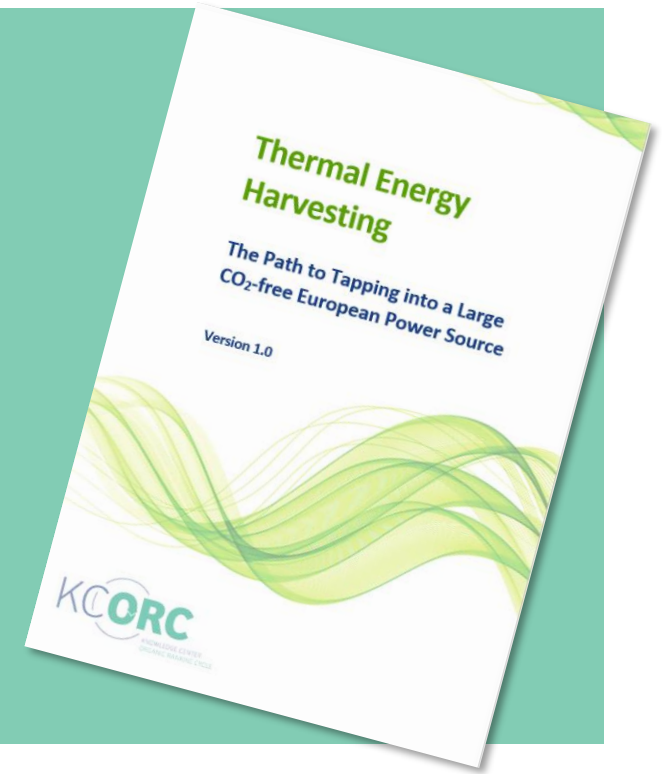


# THERMAL ENERGY HARVESTING

THE PATH TO TAPPING INTO A LARGE  
CO<sub>2</sub>-FREE EUROPEAN POWER SOURCE



*Prof. David Sánchez*

KCORC member and advisor to the KCORC Board

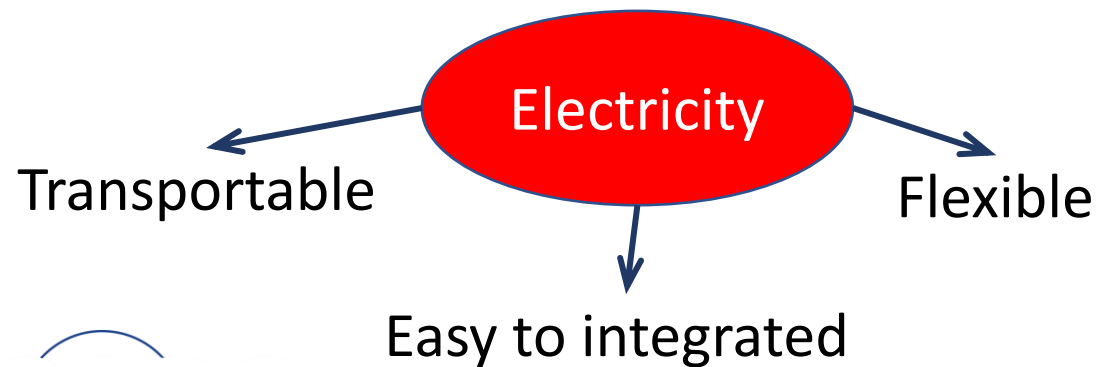
European Turbine Network: Annual Workshop 2022 – Berlin  
12,13 October 2022



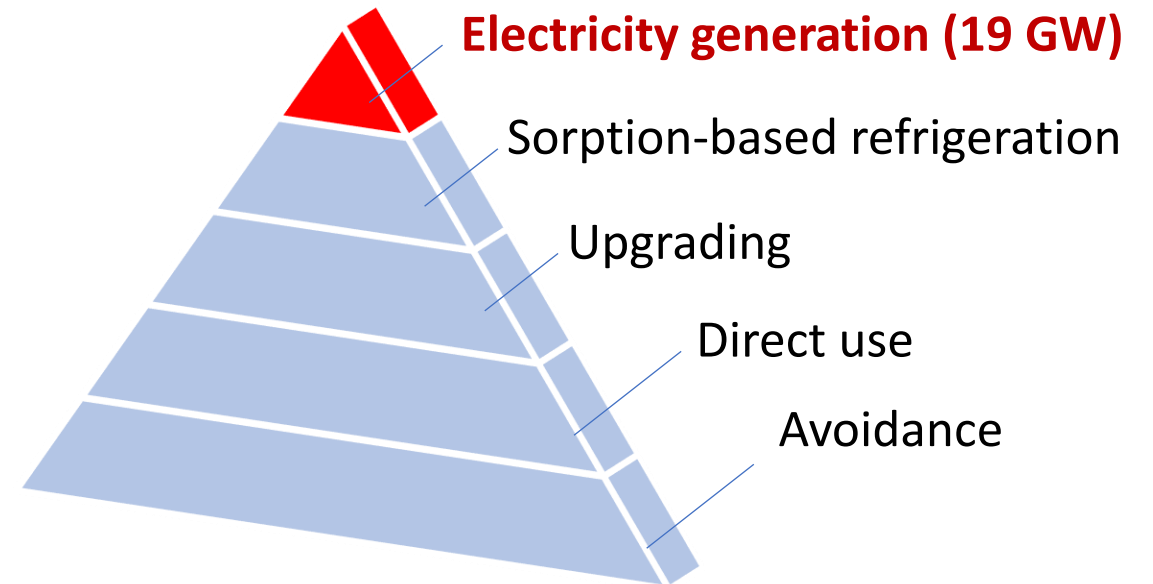
# Waste Heat

## Sources:

- (Petro) chemical processes
- Materials production (metal, cement, glass...)
- Electricity & mechanical drive
- Incinerators (waste, fuel residues or biomass)



## Utilization opportunities



# Waste Heat Recovery Potential in Europe

Temperature level	Theoretical Potential	Technical Potential	Installable Capacity
Total	882 TWh <sub>th</sub>	150 TWh <sub>el</sub>	18.8 GW <sub>el</sub>

Stationary (industry)

VERY  
cautious



**x 19**

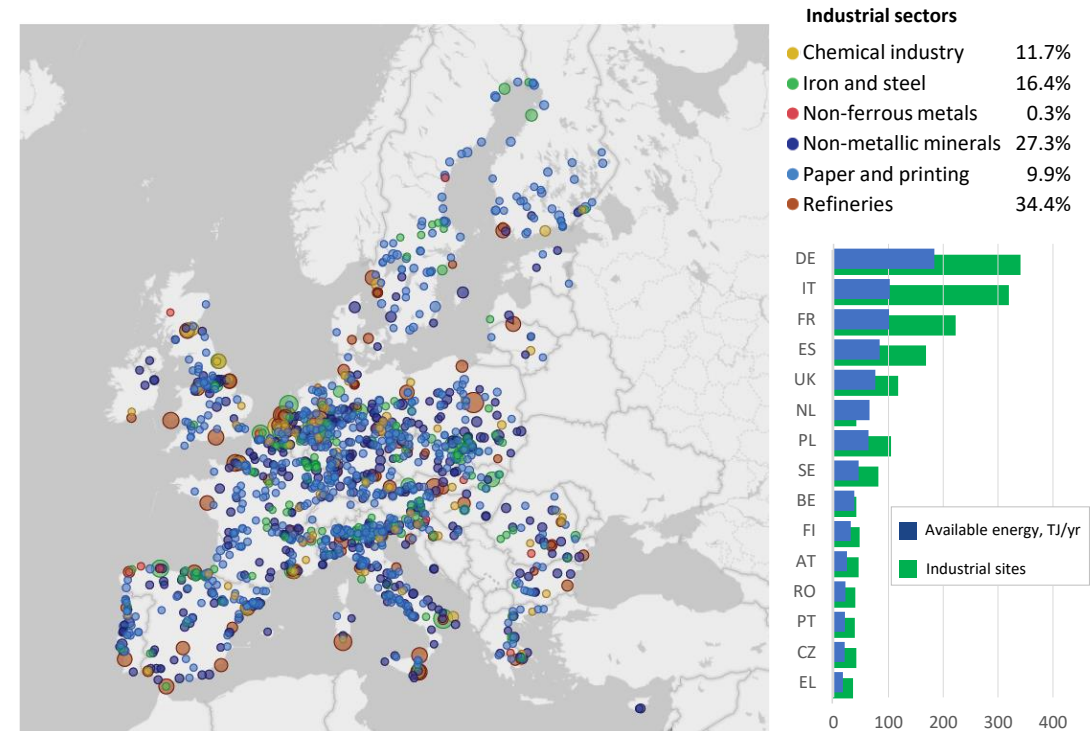
Mobile: trucks, ships, trains, even aircraft → **HUGE**

Further R&D needed, but, e.g., trucks already on the road...

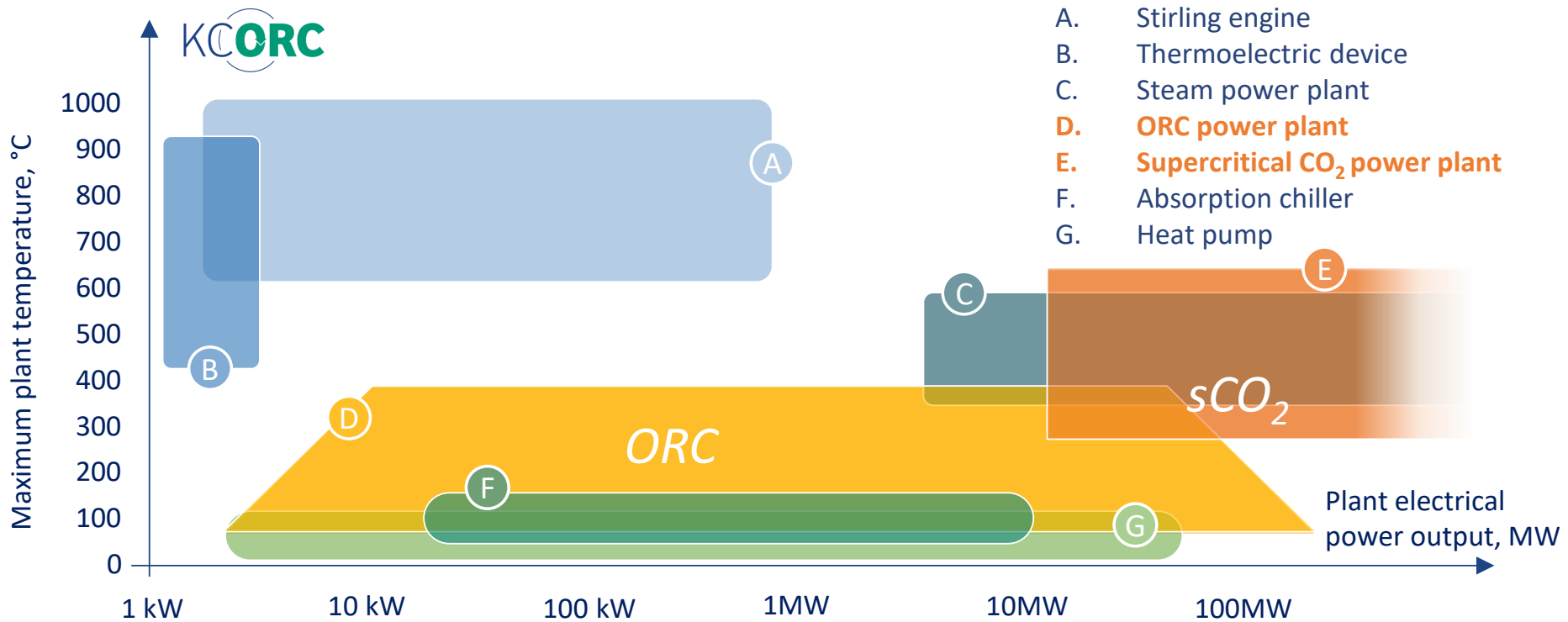
**ALSO WITH H<sub>2</sub> (or other CO<sub>2</sub>-neutral) fuel!!!**

# WHR Market

- Global sales (WHR equipment) \$65B/year
- CAGR 6.9%
- Europe's share 38%
- Europe's potential (WH2P) → 150 TWh (18.8 GW)
- Needed: 45 000 jobs in ten years



# ORC Systems – Efficient, Flexible, Scalable



**ALL main and emerging companies are in EU**

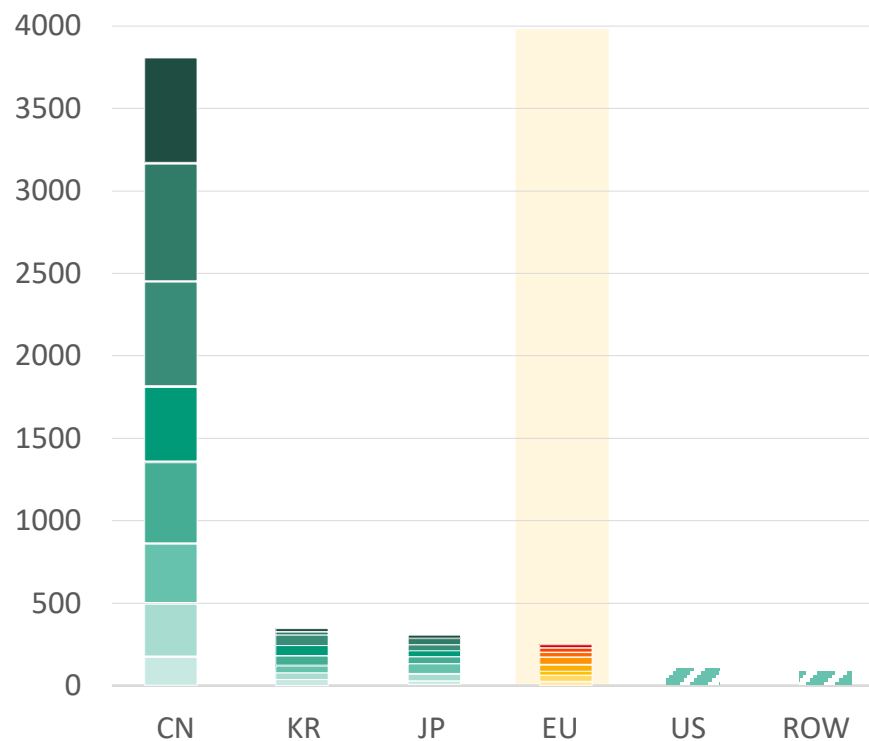
# Regulatory Framework

- WH2P technologies under- or not considered (RED3) → proposal
- EED2:
  - Harmonize efficiencies to calculate separate production of heat and power
  - WH2P incentives are fragmented within EU → EU-level needed
- ETS: WH2P must be eligible (electricity produced without additional CO<sub>2</sub> emissions)
- EU Taxonomy: WH2P missing and must be added
- ...

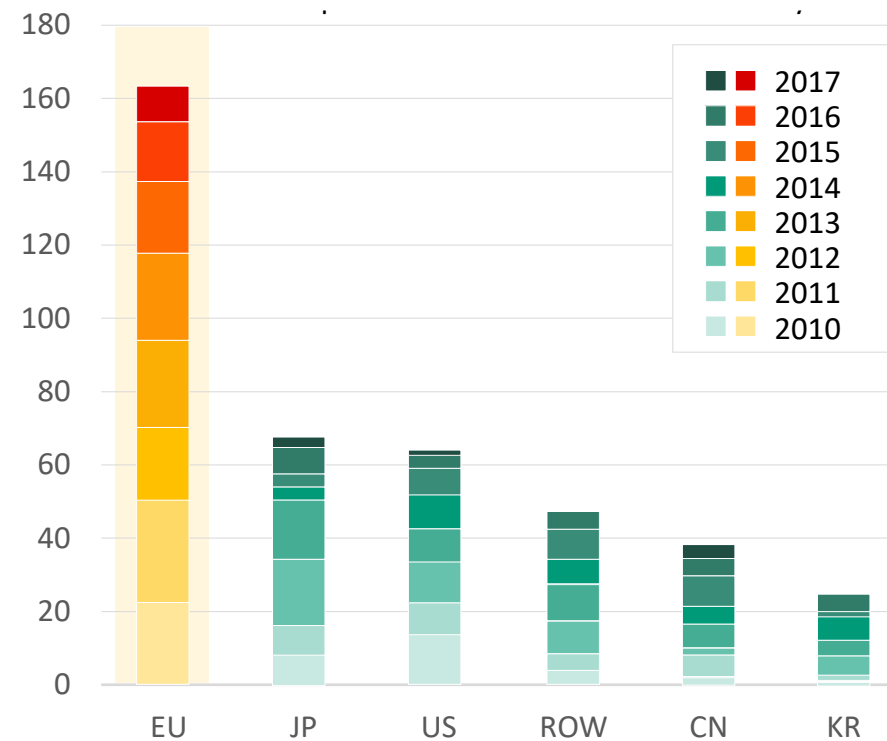
# R&D Support – EU Leadership

Valuable patents!

Patents per country & year  
(overall)

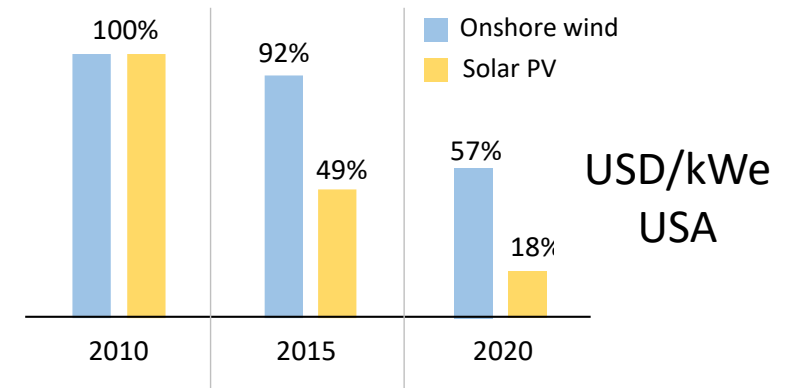
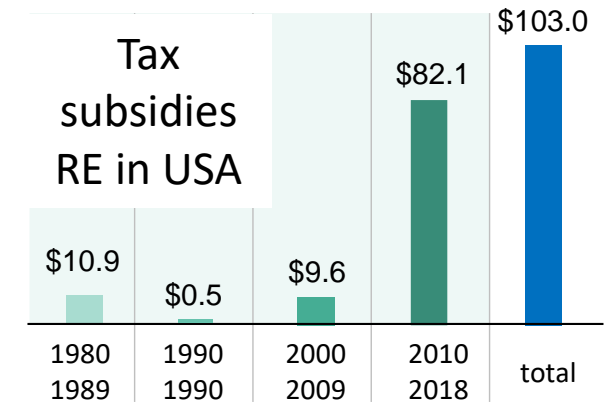


Patents per country and year  
(>2 countries)



# Weak support & R&D Funding

- Horizon Europe:
  - ~30M€ for stationary waste heat to power
  - ~20M€ for mobile waste heat to power
- Specific platform needed: ETIPoRc
  - Concerted effort
  - Gather stakeholders along supply chain





Industry must be instrumental to transform the EU into a “*modern, resource-efficient and competitive economy with an economic growth decoupled from resource use and aiming at zero net emissions of greenhouse gases by 2050*” (CETTIR)

- **WH2P** technologies are a **MUST**
- Critical enabling steps:
  - ✓ Appropriate regulatory framework
  - ✓ Appropriate R&D support
- Two main actions:
  - ✓ European Technology & Innovation Platform on organic Rankine cycle – ETIPoRc
  - ✓ New Joint Programme within EERA, ORC-specific

Available at [www.kcorc.org](http://www.kcorc.org)

