

Getting Europe off natural gas: Decarbonizing industrial heat

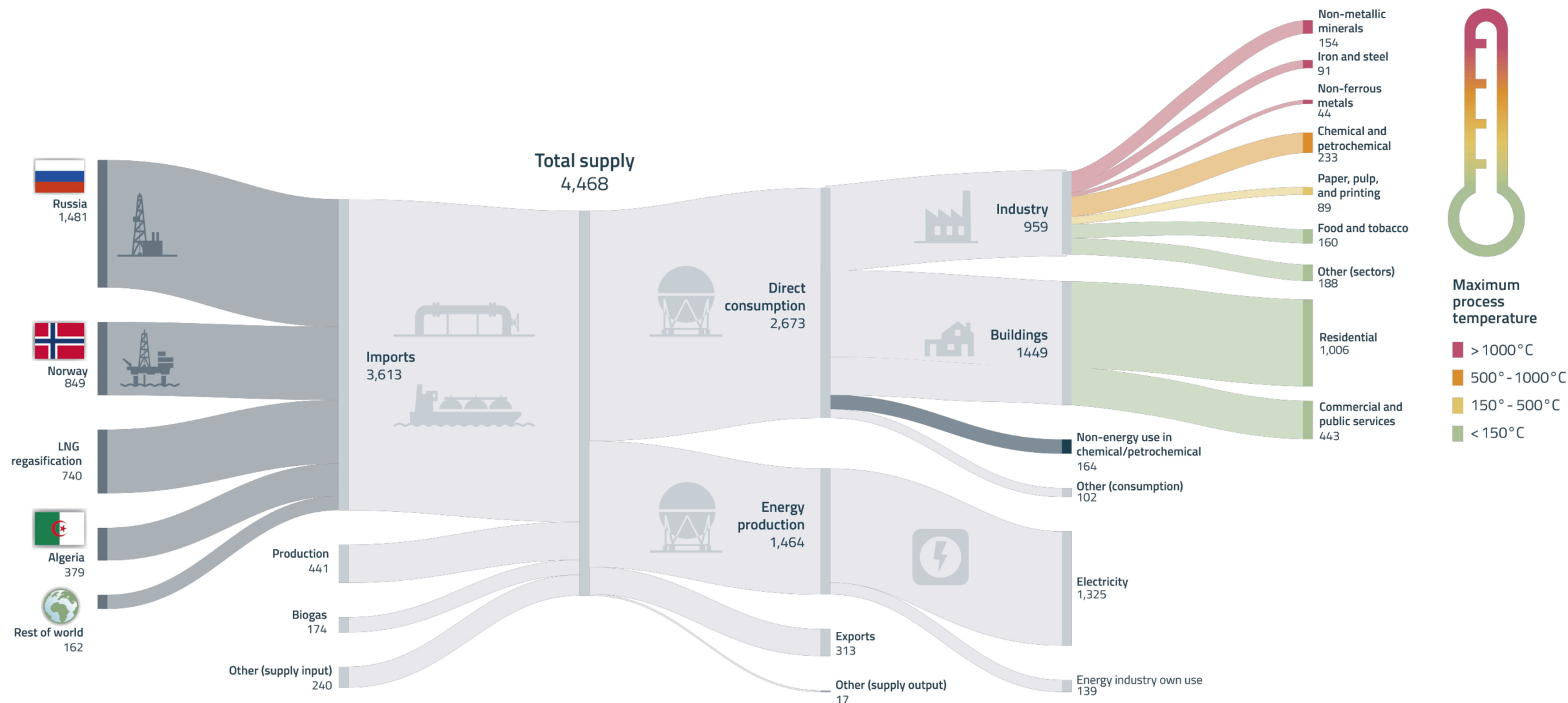
Responsible Leaders Hub
Munich Security Conference 2024

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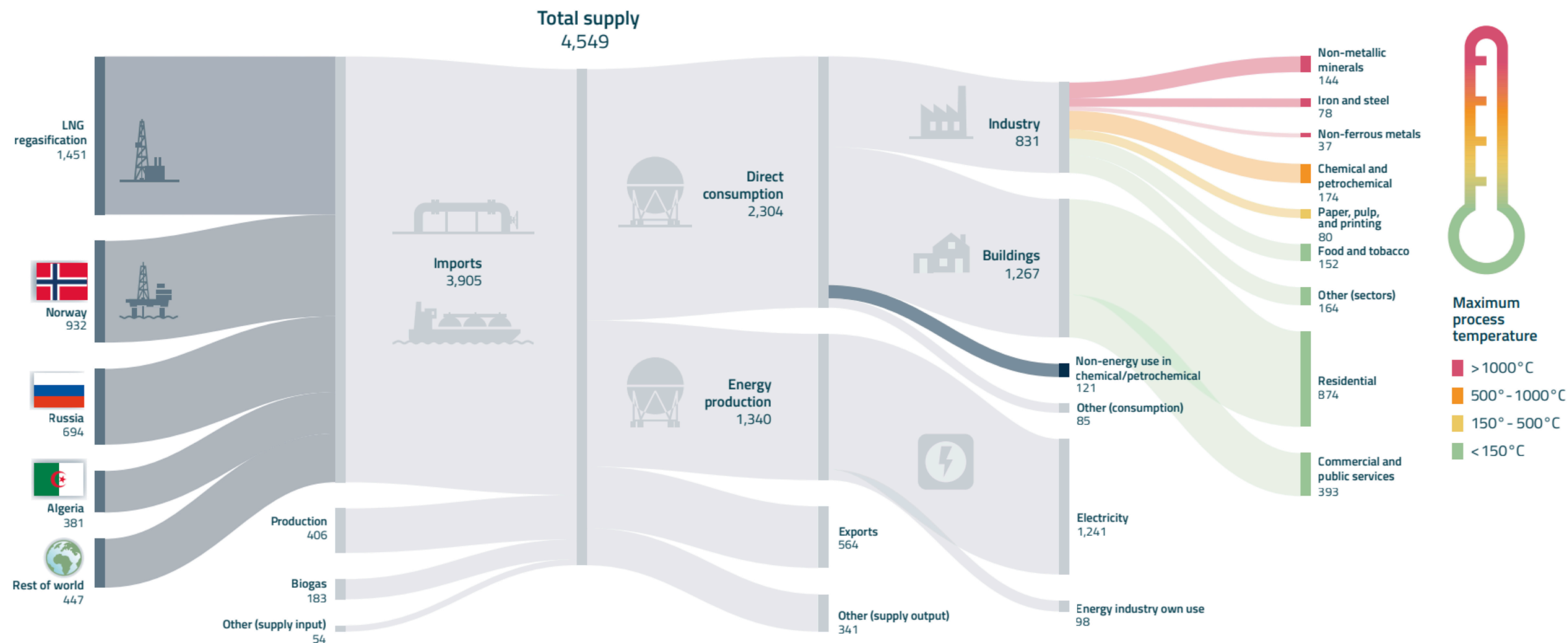
1. Natural gas flows in Europe
2. Technology pathways to decarbonize high-temperature heat
3. Key challenges
4. Key actions to accelerate development



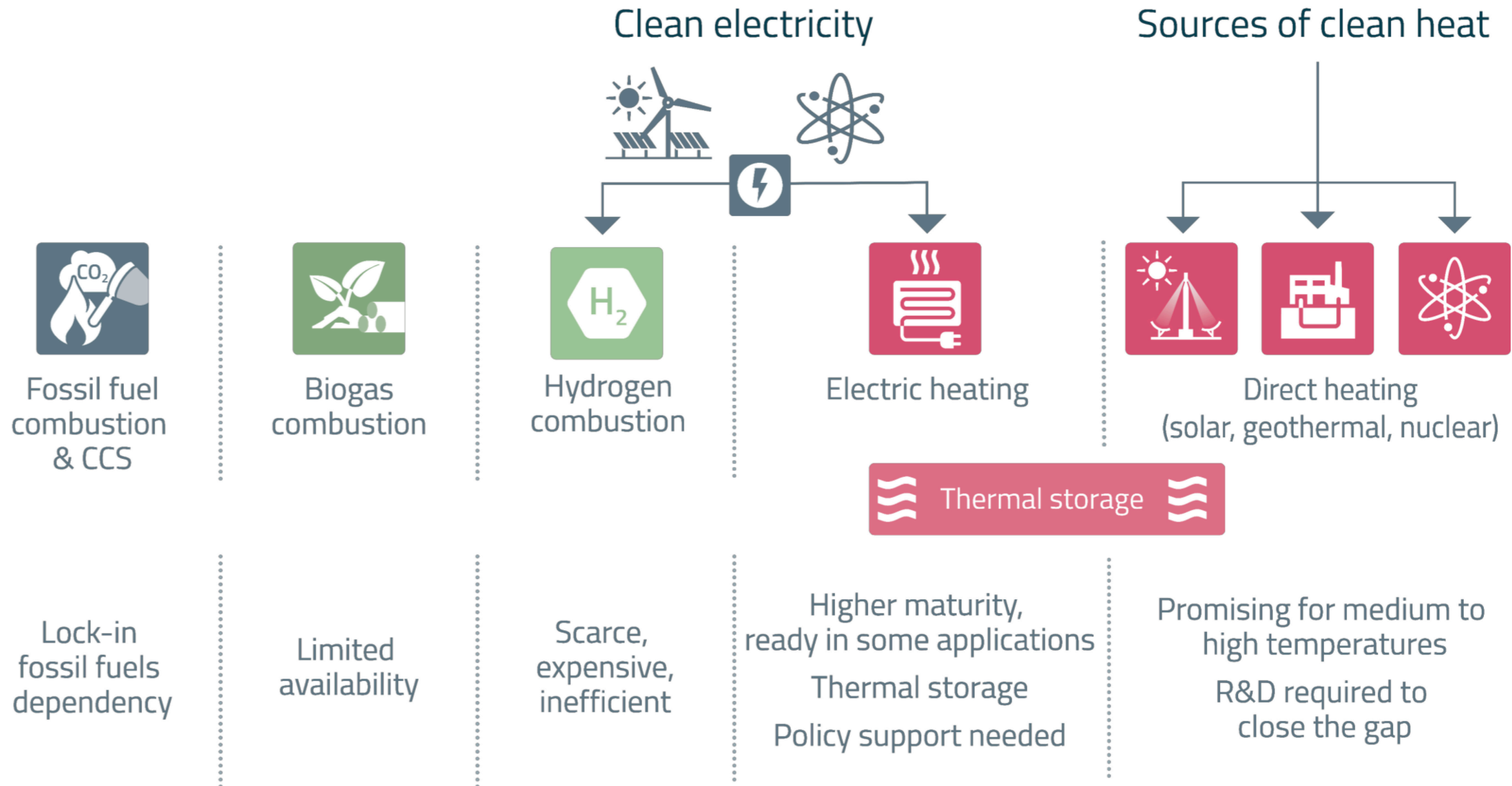
Natural gas flows in Europe, 2021



Natural gas flows in Europe, 2022



Pathways for low-carbon, high-temperature heat



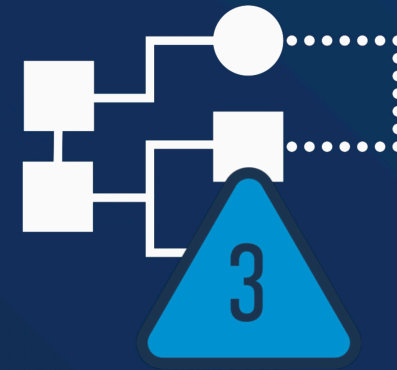
Key challenges for high-temperature heat



Physical & engineering factors
internal to the process



Economics



Infrastructure factors
external to the process

Physical challenges for high-temperature heat



- Very high temperatures to be reached
- High power density needed to deliver the heat
- High degree of customization required



Matching the high power density of current fossil sources is challenging

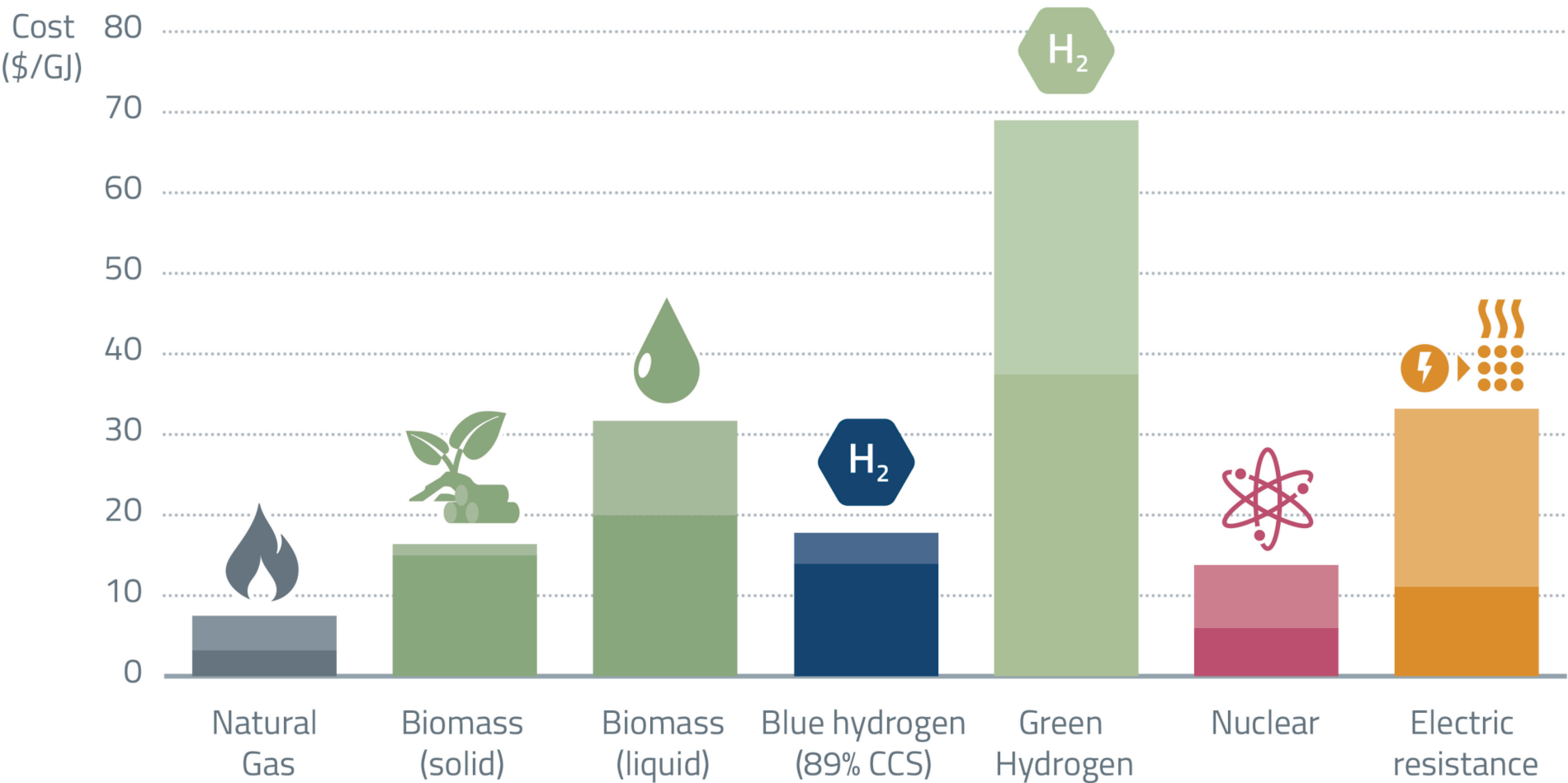
Economic challenges for high-temperature heat



- OPEX of electricity a key challenge (2-3x higher than NG)
- Energy efficiency merely a supportive measure
- Thermal storage could play an important role

➔ **Driving down the cost of clean electricity is key**

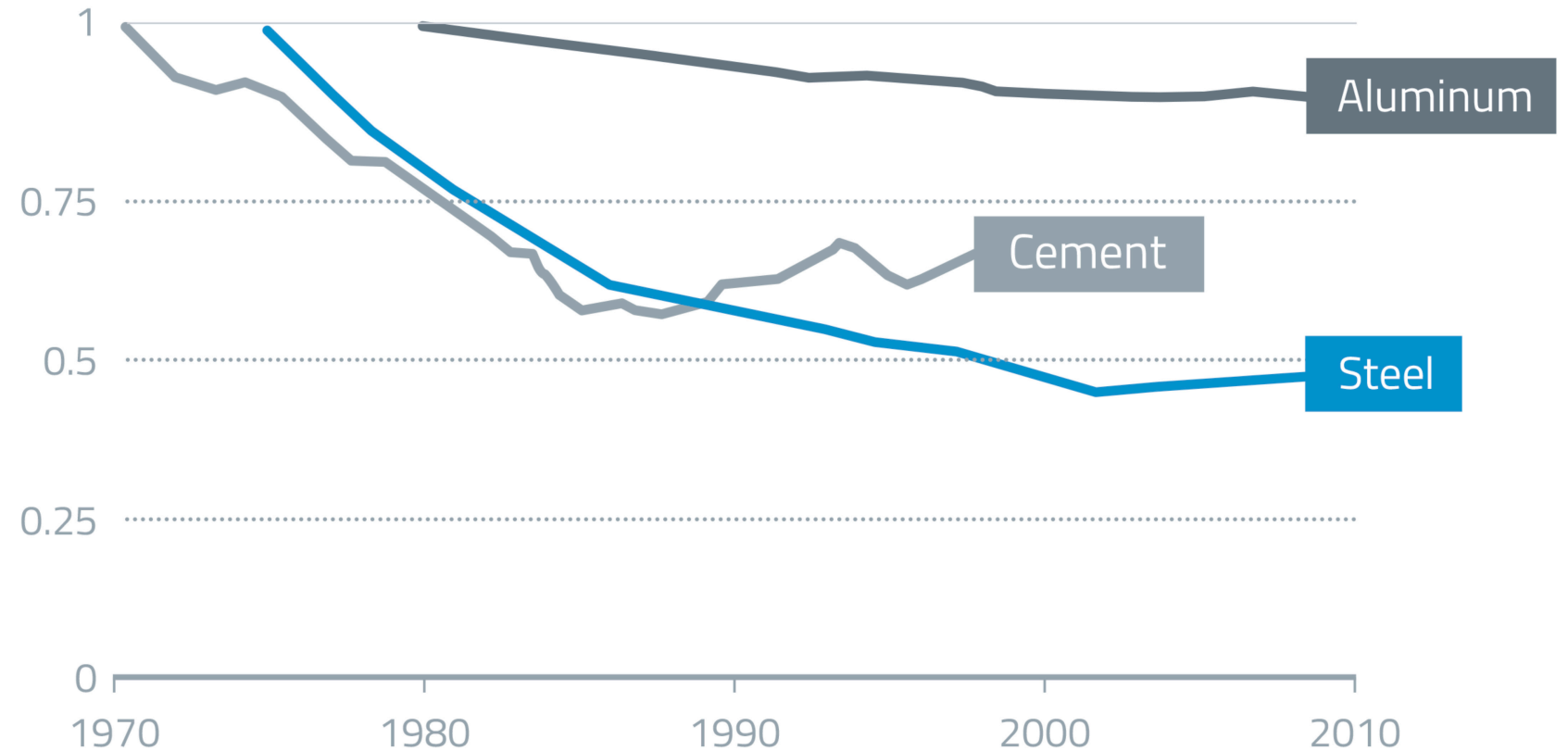
The cost of heat – natural gas is hard to beat



Energy efficiency: indispensable but insufficient

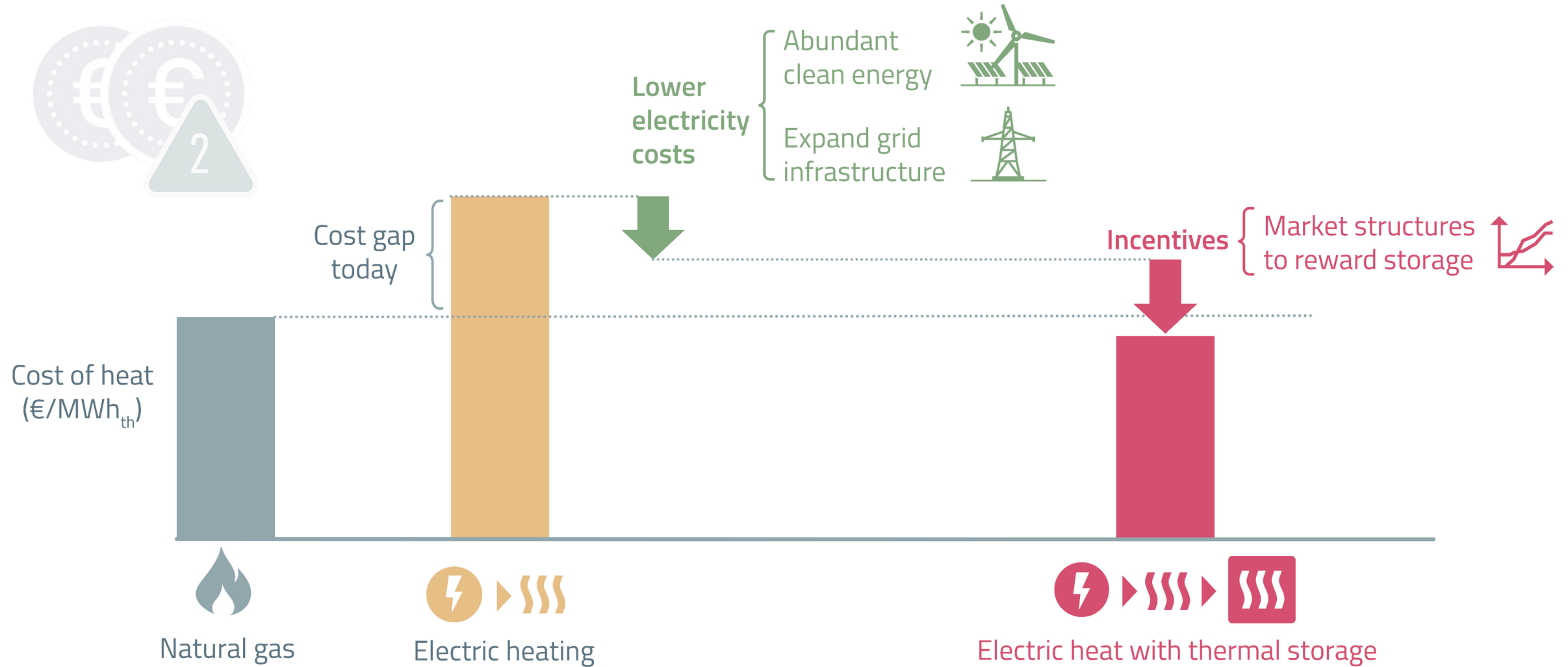


Energy intensity
(units relative to start of data)

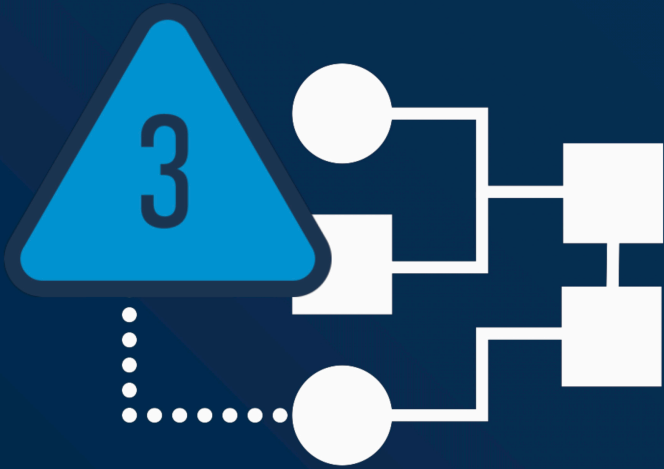


➡ **Material efficiency is the next frontier here**

Leveling the playing field against gas



Infrastructure challenges for high-temperature heat



- Security of supply
- Grid availability
- Intermittency
- Policy & market uncertainty plus a low appetite for risk

➔ ***Reliable access to clean electricity is key***

Call to action



Invest in R&D on direct heat pathways to close the remaining gap



Expand grid and access to cheap, clean electricity



Encourage the development of thermal storage

Clean electricity costs and availability are key to transition away from fossil molecules

Full report released in May 2024
in the #city of innovators



Remscheid, May 28 – 29, 2024

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