



# Advanced solar thermal technologies to address the challenges of Indian markets

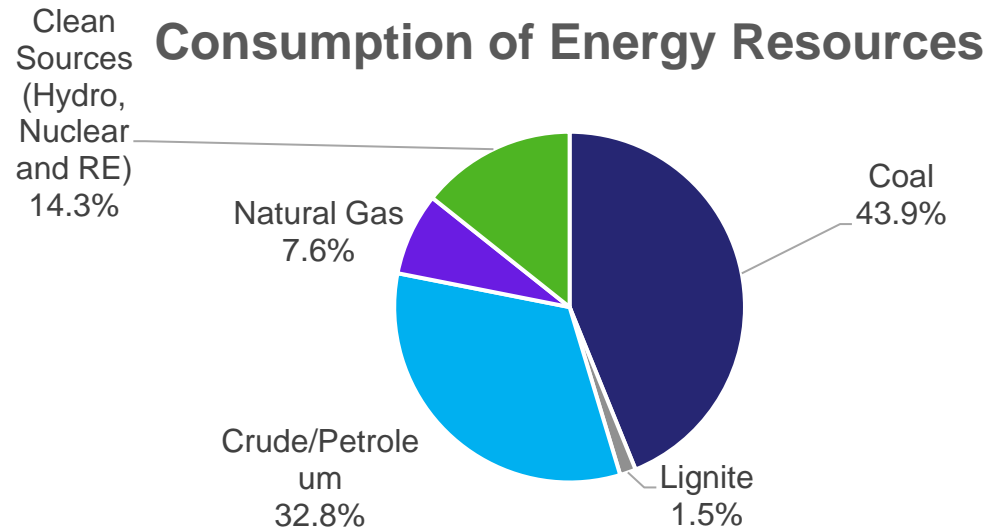
Delegation of The European Union to India

Draft

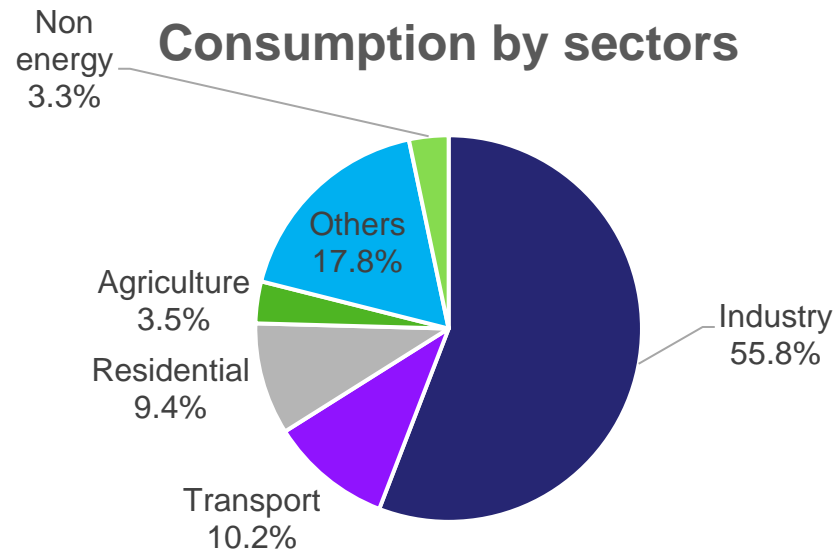


# Energy consumption in India and relevance of solar thermal

India is one of the largest consumers of Energy and the consumption stood at 32,514 PJ in 2019-20



Industrial sector is largest consumer of energy in India using more than half, i.e., 55.85% of the total energy consumption.



Key Industrial sectors

Textile

Automotive and other Transport

Food Processing

Breweries

Chemical

Dairy

Pulp and Paper

Iron and Steel

Petroleum refineries

Pharmaceuticals

Rubber

Cement

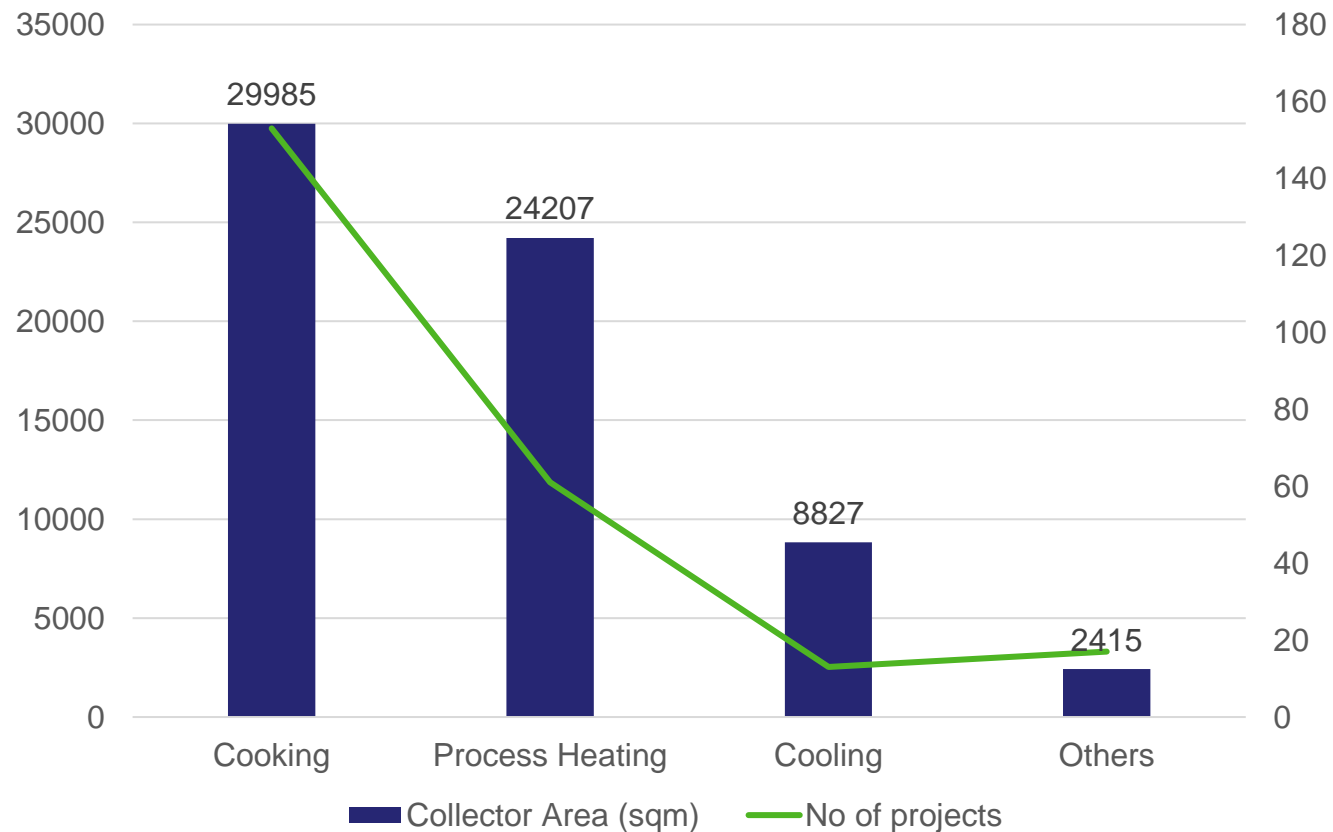
➤ Solar thermal finds application in residential areas, hospitals, commercial establishments (hotels, shopping malls, restaurants) and industrial processes, which require less than 100 °C of temperature.

➤ In Industries, the systems are used for drying, cleaning, cooking, evaporation, space heating/cooling and process heating

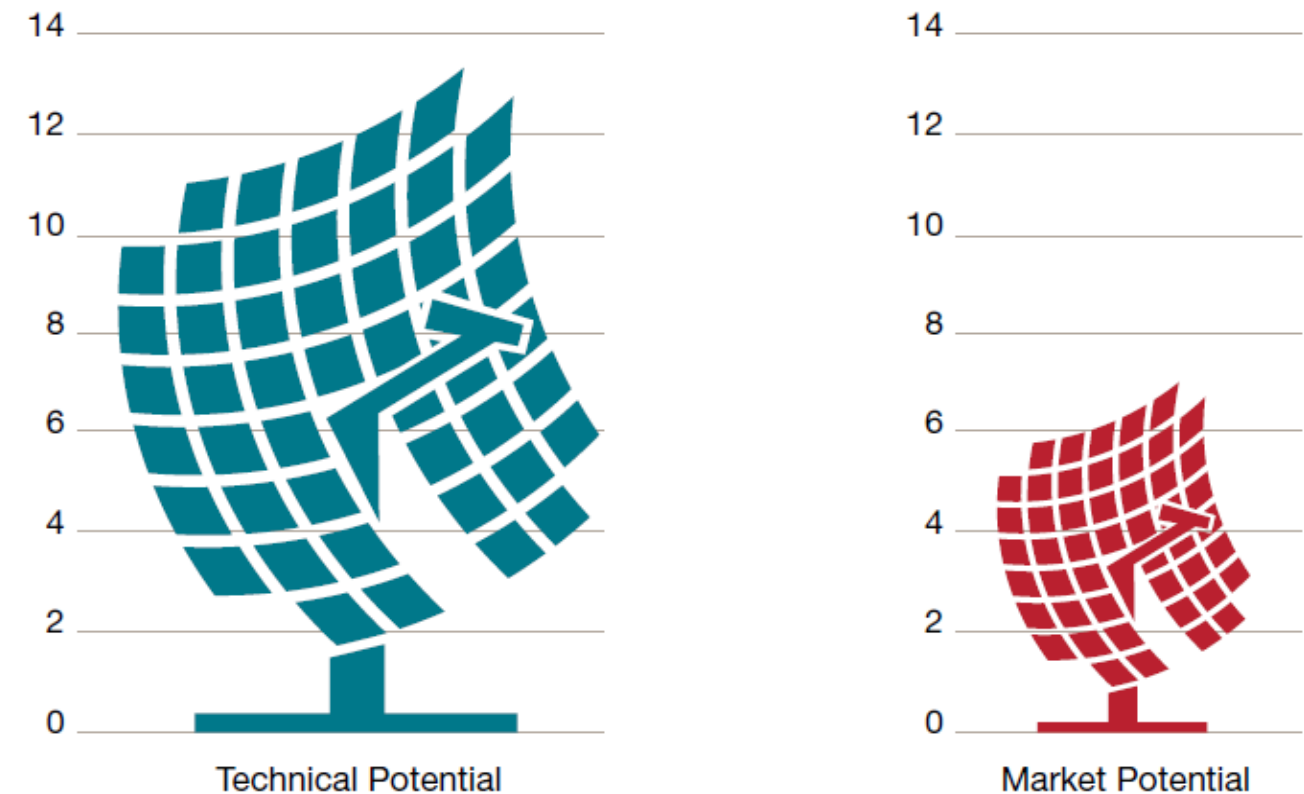
# Potential for solar thermal and policy targets

- The National mission targeted deployment of 20 million sq. m. solar thermal collector area by 2022.
- Currently within CST technology space, India has solar thermal installed capacity of ~ 70,000 sqm (48 MWth) which is projected to reach 200 MWth by 2022, as per the 'India's CST roadmap-2022'.

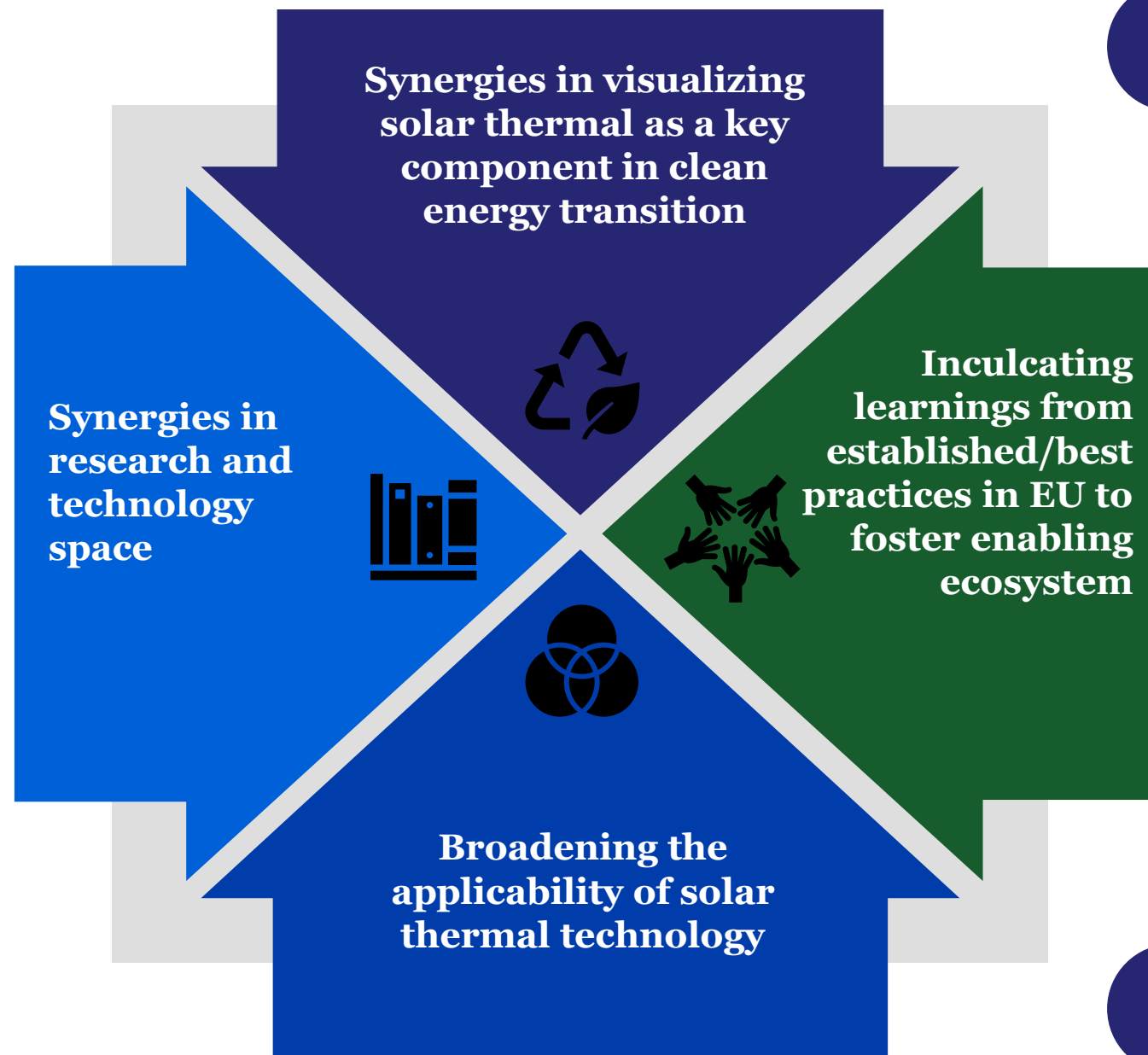
Application and collector area mapping (sq. metre)



Potential of CST's across industries in India - GW<sup>th</sup>



# Why EU-India collaboration on solar thermal and benefits realized with larger deployment



- Improved realization of clean energy vision (COP21 vision, increased penetration for renewables, industrial efficiency, etc.)
- Diversification of fuel mix resulting in improved energy security
- Increased employment opportunities
- GHG emission reduction in CO<sub>2</sub> equivalent, including cost of CO<sub>2</sub> saving
- Increased fuel saving through direct displacement of conventional fuel options in industries
- Development of a concrete R&D infrastructure, through increased technology partnerships
- Cost optimization measures through advanced state of art technology penetration and Knowledge transfer by acquainting with best practices

# Focus areas for R&I in Solar thermal

- *Thermal energy storage*
- *Improvements in collector design*
- *Digitization and performance monitoring*
- *Cost reduction measures*



# Relevance for Research and Innovation in Solar Thermal

- the current installations (~49 MWth) constitute less than 1% of the estimated potential (6.45 GWth).
- no significant tie-ups/technical support partnerships established between Indian players and foreign stakeholders that may result in investment to increase the scale of operations of Indian players or enhance their capacity
- Research and innovation (R&I) forms an essential target segment, which has not garnered much traction but has the capacity to uplift the entire segment by contributing to the following key avenues

## Pros



- Proven technology (specially non-concentrated)
- BIS standards available
- CAPEX subsidy and other financial incentives
- Regulatory mandates for non-CST in some regions
- Massive unrealized potential
- High thermal conversion efficiency

## Cons



- High upfront CAPEX
- Low awareness levels
- Operations limited by temperature range
- Limited international exposure
- Limited capacity and scale of operators
- Competition from competing RE sources such as solar PV

Improving thermal performance

Improving customer side experience

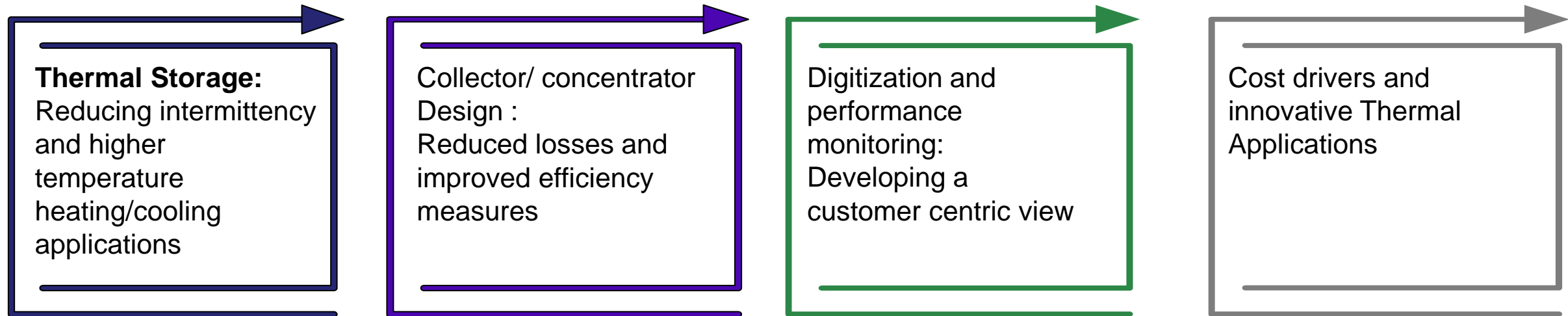
Improving application range

Reduced costing and compact design

Integrating storage

Increasing collaboration in R&I areas can help mainstream solar thermal in Indian markets as an important technology solution for fossil fuel displacement

# R&D collaboration between academia & industry (EU and India)



- R&D in new storage materials for industrial and renewable power applications can increase the rate of deployment of solar thermal storage in India.
- Research collaborations on the development of thermo-chemical energy storage, phase change materials can be promoted to develop cost-effective technologies
- Improved collector designs can lead to reduced losses and improved efficiency, reduced overall costing, improved versatility in temperature range, including possibilities of reduction in material usage.
- Interventions taking place in the EU which can be adopted in India include using polymetric collectors, advanced heat transfer fluids, compact designs of systems
- Performance and monitoring standards/tools employed during project installation and operation can ensure optimal project performance and improve predictive modelling ability for future projects
- Data analytics on performance/ generation data allows for benchmarking of solar thermal technologies
- Reducing the maintenance and operational cost of these systems.
- Promote R&D for metal glass seal, and solar selective and antireflective coatings
- Promote R&D for receivers to be able to work under high solar flux and high pressure
- Explore sources of low-iron sand
- Promote R&D for solar sensor and controller technology
- Leverage expertise of customization in industries in EU for commercializing solar thermal applications

# Other recommendations

## Financing models

- Possible replication of innovative financing models from the EU in India
- Leasing or contracting with heating/cooling as service

## Awareness and Training

- Technical seminars/ workshops/ webinars targeted at skilling
- Manual/Guide on Solar Thermal Project Development
- Partnerships between academia and private industry



## Demand Creation

- Possible regulatory mandates, for adoption of solar thermal
- Strategy on Heating and Cooling
- Trajectory beyond 2022

## Attracting investors

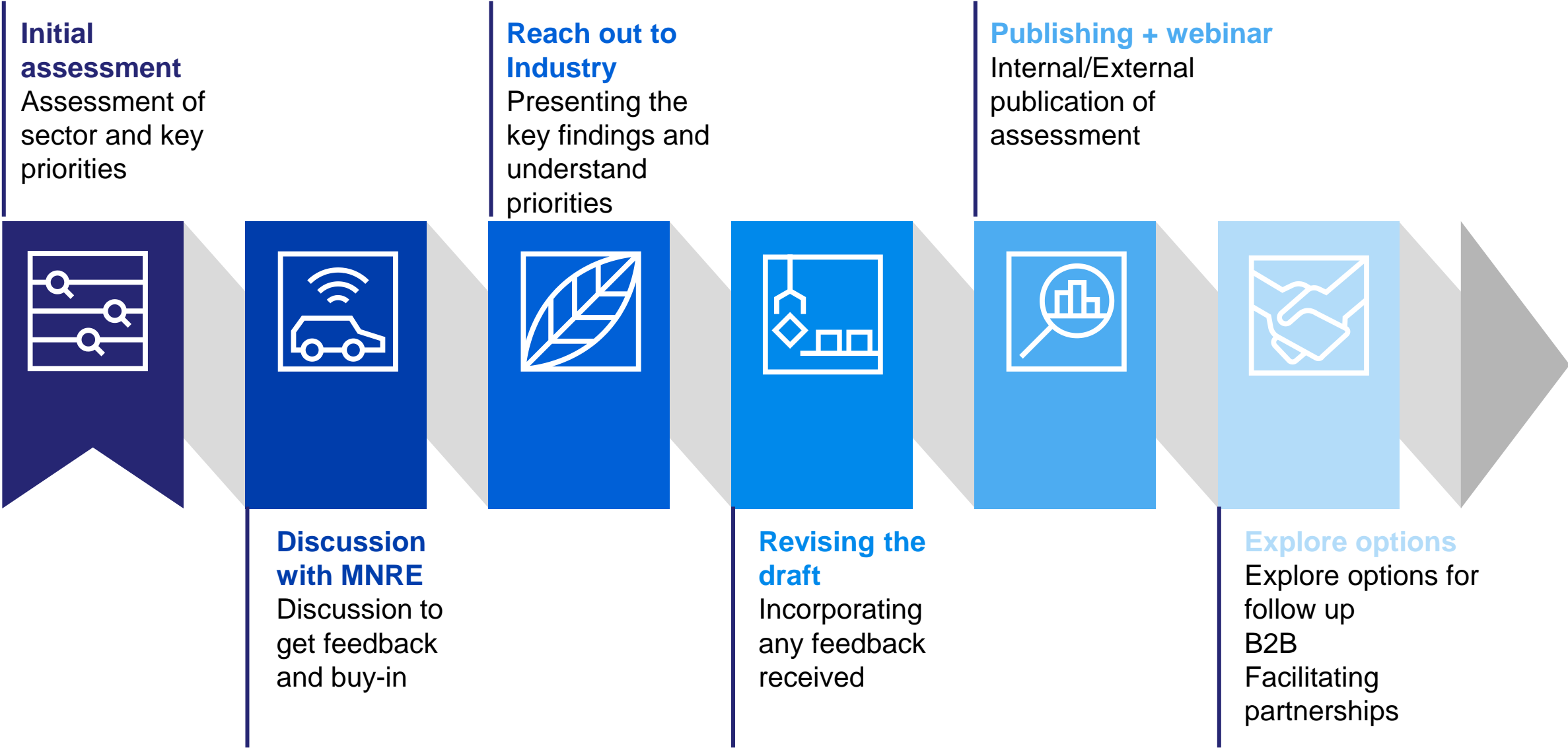
- Partnership between firms from the EU and India
- Technology partnerships and knowledge transfer agreements

## Standardized framework for design and operation of solar thermal technologies

- Physical, technical, mechanical, and legal compliances
- Performance criteria/benchmarking



# Way Forward



*Thank you*

