RD&D Activities needed to unlock technology deployment for decarbonizing existing buildings

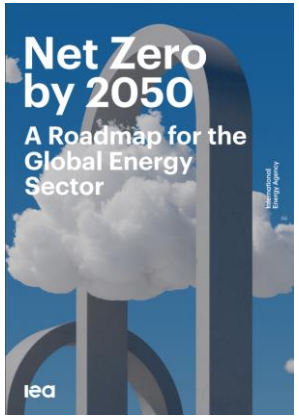

# Where is innovation needed in heating and cooling?

- Buildings are very diverse, designed and constructed one-by-one, and innovation is needed to make sure that ***all the technologies needed to achieve a zero-carbon-ready building stock get to the market***
- Innovation at the technology level is essential, in particular in 3 areas
    - Efficiency improvements in all climates and buildings types (e.g. heat pumps, PVs, alternative designs..)
    - Retrofits (e.g., deep retrofit or demolition, standardization..)
    - Flexibility and technology/vector coupling (e.g. predictive controls, integration with electricity generation.. )
- ***Innovation is not just about technologies***: design tools, guidelines, training, business models, and awareness campaigns…
- ***Innovation is not just energy and emissions***: acoustic, safety, space, heritage, circularity...
- ***International collaboration is critical to accelerate the innovation process*** (knowledge sharing, demonstration projects, support to identify priority areas..)

# IEA reference publications

## *Reference reports/tools*

[Net Zero by 2050](#)

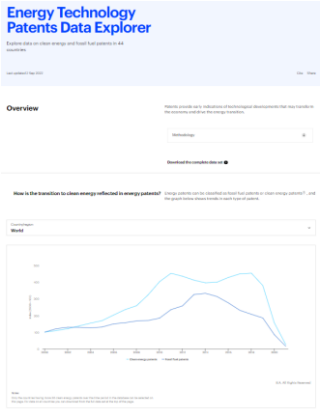



[Sustainable cooling](#)

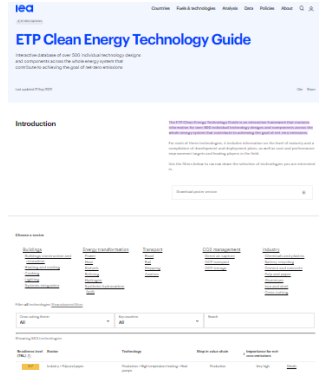

[Technology and Innovation Pathways for Zero-carbon-ready Buildings by 2030](#)


[The Future of Heat Pumps](#)


[Patents database](#)

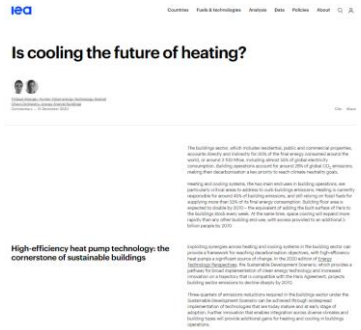



[ETP Clean Energy Technology Guide](#)




## *Articles and commentaries*

[Innovation needs](#) (heat pumps)




## *[Technology collaboration](#)*

[*New buildings*](#) [*Retrofits*](#) [*Heat pumps*](#) [*District heat*](#) [Storage & grid integration](#) [Solar thermal](#) [Behaviour](#)

Thank you for your attention