



## Solar Heat for Industrial Process

### Input to Solar Energy Strategy Public consultation



This policy brochure is part of Deliverable 9.4.

April 2022



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 792276.

## About SHIP2FAIR

SHIP2FAIR is a project developed by 15 partners from all over Europe supported by the European Commission. It aims to foster the integration of solar heat in industrial processes of the agro–food industry including by developing and demonstrating a set of tools (referred to in this input).

We give this input to the public consultation with respect to the solar thermal heat industry.

## Policy recommendations

Even if the Solar Thermal technologies (flat plate, evacuated tubes, linear Fresnel, ...) are commercial technologies, Solar Heat for Industrial Processes (SHIP) remains in the early stages of development<sup>1</sup>. It has enormous potential for growth, with 280 GW<sub>th</sub> possible by 2030 according to trade association ‘Solar Heat Europe’<sup>2</sup>. One of SHIP’s main advantages is its potential to ensure an affordable and constant price of heat during the system’s lifetime, typically 25 years.

The industrial sector accounts for approximately 30% of the total energy consumption in OECD countries<sup>3</sup>, a share of which is needed for heating and cooling buildings and for performing manufacturing steps requiring temperatures up to 350°C. Globally, half of industry’s heat needs are for temperatures up to this level. This temperature range can be addressed with non-concentrated solar thermal technologies (50°C – 180°C) and concentrated solar thermal technologies (>130°C).

Despite SHIP’s advantages, its current share of global industrial heat supply is still negligible, accounting for less than 0.02% in 2020<sup>4</sup>. The main barriers to its deployment in industry lie in a lack of policy support and investor awareness and confidence, the latter being due partly to low supply chain maturity<sup>5</sup>. Yet the necessity to tackle global warming and contain skyrocketing energy prices makes SHIP a promising option.

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<sup>1</sup> 430 entries worldwide in the SHIP-PLANTS.info database

<sup>2</sup> ‘Energising Europe with solar heat - A Solar Thermal Roadmap for Europe’, Solar Heat Europe, April 2022

<sup>3</sup> IEA Solar Heating and Cooling Technology Collaboration Programme, *Technology Position Paper: Solar Heat Integrations in Industrial Processes*, May 2020

<sup>4</sup> International Energy Agency, *Tracking Industry 2021 Report*, November 2021

<sup>5</sup> Ibid.

SHIP2FAIR, a Horizon 2020 project focused on integrating SHIP to the agro–food sector, makes the following recommendations to facilitate SHIP’s expansion:

- A mandate in each Member State for industrial companies to generate 10% of their process heat needs from solar thermal by 2030 in line with Solar Heat Europe’s position<sup>6</sup>.
- CAPEX subsidies for SHIP: CAPEX of SHIP plants is quite high regarding other competing technologies and there is a need to find new funding sources, especially for SMEs in Europe. Many European countries have already set grants for reducing the investment and/or preferential loans<sup>7</sup>.
- Third-party ownership and -financing of systems. Financing has been recognized as major barrier to the uptake of solar thermal technology in industrial processes due to high upfront costs and unaccounted externalities, as well as the continued use of fossil fuel subsidies in many parts of the world<sup>8</sup>.
- Promoting standards, guidelines and tools for SHIP certification. Even if each plant is unique, a common standard/rules can be applied in order to reduce the engineering studies and therefore limit the costs. SHIP2FAIR has developed software to support design guidelines and optimize and replicate solar thermal systems in for widespread use in industrial processes (refer to Box 3).
- Promoting digitalization in SHIP in order to optimize the energy production and its integration in the process. For example, the solar resource forecast, a thermal storage and a smart control of the industrial process will reduce the solar thermal energy thrown away. Public bodies should also encourage industrial enterprises to collect valuable data for SHIP project development.

<sup>6</sup> Presented by SHE President Costas Travasaros on 29 March 2022

<sup>7</sup> Collection of available solar process heat related national and trans-national research and funding programs, SHC – IEA, Task 64 IV, Deliverable DE1

<sup>8</sup> REN21, *Renewables Global Status Report*, April 2022

Support policies will be a key factor to reinforce the adoption of energy efficiency measures in industrial enterprises and allow for a greater deployment of SHIP across Europe. As REN21 has shown, political and institutional barriers include weak institutional structures and complex, fragmented markets which are not well understood, inadequate data sources on the types and amounts of energy needed to meet renewable heating and cooling (RHC) needs<sup>9</sup>. Finally, current policy frameworks are built around fossil fuels and policymakers have little awareness about the effects of using fossil fuels in heating and cooling on the climate.

To reach a share of 10% by 2030, we call for obligations for certain industries with heat demand matched to the temperatures and quantities that SHIP can supply to incorporate solar thermal heat into their processes. The campaign Solarise Heat ([solariseheat.eu](http://solariseheat.eu)) calls for measures to deliver 200 TWh of solar heat for industry per year by 2030, from an installed capacity estimated at 140 GW<sub>th</sub>. Indeed, Solar Heat Europe expects industry to be the segment that must see the most growth to reach the campaign's 2030 or 2050 targets (see Figure 1)<sup>10</sup>. The 280 GW<sub>th</sub> foreseen to be installed by 2030 would meet the needs "of an industrial sector such as food, drinks and tobacco, which uses predominantly low and medium temperature heat"<sup>11</sup>.

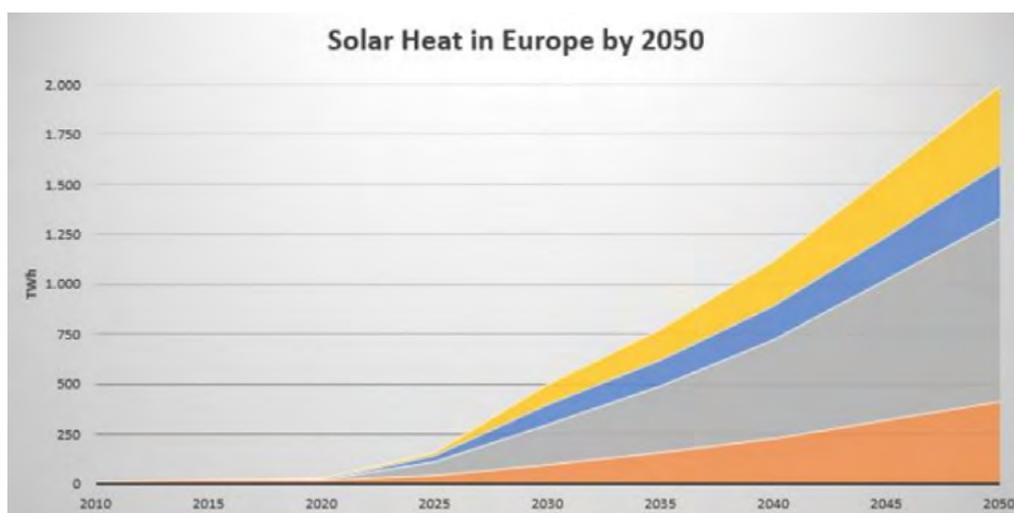


Figure 1 - solar heat's future trends in Europe, according to Solar Heat Europe's April 2022 Roadmap

Through investment grants in France and the solar heat tariff in the Netherlands, several multi-MW SHIP plants have been commissioned over the last few years, and SHIP costs have decreased by two-thirds in six years (see Box 1)<sup>12</sup>. Large-scale projects have low specific costs than smaller projects.

<sup>9</sup> REN21, *Renewables Global Status Report*, April 2022

<sup>10</sup> Solar Heat Europe, *'Energising Europe with Solar Heat: A Solar Thermal Roadmap for Europe'*, April 2022

<sup>11</sup> Ibid.

<sup>12</sup> Solar Payback, *'Cost Trends of Solar Energy for Heat in Industry'*, August 2021

CAPEX grants are the most common form of support for SHIP, and according to the IEA Solar Heating and Cooling Technology Collaboration Programme, this form of support is also the most appreciated<sup>13</sup>. The report claims that financial support needs to be specific to a company's precise positioning in the value chain, stating: "[SHIP] has to become a business case for all relevant stakeholders including the industrial end-users, the technology suppliers but also plant operators and investors" - (see also Box 2)<sup>14</sup>.

The solar thermal industry knows it must talk to the financial community better and involve stakeholders to develop and provide information on financing operations for SHIP<sup>15</sup>. Around 79% of turnkey SHIP suppliers also agree that heat supply contracts or ESCO models (also known as third-party financing of system) are an important means of increasing deployment<sup>16</sup>.

In 2014, the weighted-average installed costs of 11 SHIP projects were 1,679 USD/kW, while the average of 15 plants commissioned in 2020 dropped to 531 USD/kW, a decrease of 68 %.

Solar heat costs range between 2.57-7.35 EUR-cent cost per kWh, with SHIP on the higher end of the range in comparison with solar district heating.

Box 1 – past and current solar thermal costs. Source: Solar Payback Cost Trends Report; more data in IRENA 'Renewable Power Generation Costs in 2020' Fig 9.2, (2021)

"Compared to other instruments, a CAPEX grant is easiest to include in an economic assessment approach, for communication with end users and by this, to support actual implementation including financing."

Box 2 – the view from an IEA-SHC survey in 2021

Governments must make permitting for SHIP easier. To be deployed at scale procedures must be streamlined. In the SHIP2FAIR project, for example, permitting issues caused significant installation delays at the Larnaudie demo site. The absence of clear permitting procedures, or slow procedures causes delays, which can damage investor confidence and hold back progress in decarbonisation.

SHIP2FAIR has developed two tools to improve SHIP's efficiency. The project's replication tool (see Box 3) can evaluate the techno-economic potential of a solar heat technology based on local solar potential and process heat demand – a useful tool to gauge the applicability of SHIP for a particularly industrial plant. SHIP2FAIR's control tool (see Box 4) uses digitalization to increase the productivity of SHIP systems.

SHIP2FAIR's **Replication Tool** is a software tool which combines data from solar generation and process features to support the concept design of SHIP integration in projects to optimise the system according to user's needs.

Box 3 – SHIP2FAIR's replication tool

SHIP2FAIR has validated a **Control Tool** as an online Decision Support System. This will optimize the management of process heating systems through live monitoring and performance evaluation to better predict maintenance interventions and maximize solar power production also considering weather forecast.

Box 4 – SHIP2FAIR's control tool

Solar Heat for Industrial Processes must be supported to decarbonise industry cost-efficiently. SHIP's current status and potential are explained in more detail below.

<sup>13</sup> IEA SHC TASK 64/IEA SolarPACES Task IV. Deliverable Report D.E1 Subtask E, *Collection of available solar process heat related national and trans-national research and funding programs*, April 2021

<sup>14</sup> Ibid.

<sup>15</sup> IEA SHC Task 64/ SolarPaces IV Subtask E Guideline to Market Presentation

<sup>16</sup> Solar Payback, *Solar Heat for Industry*, April 2017

## Solar heat: an attractive option for industry

### IEA: rapid decarbonisation essential and solar thermal necessary for net-zero

In May 2021, the International Energy Agency (IEA) published a roadmap with the objective of achieving the Net Zero carbon emission by 2050 for the Global Energy Sector and limiting global temperature rise to 1.5 °C.

In order to limit global temperature increase to 1.5°C, the IEA recommends:

- No investment in new fossil fuel supply beyond projects committed in 2021
- All electricity to be zero-emission in the OECD by 2035, and globally by 2040
- No new fossil fuel boilers sold from 2025

The IEA sees solar thermal as part of the solution to meet these conditions. The IEA calls for:

- A 6x increase in collector area is needed (all applications considered) to achieve a solar thermal collector area of 165 million m<sup>2</sup>/yr
- Solar heat to covers 11% of the industrial heat demand in 2050 globally. Here, we and Solar Heat Europe want Europe to move first and faster, achieving about this penetration by 2030 – see above.

### Energy price volatility

Energy prices are a key issue for the economic well-being of the European Union. From 2000-2019, energy prices have dramatically increased.

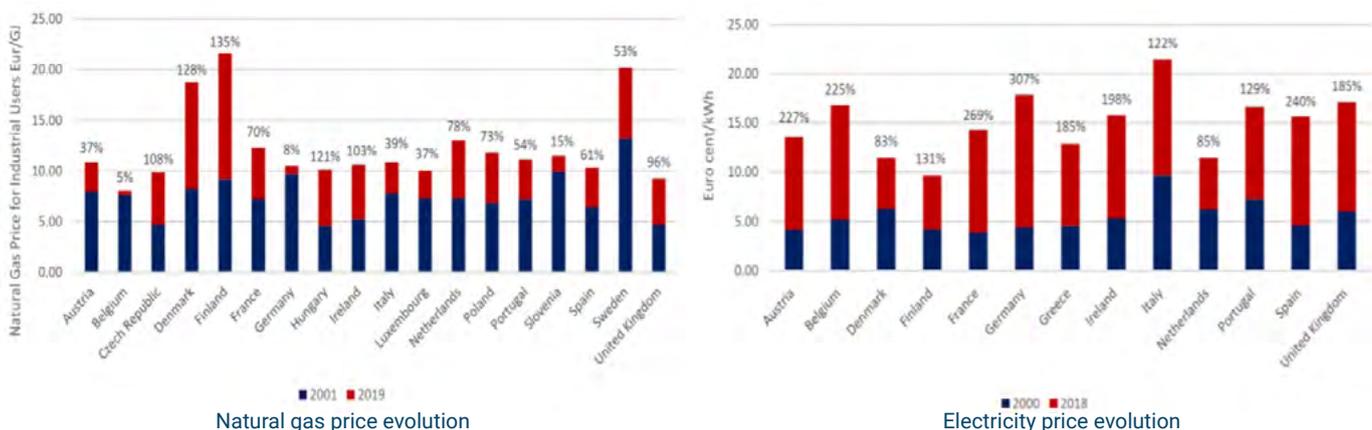


Figure 2 - energy price evolution

This tendency has been accelerated by the economic recovery from the pandemic:

- During the 3rd quarter of 2021: The largest year-on-year price increases were registered in Ireland (+323%), Portugal (+215%) and Spain (+214%), triggered by rising gas prices<sup>17</sup>.
- Wholesale gas prices in Europe continued their sharp increase in the 3<sup>rd</sup> quarter of 2021 as spot contracts rose from 37 €/MWh to 85 €/MWh.

<sup>17</sup> European Commission, Gas and Electricity Market Reports, [https://energy.ec.europa.eu/data-and-analysis/market-analysis\\_en](https://energy.ec.europa.eu/data-and-analysis/market-analysis_en)

## Energy insecurity

In addition to the pandemic, Russia's invasion of Ukraine has had a huge impact on the energy market. Due to the economic sanctions against Russia, the EU has decided to reduce by 2/3 the import of Russian oil & gas by the end of year to end dependence by 2027. For that, different actions should be taken:

- Reduce the consumption.
- Diversify the providers.
- Increase the renewable energy share.

The decrease in consumption will affect the economic activity. And the provider for diversification will not be an easy task. Russia is the 1<sup>st</sup> gas provider and 2<sup>nd</sup> oil provider worldwide. Russia provides 41% of the European gas and some countries like Finland and Slovakia are more than 75% dependent. Affordable substitution of Russian fuel by other supplies of fossil fuels looks unrealistic, particularly in the long term.

Therefore, it is important to increase the share of renewable energy. Moreover, fossil fuel prices are foreseen to remain at high levels. Solar thermal technology, once installed, operates for little cost. The cost for the owner is the steady repayment of the capital loaned + interest, and/or a return on equity for the initial investment.

## Capitalising on SHIP's potential

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SHIP technology's advantages as a sustainable source of energy with enormous potential for energy independence, stability, job creation and efficiency are clear. To capitalise on the potential of solar heat in industrial processes, policies must facilitate SHIP's expansion to meet Europe's energy needs.

## The energy needs

The IEA has enlightened that the energy needs in industry represents one third of the global energy consumption and 74% of this energy is consumed as heat.

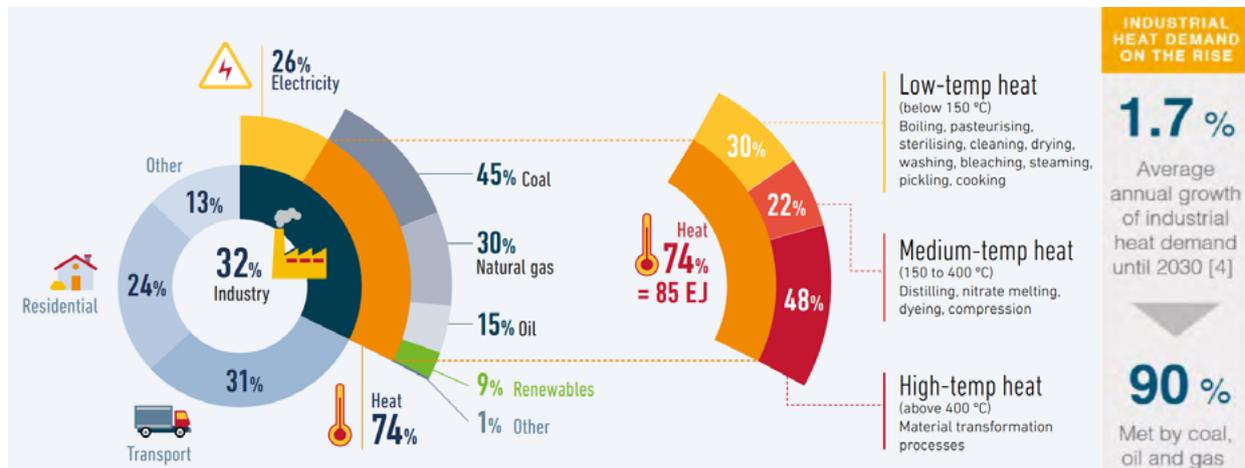


Figure 3 - energy demands in industry  
 Source: Solar Payback (2017), based on IEA statistics and calculations by IRENA

Zero-carbon solutions for industrial heat must be found:

- Industries are the driving force of economy and there is a need to have affordable and sustainable energy supply.
- The energy needs are concentrated locally.

SHIP2FAIR's Consortium:



Online presence:

Website: [ship2fair-h2020.eu](http://ship2fair-h2020.eu)  
 Twitter: @SHIP2FAIR  
 LinkedIn: [ship2fair-h2020](https://www.linkedin.com/company/ship2fair-h2020)