



Solar Heat for Industrial Processes

EXPLOITING UNTAPPED POTENTIAL OF INDUSTRIAL SOLAR HEAT: SHIP2FAIR

Day 2 – Thursday 15 June, 2023 - Madrid, Spain

sustainableplaces.eu



Solar Heat for Industrial Processes
towards Food and Agro Industries
commitment in Renewables

Project Welcome and Presentation

Final Event SP23, 15/06/2023

Miguel Zarzuela – mzarzuela@fcirce.es



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

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SHIP2FAIR Agenda

TIME	TOPIC	SPEAKERS
09h00	SHIP2FAIR welcome and presentation SHIP2 FAIR main goal, <u>objectives</u> and introduction to project's set of technologies and tools.	Miguel Zarzuela (CIRCE)
09h15	Solar thermal technologies for the <u>agro-food</u> industry	Dimitrios Papageorgiou (TVP) and Irapua <u>Ribero</u> (IS)
09h35	Presentation of the Control Tool	Viktor Unterberger (BEST)
09h55	Presentation of the Replication Tool	Giorgio Bonvicini (RINA-C)
10h10	Hand-on experience & good practices in solar thermal adoption in the <u>agro-food</u> sector - RODA	Esperanza Tomas (RODA)
10:25	Questions	
	BREAK	

SHIP2FAIR Agenda

11h00	SHIP2FAIR welcome – Part II	Miguel Zarzuela (CIRCE)
11h05	Hand-on experience & good practices in solar thermal adoption in the <u>agro-food</u> sector – M&R	Antonino <u>Giummulè</u> (M&R)
11h20	Business and financing schemes for SHIP installation	Dimitrios Papageorgiou (TVP) and Irapua <u>Ribero</u> (IS)
11h40	Presentation of Replication Studies for solar thermal in industry	Giorgio Bonvicini (RINA-C) and Irapua <u>Ribero</u> (IS)
12h55	Roadmap for deployment of Solar Heating for Ship2Fair	Nicola Chiara (LINKS)
12h05	Renewable penetration in Spanish Industry	Susana Rivera (<u>Cooperativas</u>)
12h15	Lessons learnt and Policy Recommendations	Luis Heras (CIRCE)
12h25	Questions	

SHIP2FAIR Concept

Unveiling the untapped potential of solar heat for agroindustries in EU

Fostering the integration of solar heat in industrial processes - **SHIP** from agro-food sector, by developing and demonstrating a set of tools and methods for the development of industrial solar heat projects during its whole life-cycle.

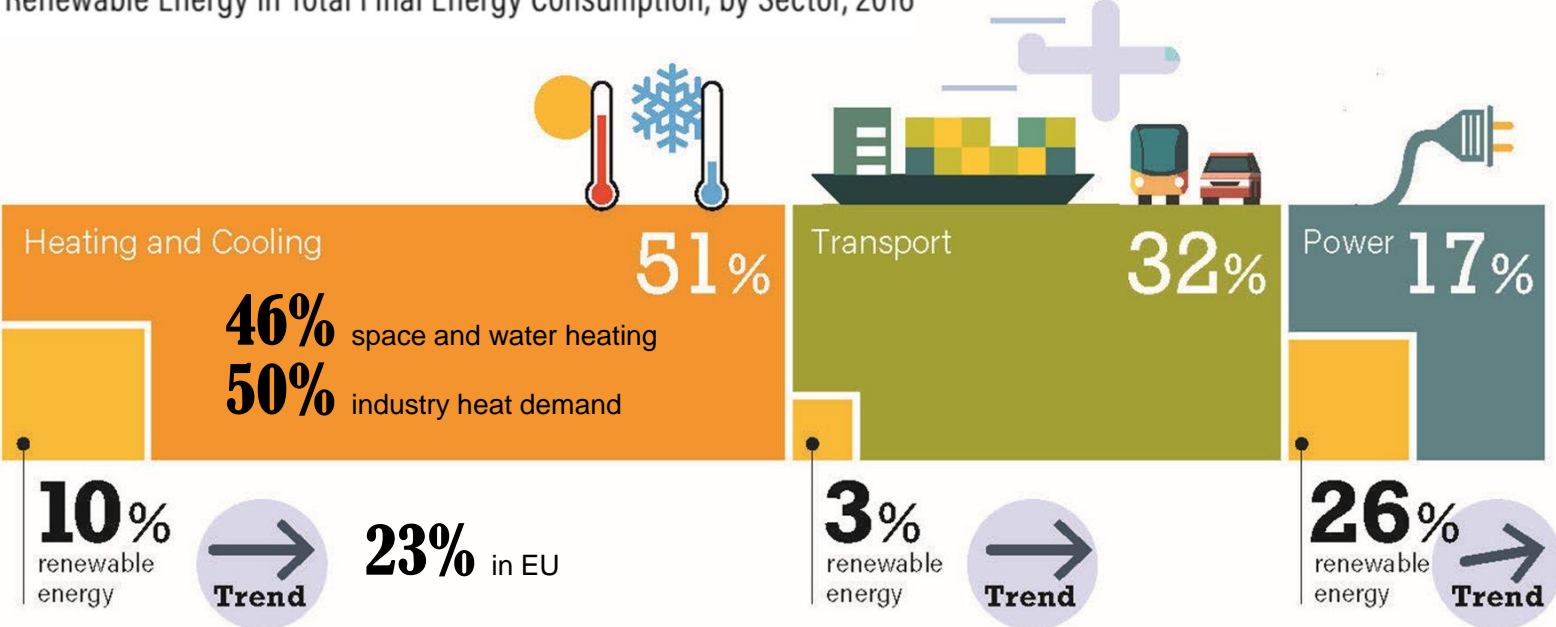
BUDGET: 8M €

DURATION: 2018-2023



Global Outlook – Energy Demand

Renewable Energy in Total Final Energy Consumption, by Sector, 2016



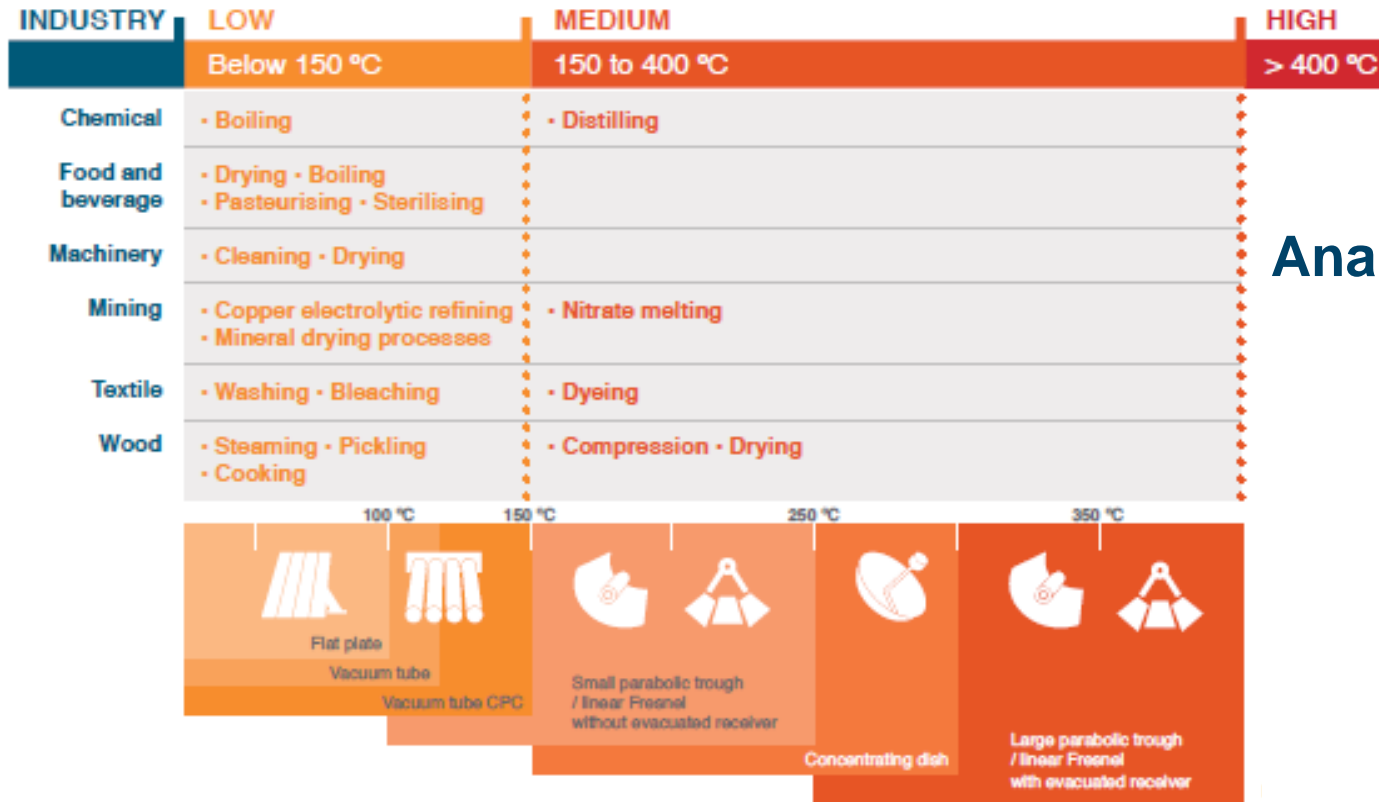
Note: Data should not be compared with previous editions of the Renewables Global Status Reports. Electricity also supplies final energy demand in the heating and cooling sector (71% in 2016), and transport sector (11% in 2016).

Source: Based on OECD/IEA.

REN21 RENEWABLES IN CITIES 2019 GLOBAL STATUS REPORT

Solar Heat for Industrial Processes towards Food and Agro Industries commitment in Renewables

Market Analysis State of the Art



Source: [SHC](#)

SHIP2FAIR Concept

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SHIP2FAIR Partners

Coordination



Solar technologies
providers



R&D and consulting



Agro-food field
experts



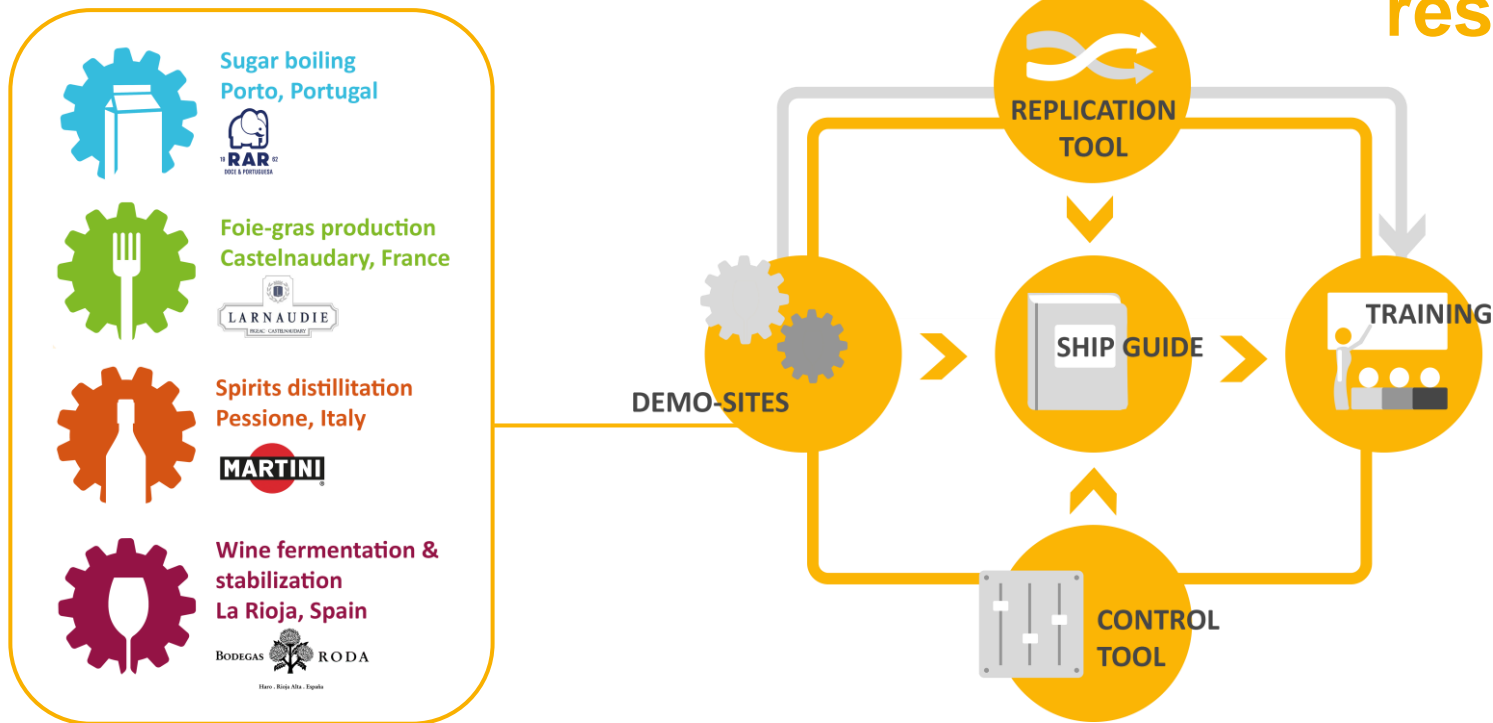
Dissemination &
Training



SHIP2FAIR will develop & demonstrate, in a 4 real industrial sites - **demo-sites**, a set of **tools & methods** for the development of industrial solar heat projects during their whole life-cycle.

SHIP2FAIR

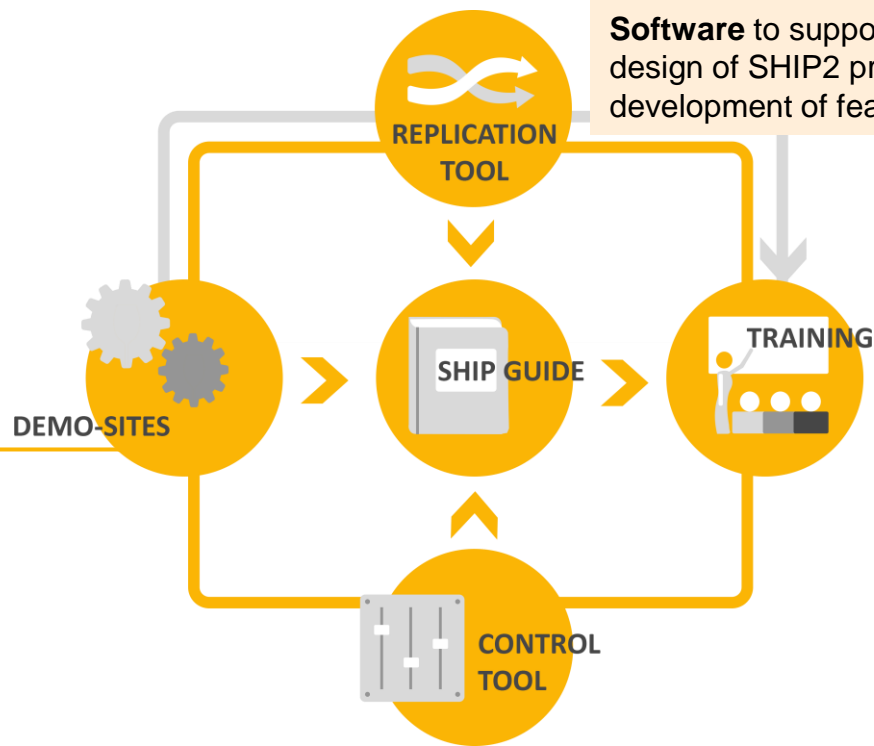
Expected results



SHIP2FAIR will develop & demonstrate, in a 4 real industrial sites - **demo-sites**, a set of **tools & methods** for the development of industrial solar heat projects during their whole life-cycle.

SHIP2FAIR Expected

- Sugar boiling**
Porto, Portugal
RAR
Rios & Paredes
- Foie-gras production**
Castelnaudary, France
LARNAUDIE
Maison Castelnaudary
- Spirits distillation**
Pessione, Italy
MARTINI
- Wine fermentation & stabilization**
La Rioja, Spain
BODEGAS RODA
Here - Rioja - Ma - Equis

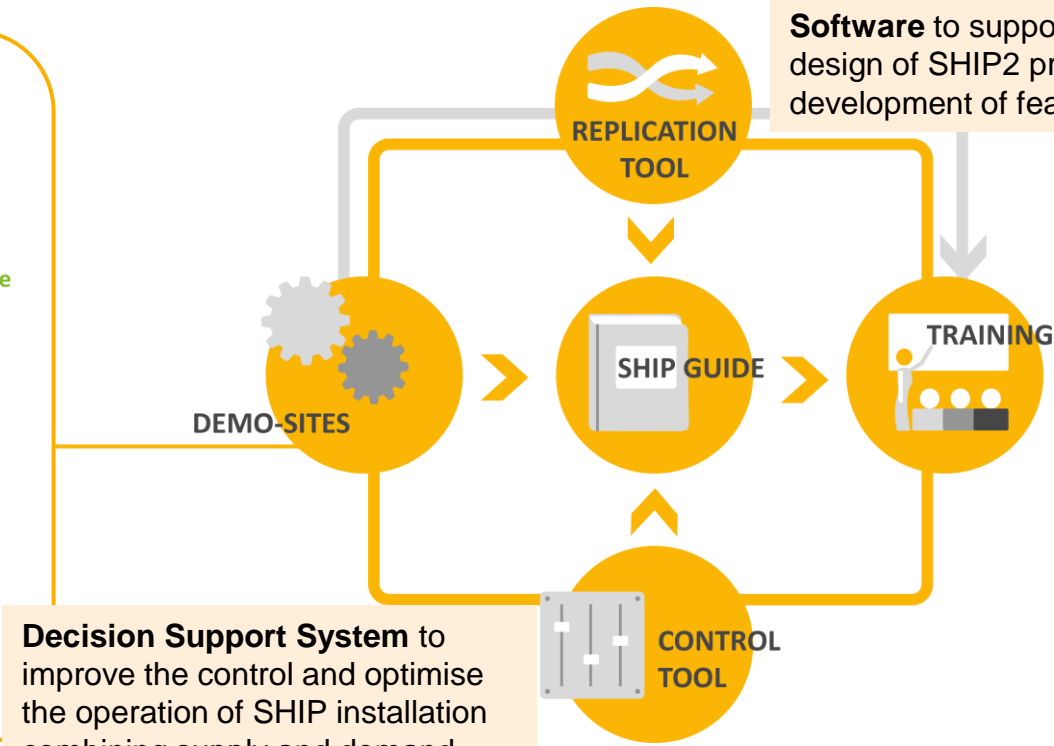


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Pessione, Italy
MARTINI
- Wine fermentation & stabilization**
La Rioja, Spain
BODEGAS RODA

Software to support the concept design of SHIP2 projects & the development of feasibility studies



Decision Support System to improve the control and optimise the operation of SHIP installation combining supply and demand data

SHIP2FAIR will develop & demonstrate, in a 4 real industrial sites - **demo-sites**, a set of **tools & methods** for the development of industrial solar heat projects during their whole life-cycle.

SHIP2FAIR Expected

Sugar boiling
Porto, Portugal
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Foie-gras production
Castelnaudary, France
LARNAUDIE

Spirits distillation
Pessione, Italy
MARTINI

Wine fermentation & stabilization
La Rioja, Spain
BODEGAS RODA

Deploy SHIP demonstrators in 4 industrial sites

DEMO-SITES

Decision Support System to improve the control and optimise the operation of SHIP installation combining supply and demand data

REPLICATION TOOL

SHIP GUIDE

TRAINING

CONTROL TOOL

Software to support the concept design of SHIP2 projects & the development of feasibility studies

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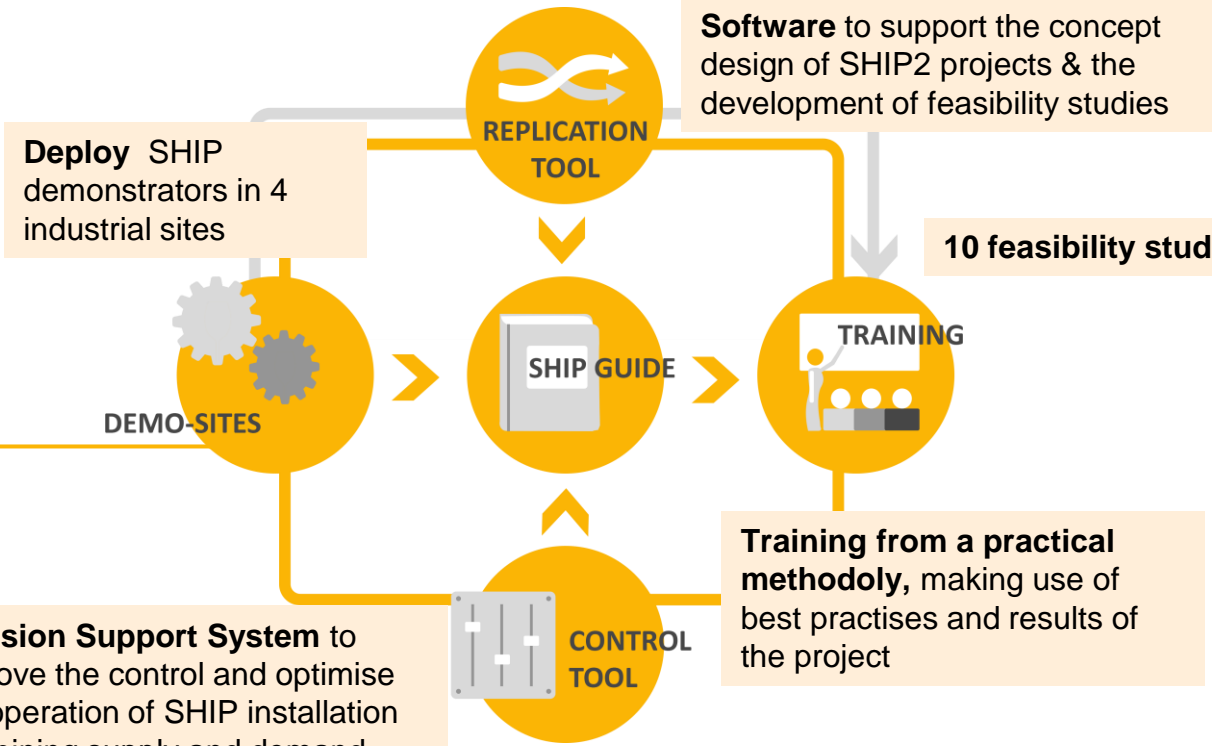
SHIP2FAIR Expected

Sugar boiling
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MARTINI

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La Rioja, Spain
BODEGAS RODA



The demo-sites & the flagship projects

SHIP systems fully validated in real processes:

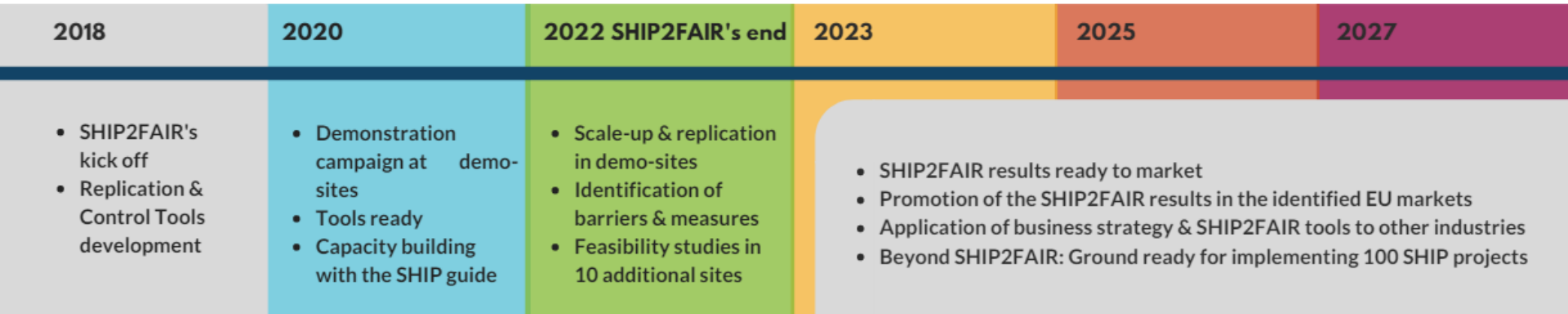


Novel solar collectors demonstrated in average irradiance areas through demonstration campaign

- **Total capacity:** 1.7 MWth
- **Solar fraction:** 24% av.
- **Yearly average solar efficiency:** 44% (M&R)-54% (RODA)
- **Primary energy savings:**
 - 2 GWh/year
 - 570 tCO₂/year avoided
 - 2.7 GWh/year increase of RES in industrial heating

SHIP2FAIR

From 2018 to 2022 and beyond





Thank you!

info@ship2fair-h2020.eu
www.ship2fair-h2020.eu





Solar Heat for Industrial Process towards Food and Agro Industries commitment in Renewables

Hand-on experience & good practices in solar thermal adoption in the agro-food sector

Sustainable Places, 15th June 2023



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Demo site example and successful results SHIP2FAIR

ITEM	AGENDA
1	<i>Company description: Martini & Rossi</i>
2	<i>Technology description</i>
3	<i>System integration</i>
4	<i>Lessons learnt and next steps</i>



ROLE OF PESSIONE OC

Is the **CRADLE OF MARTINI** and the producer of **FLAGSHIP BRANDS**

within the Bacardi portfolio

CENTER OF EXCELLENCE and **PROFICIENCY** for production, development and industrialization of **VERMOUTHS**, **SPARKLING WINES** and **BACARDI BOTTLING**

1863

MARTINI, SOLA e C.ia
officially was born

1993

Bacardi acquire
MARTINI & ROSSI



Company description SHIP2FAIR Martini & Rossi

It all began with three men...



Teofilo Sola
1831-1879



Alessandro Martini
1834-1905



Luigi Rossi
1828-1892

JULY 1ST, 1863: Martini, Sola e Compagnia was **OFFICIALLY BORN IN TURIN.**

Alessandro Martini and Teofilo Sola were two of the founders.

Luigi Rossi, **SKILLED HERBALIST AND WINE TECHNICIAN**, was part of the company with a participating share.

In 1864 **PRODUCTION MOVED TO PESSIONE**, a strategic centre for its closeness to the railway line that links up Turin and Genoa towards the international markets.

Company description SHIP2FAIR

Pessione: How it looks now



KEY DATA FY 2022



Formulas and products

- 27 Martini
- 16 Sparklingwines
- 20 Bacardi
- 3 Liquors and Spirits



Countries supplied
over 100



Plant surface
161,000 m² - 40 acres



Volume

19.7 M 9L cases bottling



Covered surface
68,000 m²



SKUs handled

775 (production + co-packing)



Certifications

- ISO 14001 since 2002
- OSHAS 18001 (ISO 45001) since 2006
- ISO 9001 since 2007
- Equalitas in 2020
- Great Place to Work 2022

Company description SHIP2FAIR

Martini & Rossi: 3 main families of product

MARTINI APERITIFS



MARTINI SPARKLING



BACARDÍ



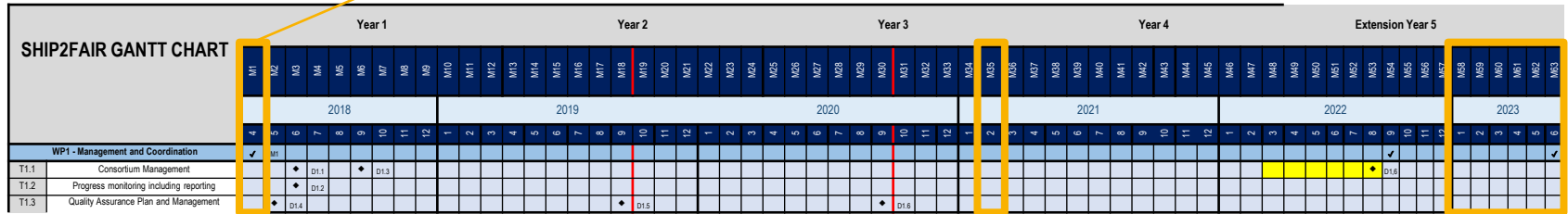
Solar Heat for Industrial Processes towards Food and Agro Industries commitment in Renewables

Technology Description SHIP2FAIR

New solar field installation



April 2018: Project Start, Martini & Rossi applied to the SHIP2FAIR program as a Demo site



Feb 2021: Solar Field installation completed

Feb 2023 till the end of the project (June 2023): Fine tuning ongoing

Technology Description SHIP2FAIR

New solar field installation

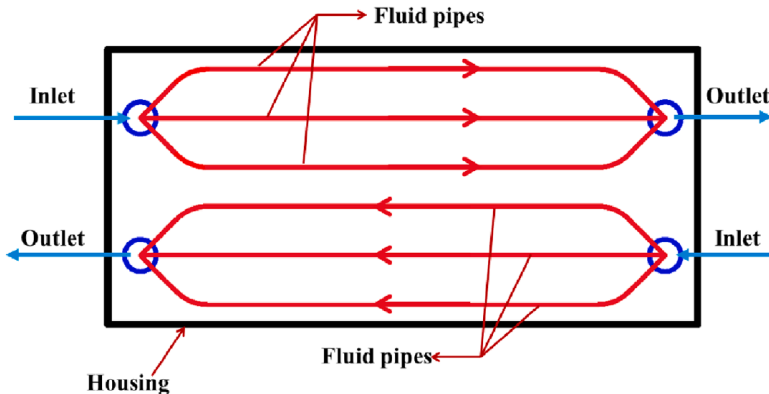
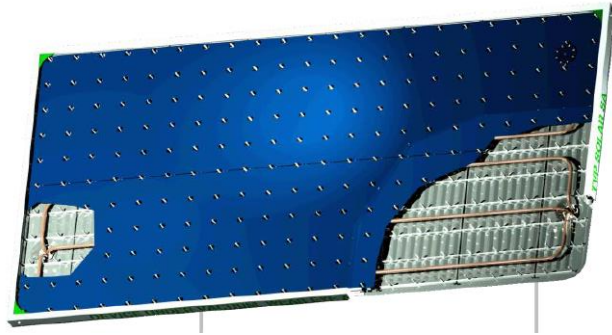


SOLAR FIELD SPECS		
SF Inlet Temperature	152	°C
SF Outlet Temperature	165-177	°C
Hot Water Density	912,3	kg/m ³
Hot Water Specific Heat	4,3	kJ/kg/K
Solar Field Peak Efficiency	56%	
Safety Factor	113%	
# Of Panels	298	#
Gross Area	596	m ²
Installed Area	1.073	m ²
Solar Field Peak Power	329	kW
Panels' Tilt Angle	35	°

Solar Heat for Industrial Processes towards Food and Agro Industries commitment in Renewables

Technology Description SHIP2FAIR

New solar field installation

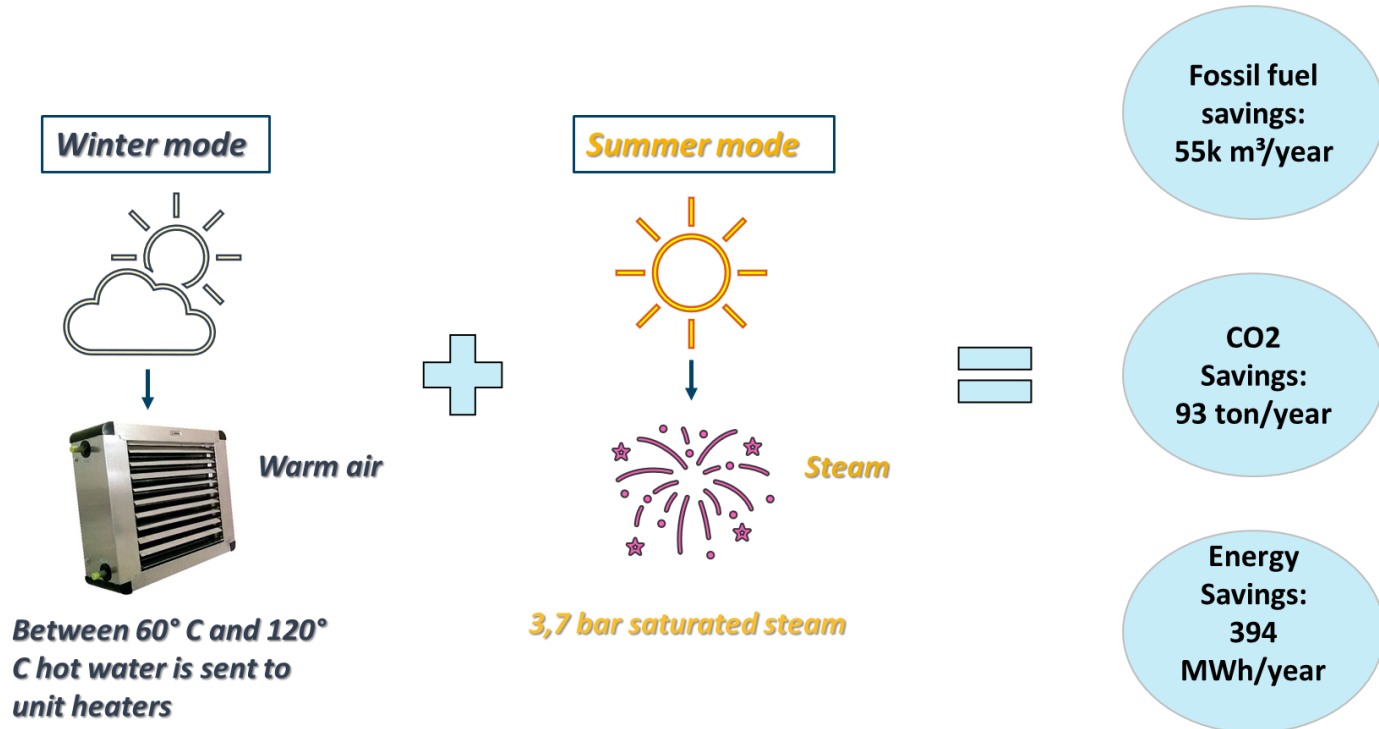


TVP  SOLAR

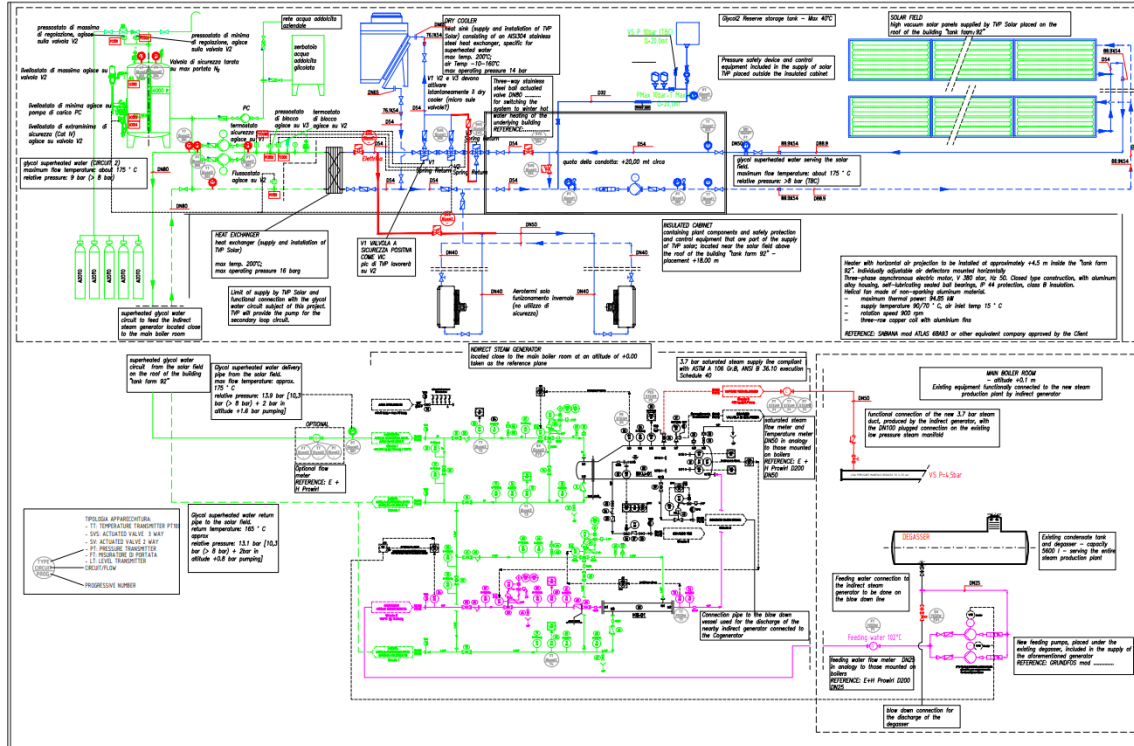
- SolarKeyMark certified up to 200°C
- Highest energy production with any ambient temperature, in any climate condition
- High-vacuum insulation suppresses thermal losses
- 20 years consistent & predictable performance without any degradation
- Designed for industrial-scale applications

Technology Description SHIP2FAIR

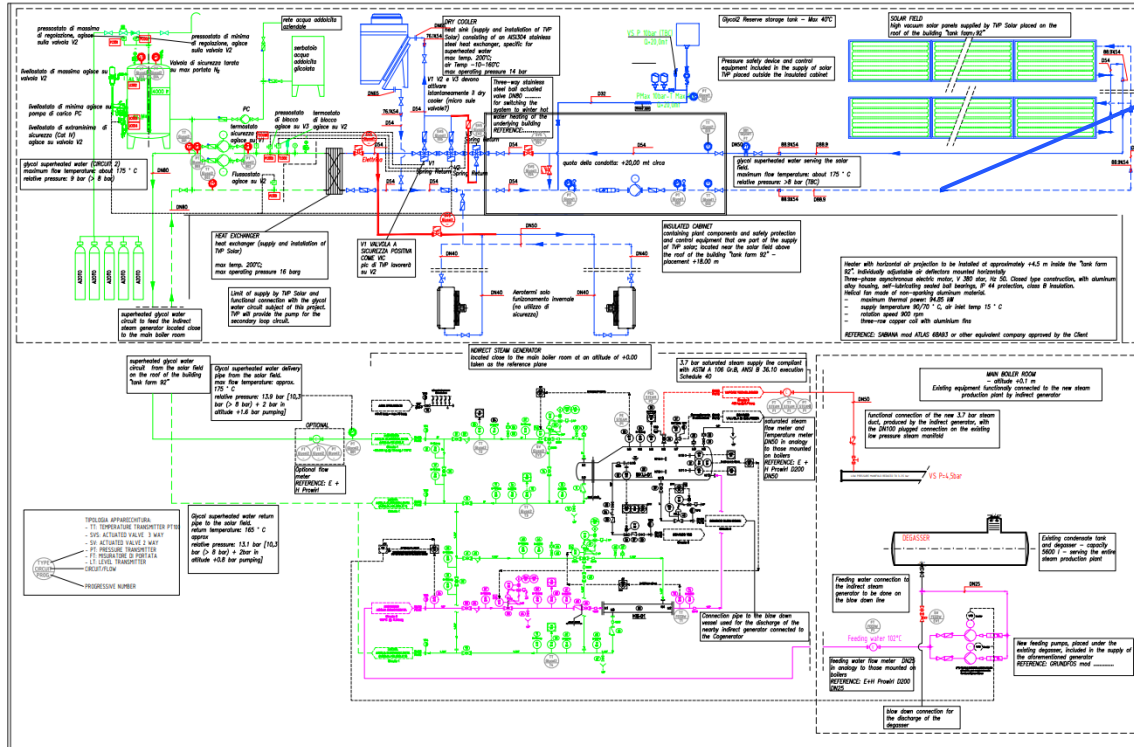
M&R Energy Source



P&ID SHIP2FAIR M&R Energy Source



P&ID SHIP2FAIR M&R Energy Source

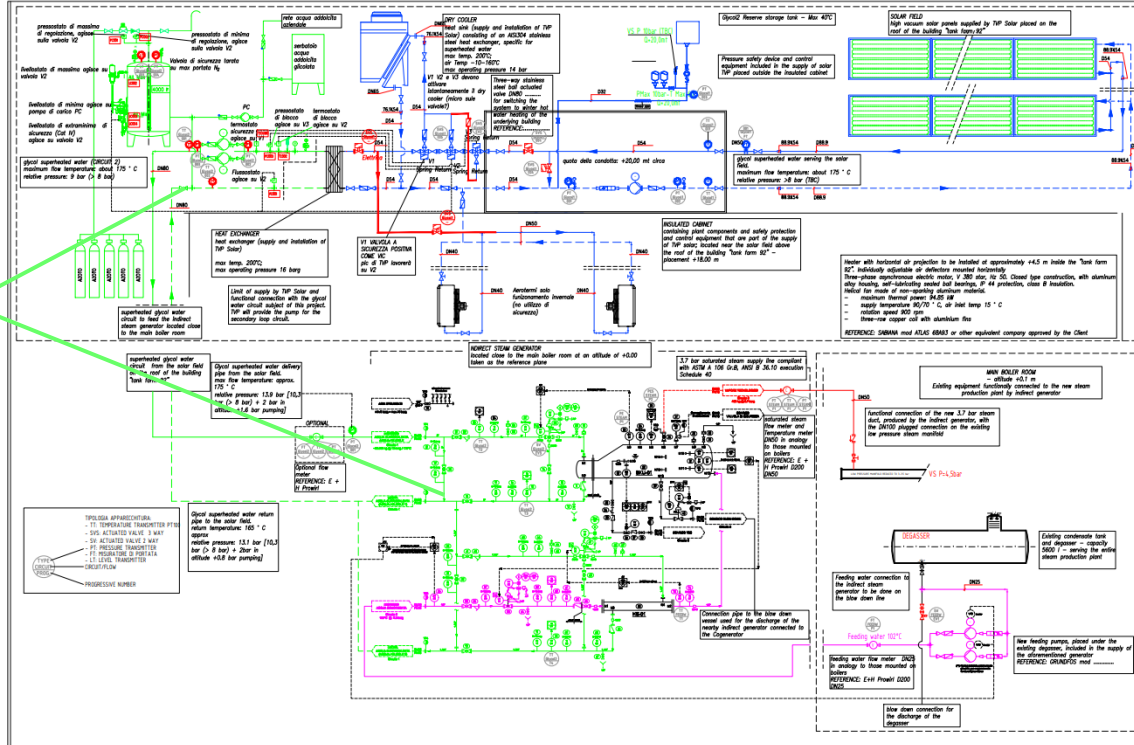


Solar Heat for Industrial Processes towards Food and Agro Industries commitment in Renewables

P&ID SHIP2FAIR

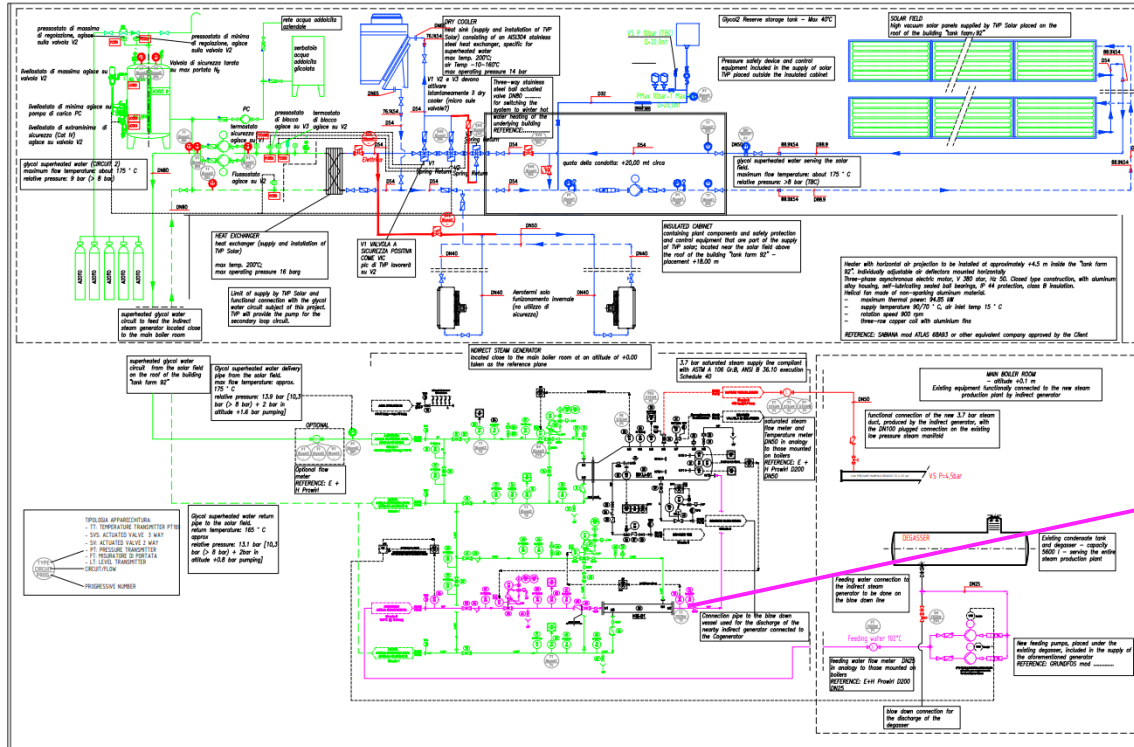
M&R Energy Source

Circuit 2: Flow from/to Indirect Steam Generator



Solar Heat for Industrial Processes towards Food and Agro Industries commitment in Renewables

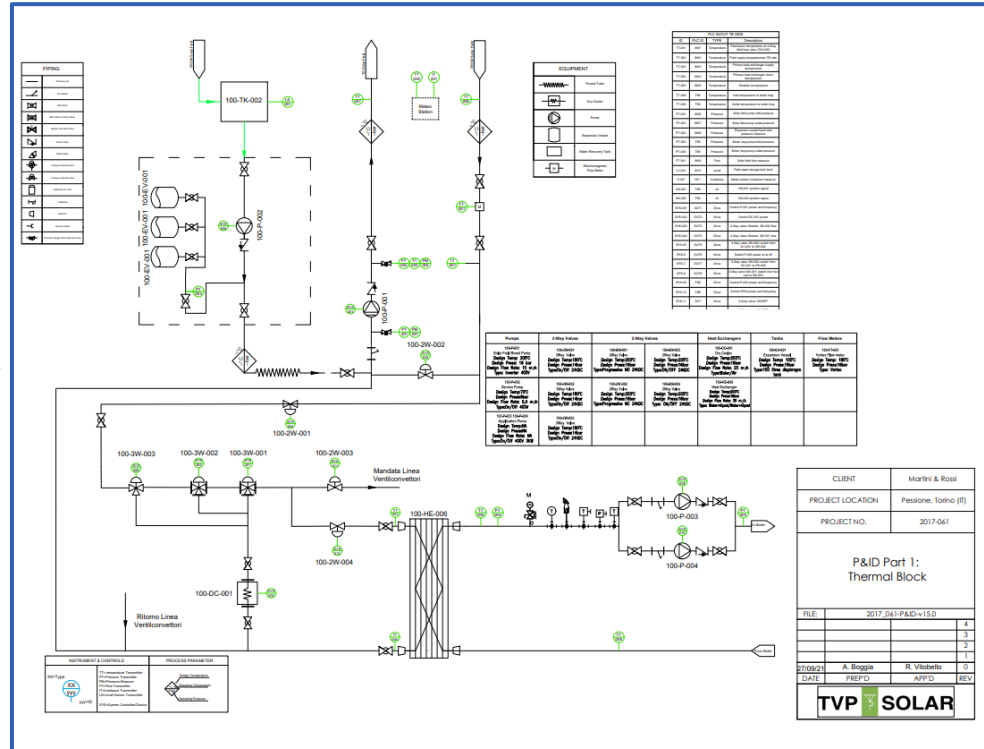
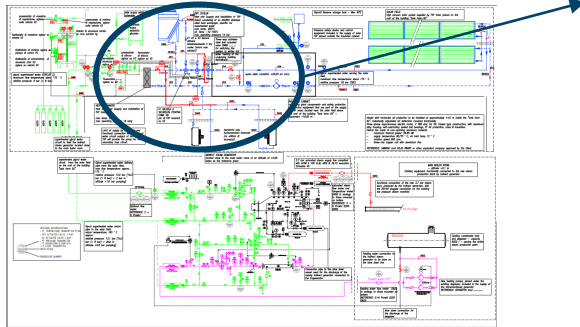
P&ID SHIP2FAIR M&R Energy Source



Steam generator feed water circuit

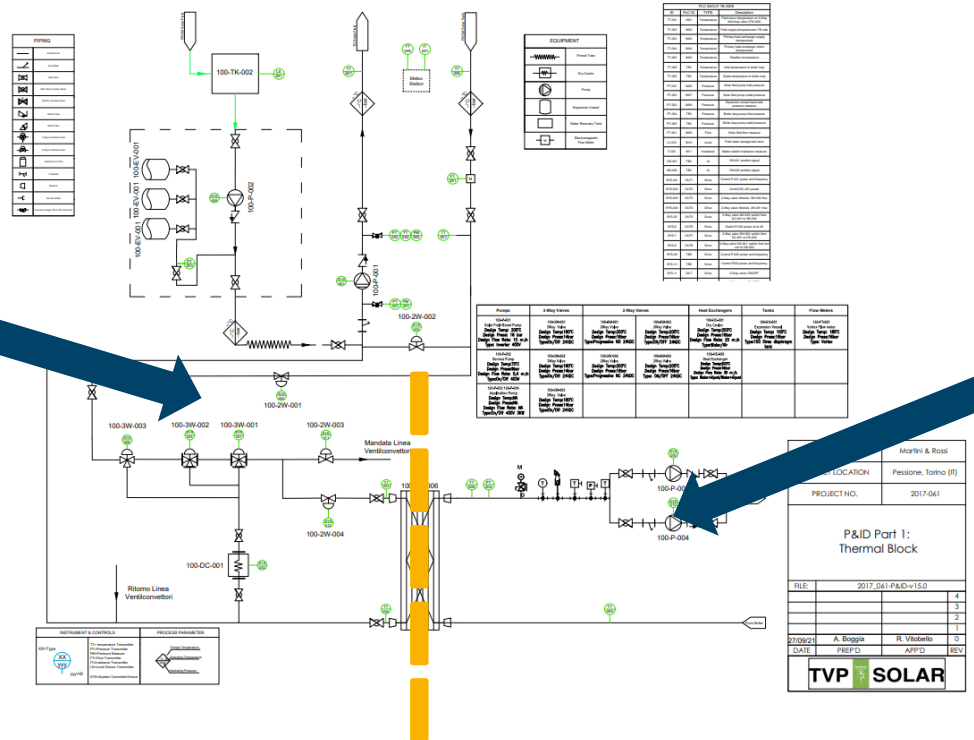
Focus on thermal block SHIP2FAIR M&R Energy Source

How the system is able to drive the flow based on circuit 1 temperature and pressure.



Focus on thermal block SHIP2FAIR M&R Energy Source

Circuit 1: Flow from/to Solar Field



Circuit 2: Flow from/to Indirect Steam Generator

Equipment	Symbol	Equipment	Symbol
Control Valve	[Symbol]	Control Valve	[Symbol]
Flow Control	[Symbol]	Flow Control	[Symbol]
Pump	[Symbol]	Pump	[Symbol]
Pressure Control	[Symbol]	Pressure Control	[Symbol]
Flow Measurement	[Symbol]	Flow Measurement	[Symbol]
Temperature Measurement	[Symbol]	Temperature Measurement	[Symbol]
Level Measurement	[Symbol]	Level Measurement	[Symbol]
Positioning	[Symbol]	Positioning	[Symbol]

Process	P-Flow Values	P-Flow Values	Heat Exchanger	Valves	Alarm Notes
100-2W-001	100-2W-001	100-2W-001	100-2W-001	100-2W-001	100-2W-001
100-2W-002	100-2W-002	100-2W-002	100-2W-002	100-2W-002	100-2W-002
100-2W-003	100-2W-003	100-2W-003	100-2W-003	100-2W-003	100-2W-003
100-2W-004	100-2W-004	100-2W-004	100-2W-004	100-2W-004	100-2W-004

Maurini & Rossi	
LOCATION	Pessione, Iatro (IT)
PROJECT NO.	2017-061
P&ID Part 1: Thermal Block	
FILE	2017-061-P&ID-15.0
	4
	3
	2
	1
2018/01	A. Boggi - R. Viotello
DATE	PREP APPD REV
TVP SOLAR	

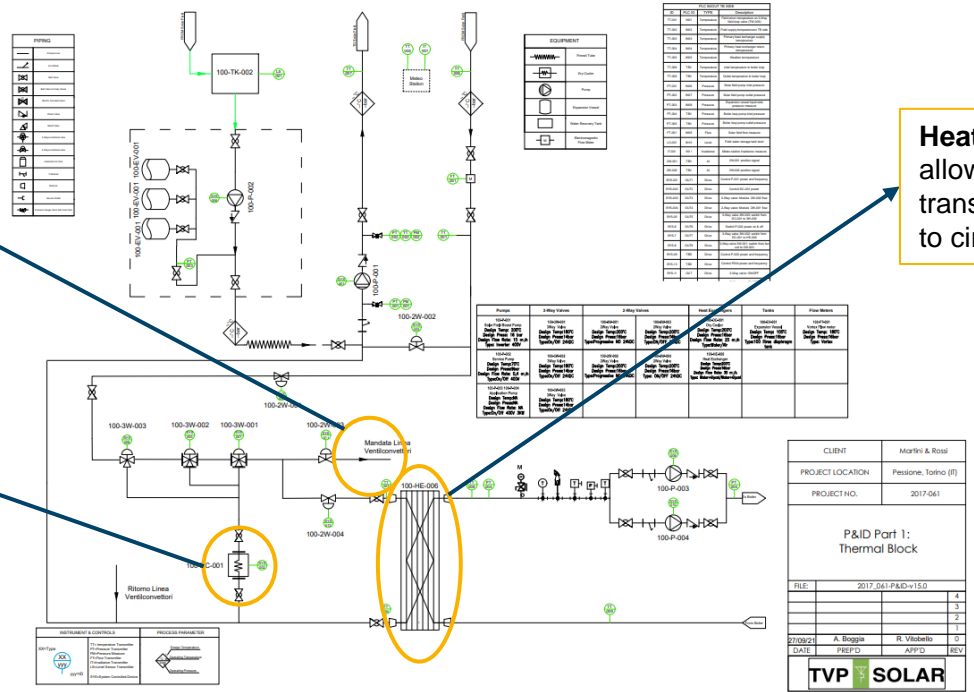
Focus on thermal block SHIP2FAIR

M&R Energy Source

Unit heaters pipeline

Heat Exchanger: To allow the energy transfer from circuit 1 to circuit 2.

Dry Cooler: To allow the energy dissipation, in case of emergency

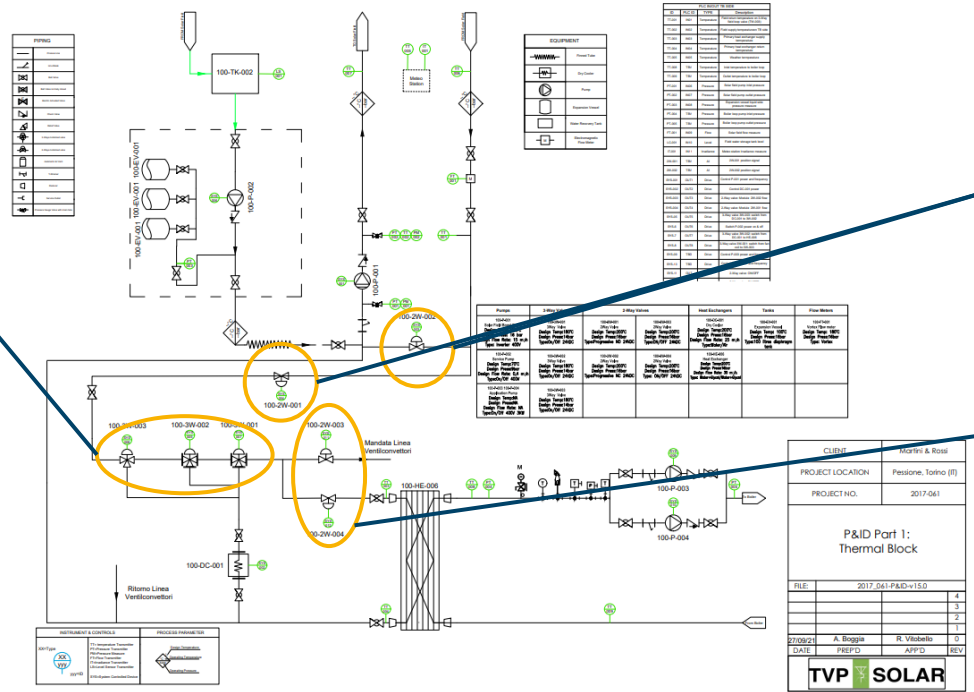


Focus on thermal block SHIP2FAIR M&R Energy Source

N°3 3-way valves for driving the flow to the Dry Cooler or the «Application»

N°2 2-way valves to send the flow to the thermal block

N°2 2-way valves to drive the flow to the Heat Exchanger or to the Unit heaters



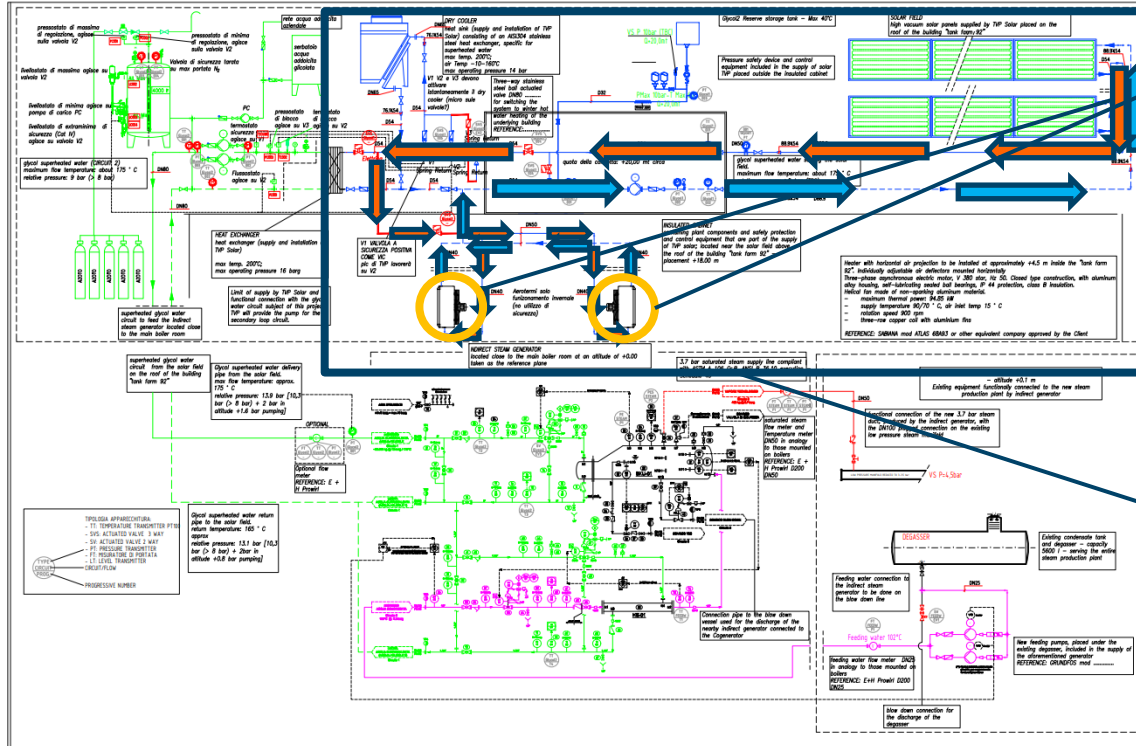
Winter Mode SHIP2FAIR Operation Mode details

Winter mode



Warm air

Between 60° C and 120° C hot water is sent to unit heaters



Unit Heaters: to provide energy to the environment

How the circuit 1 works in winter mode: Energy Production

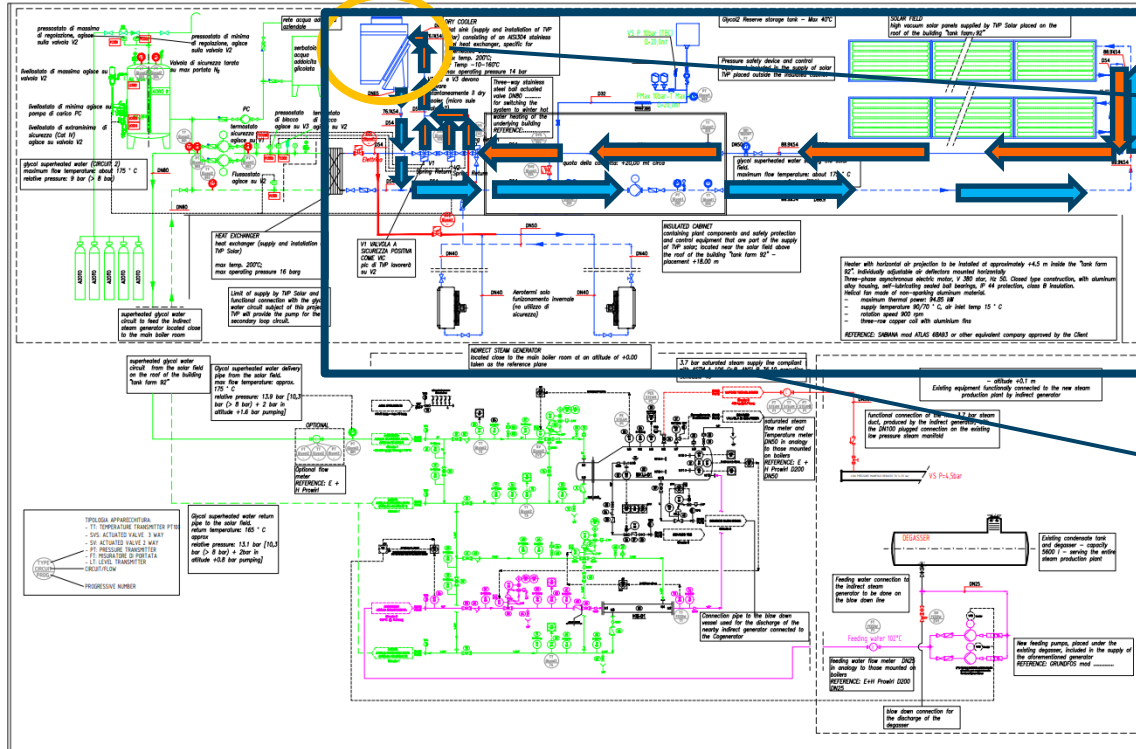
Winter Mode SHIP2FAIR Operation Mode details

Winter mode



Warm air

Between 60° C and 120° C hot water is sent to unit heaters



Dry Cooler

How the circuit 1 works in winter mode:
Dry Cooler – Heat Dissipation
Temperature above 120° C

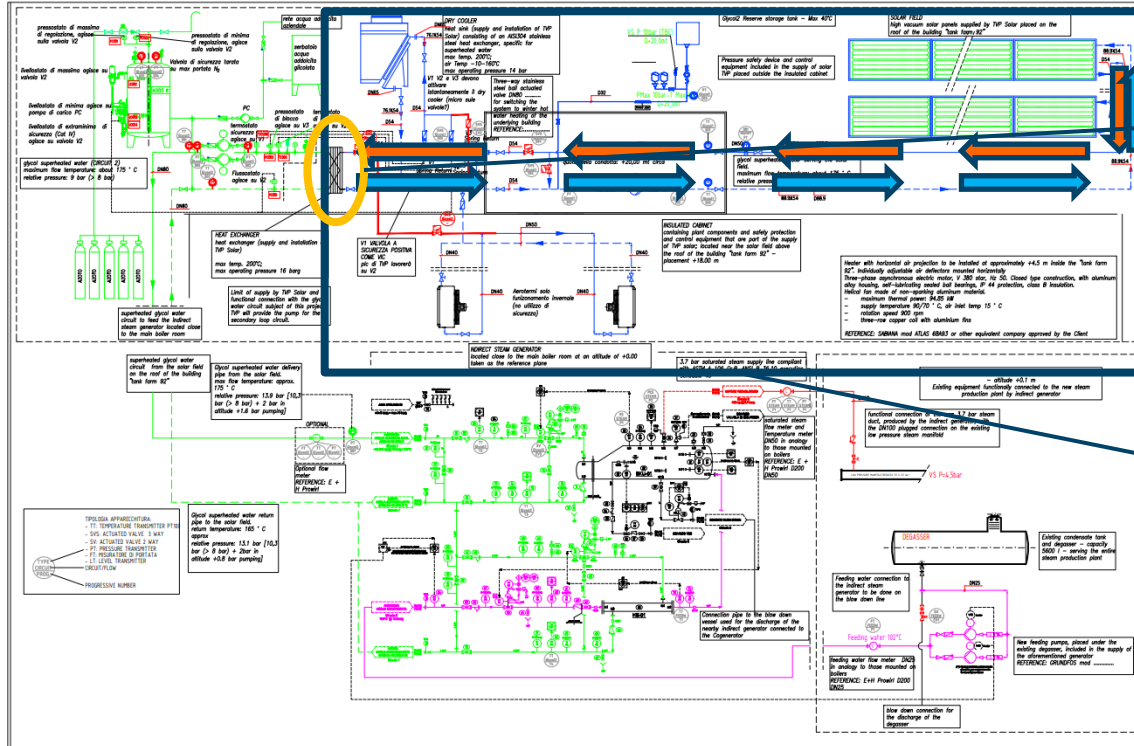
Summer Mode SHIP2FAIR Operation Mode details

Summer mode



Steam

3,7 bar saturated steam



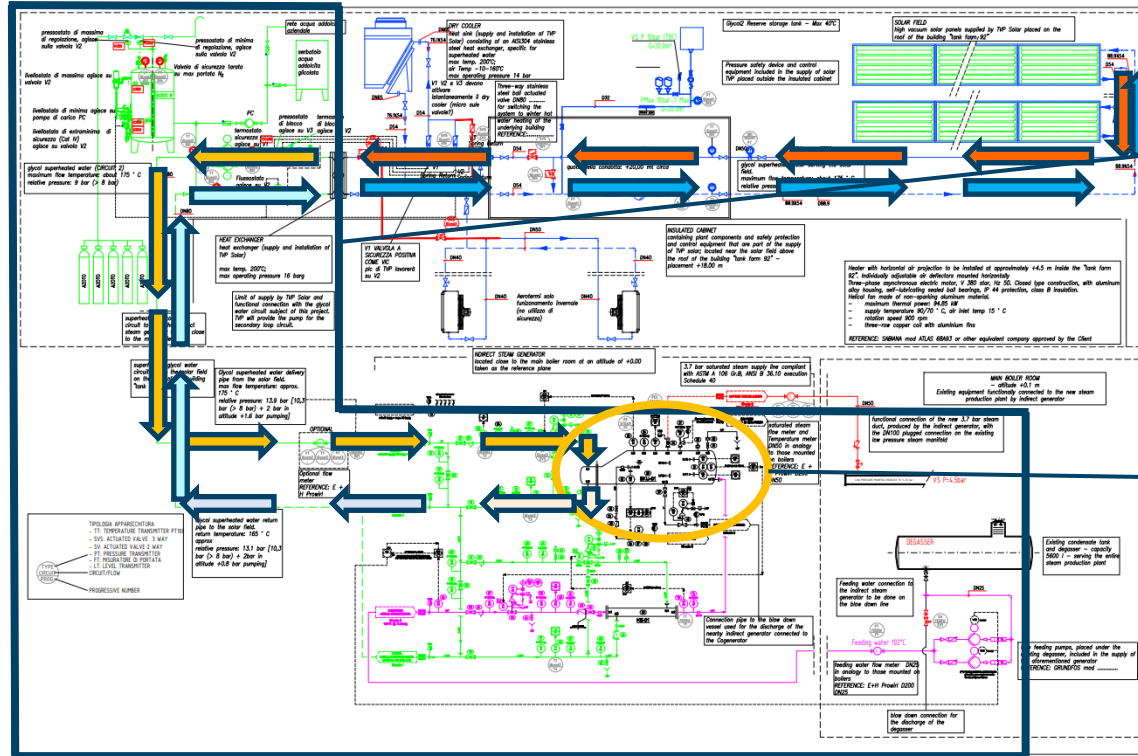
Summer Mode SHIP2FAIR Operation Mode details

Summer mode



Steam

3,7 bar saturated steam



How the **circuit 2** works in **summer mode: Energy Production.**

Indirect steam generator: To feed the main steam collector with new green 3.7 bar steam.

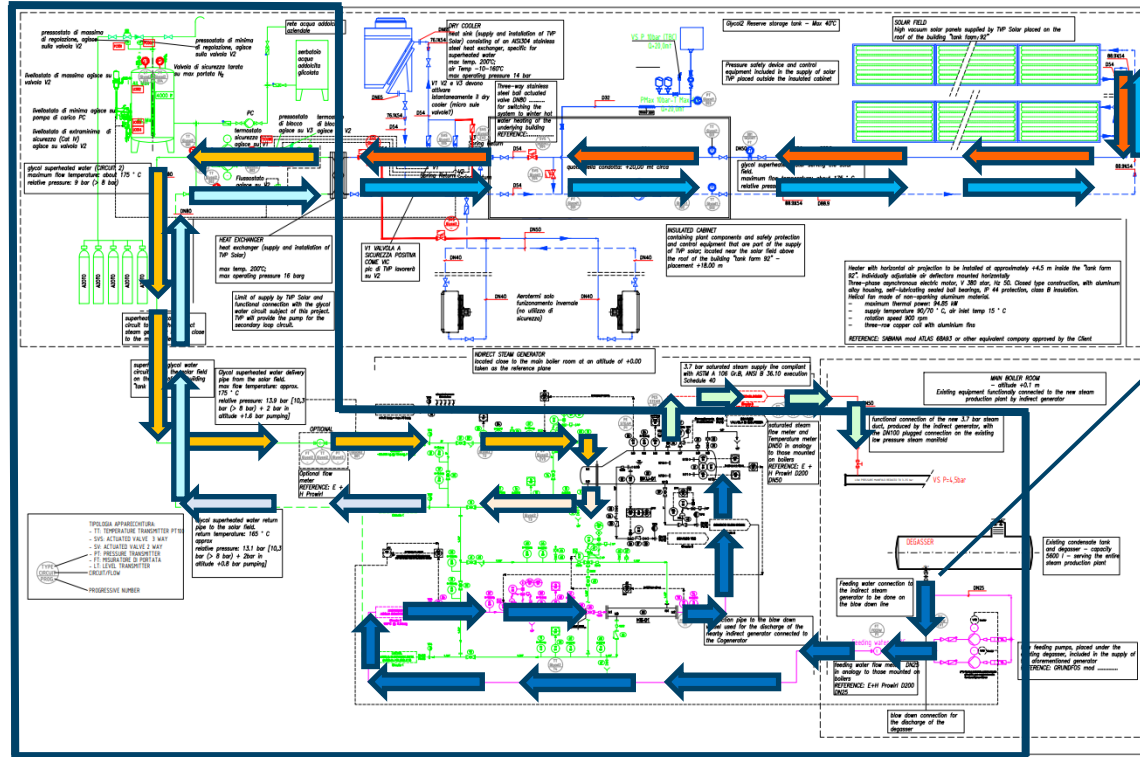
Summer Mode SHIP2FAIR Operation Mode details

Summer mode



Steam

3,7 bar saturated steam



Feed water circuit:
The water entering the ISG comes from the Degaser (104 °C)

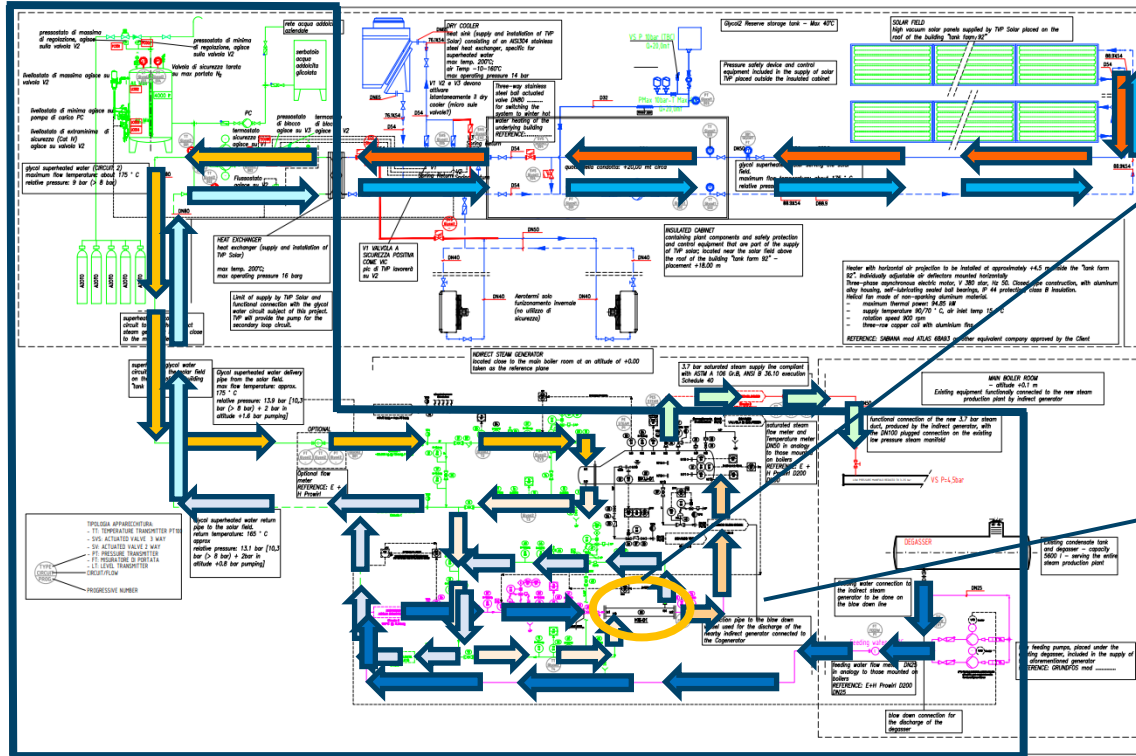
Summer Mode SHIP2FAIR Operation Mode details

Summer mode



Steam

3,7 bar saturated steam

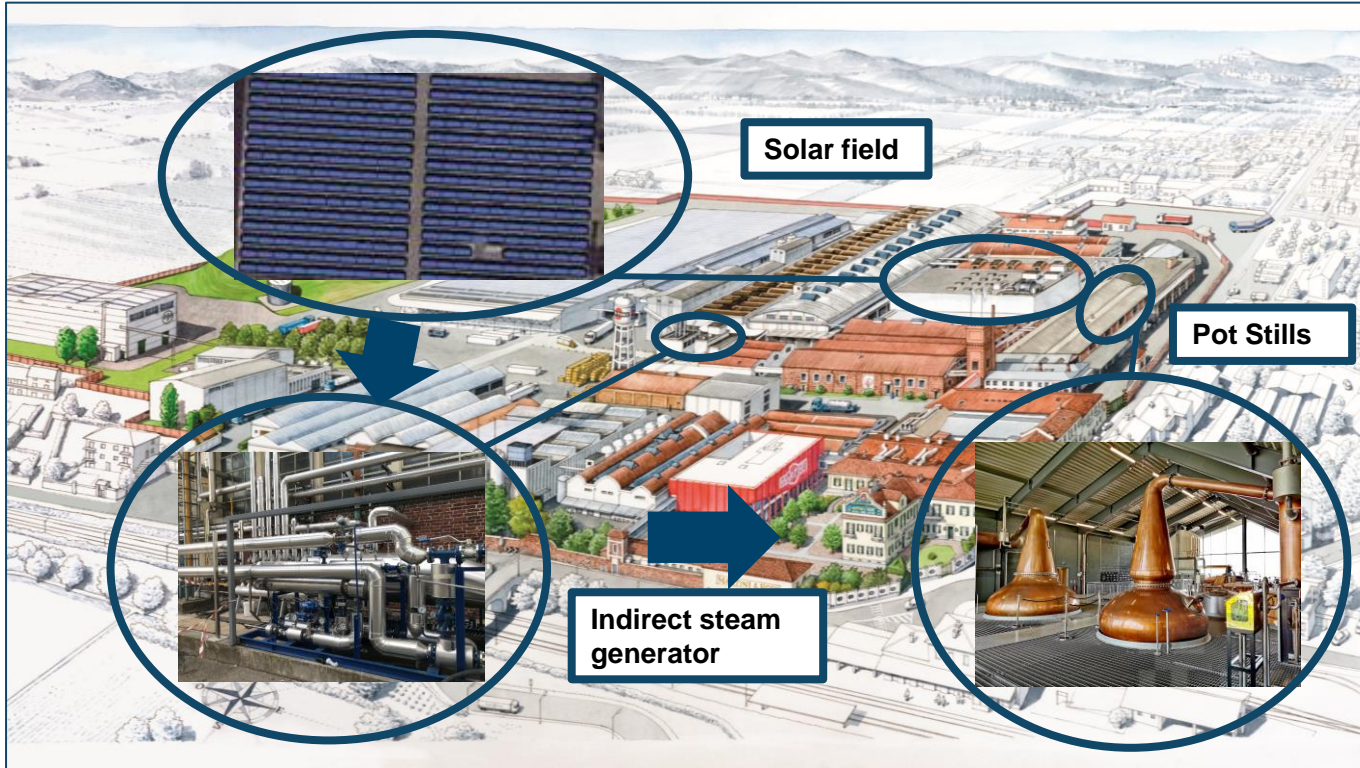


Heat Exchanger:
Used for pre-heating the water entering the ISG

Feed water circuit:
Before entering the ISG it is preheated using the return of circuit 2.

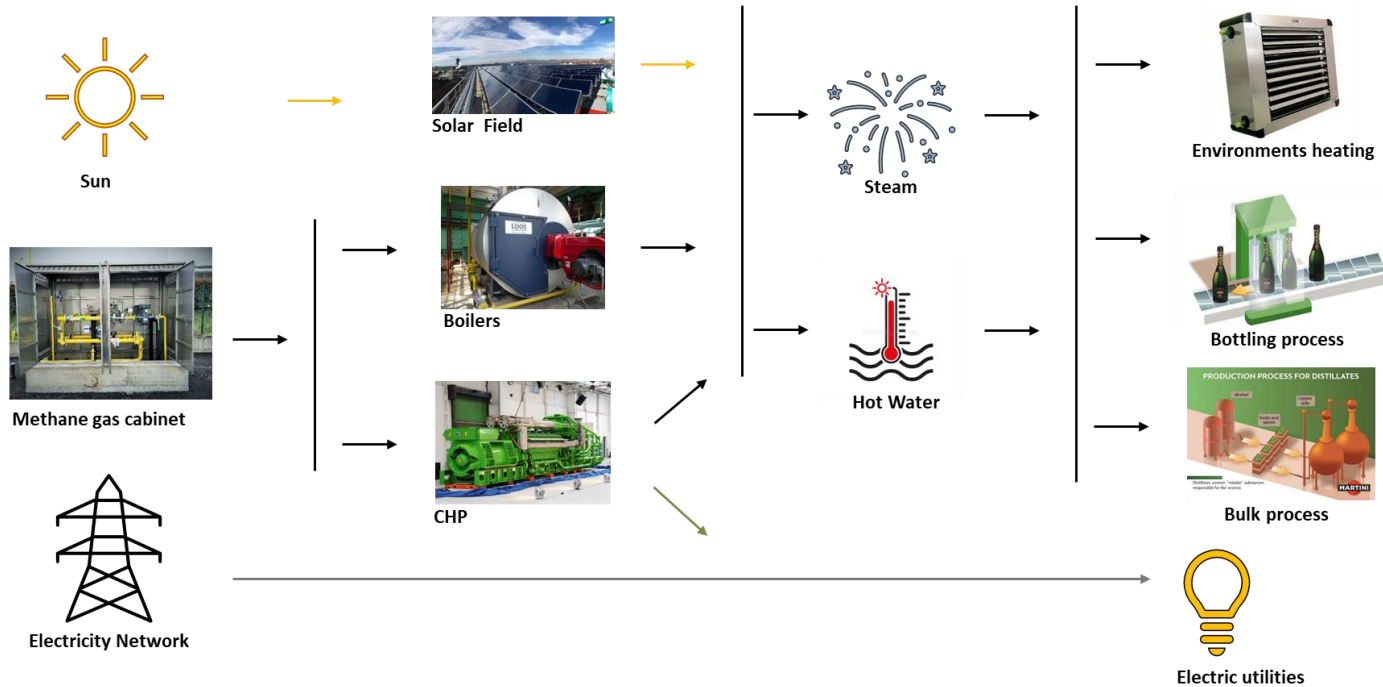
System Integration SHIP2FAIR

M&R Energy Architecture



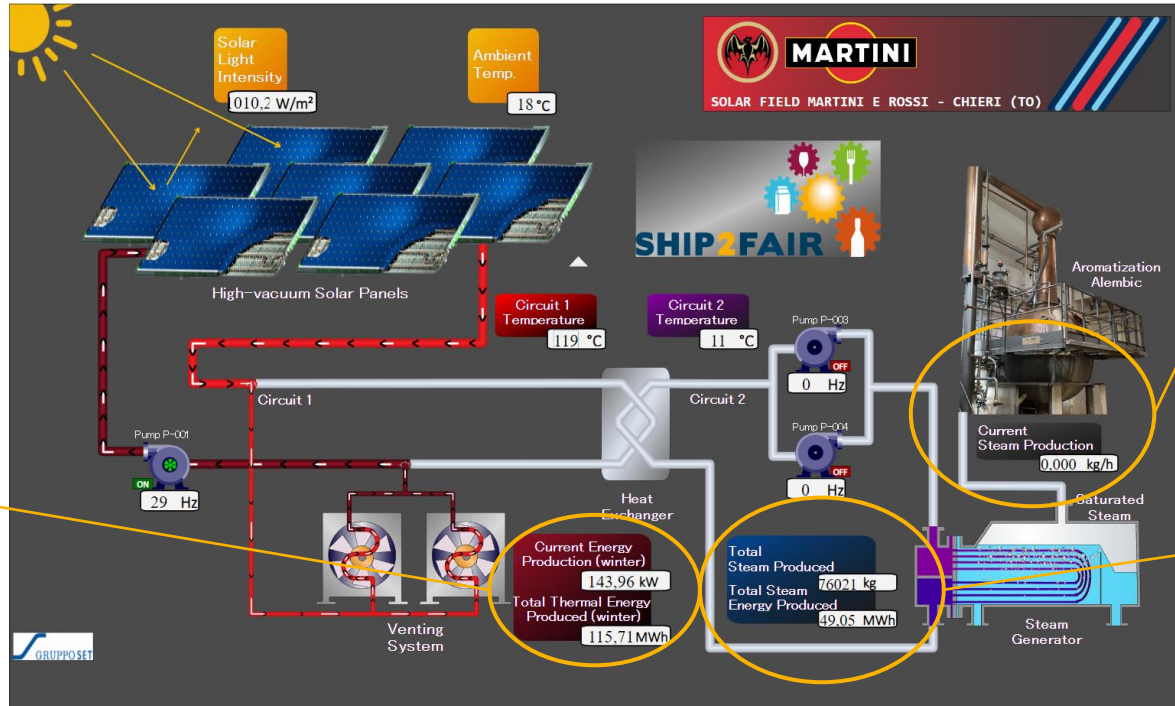
Solar Heat for Industrial Processes towards Food and Agro Industries commitment in Renewables

System Integration SHIP2FAIR M&R Energy Architecture



Solar Heat for Industrial Processes towards Food and Agro Industries commitment in Renewables

Technology Description SHIP2FAIR System integration



Total and real time energy production in Winter Mode

Real time steam production in Summer Mode

Total energy produced in Summer Mode

Lesson learnt SHIP2FAIR

3 main categories

Regulatory aspects

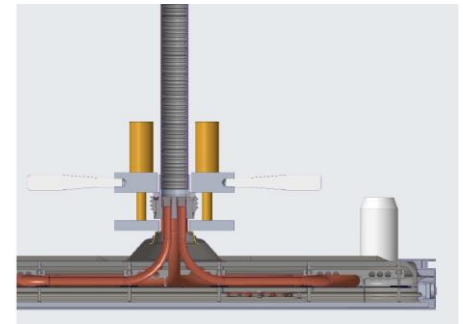
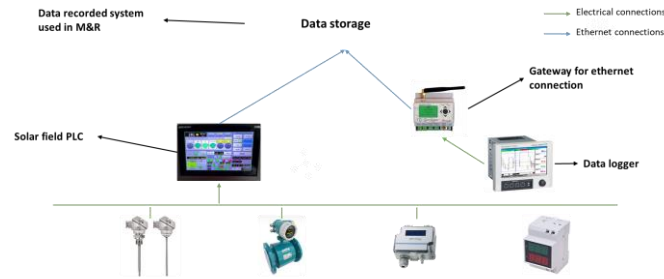
Due to the high temperatures and pressures reachable by the system, it is mandatory to meet the requirements for standard technologies. There is still no specific regulation for solar power plants in the industrial sector in Italy.

IT infrastructure

To enable the right interconnection between the system and the project partners, it was necessary to build a proper infrastructure compliant with both internal IT policies and project requirements.

Mechanical defeats

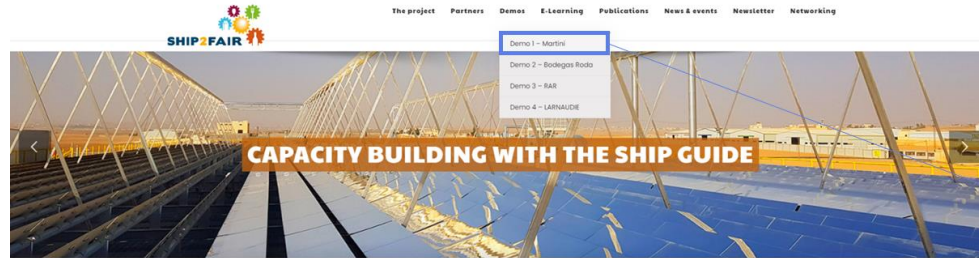
Due to the significant temperature differences between day and night, an in-depth analysis and testing phase was necessary on the mechanical components of the system.



Next steps SHIP2FAIR

Nr	Objective description	M&R Next Steps
1.	Systems operating modes.	Fine Tuning ongoing: <ul style="list-style-type: none"><li data-bbox="807 541 1763 615">• Finding the best solution for the settings of the two circuit pumps to maximize the efficiency of the heat exchange.<li data-bbox="807 628 1750 659">• Finding the best valve opening setting to maximize boiler efficiency
2.	Remote Supervision system	Create an IT infrastructure to allow TVP to enter the solar field PLC remotely for maintenance and analysis purposes.

ShipToFair Website SHIP2FAIR



HOME

SHIP2FAIR (Solar Heat for Industrial Process towards Food and Agro Industries commitment in Renewables) aims to foster the **integration of solar heat in industrial processes of the agro-food industry**. With this purpose, SHIP2FAIR will develop and demonstrate a set of tools and methods for the development of industrial solar heat projects during their whole life-cycle.

Demonstration and validation will take place at four real industrial sites, representative of the agro-food sector: **spirits distillation (Italy), fresh duck products manufacturing (France), sugar boiling (Portugal) and wine fermentation and stabilization (Spain)**.



Process: Distillation bottle warming and sanitification (steam production at 3 bar and 125°C)

Site: Pessione/Torino

Country: Italy

Longitude: E 7° 50' 16"

Latitude: N 44° 58' 15"

DNI: 1219 kWh/m²

Space opportunities: the site has availability of 1000 m² of rooftop

Description of the energy scenario

Heat demand: The thermal demand is quite constant during the whole year, while the variation of fuel consumption is caused by weather conditions.

The process works fully operative 16 hours per day during the working days and it is at base load (mostly for anti-icing purpose particularly in winter) during Saturdays and Sundays.

Solar Heat for Industrial Processes towards Food and Agro Industries commitment in Renewables

agiummule@bacardi.com

Solar Heat for Industrial Process towards Food and Agro Industries commitment in Renewables



SHIP2FAIR

Suitable business and financing schemes for SHIP* installation

*Solar Heat for Industrial Processes

SHIP2FAIR FINAL EVENT
“Decarbonisation of the agro-food industry with solar heat: technologies and processes”
Sustainable Places 2023, 15 June 2023



Dimitrios Papageorgiou



Irapua Ribeiro



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SHIP Market Prospects SHIP2FAIR Summary



Several successful stories of [implemented projects](#) around the world



Diverse funds resources available for SHIP projects



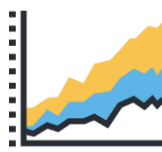
Decreasing SHIP costs throughout time



High fossil fuels prices & climate commitments boost [solar thermal market](#)



Possible alternative for several segments of the industrial sector



Trending technologies for the last 15 years

Solar Heat for Industrial Processes towards Food and Agro Industries commitment in Renewables

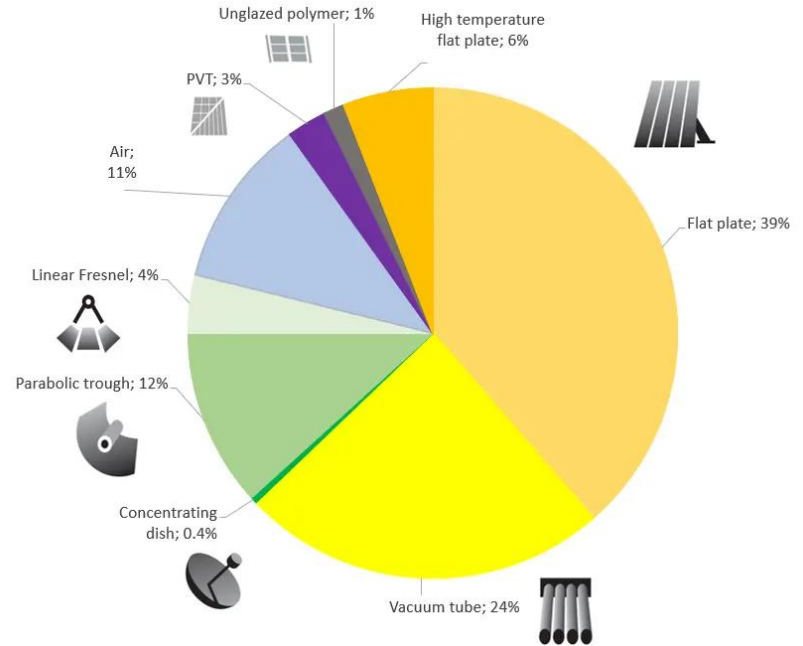
SHIP Market Prospects SHIP2FAIR

A dynamic market

High level of dynamism on the SHIP world market in 2022

	2017	2018	2019	2020	2021	2022	Total until 2022
No. of SHIP systems	107	99	86	85	71	114	at least 1,089

Source: SolarThermalWorld



Stats of 2022 by technology type

Solar Heat for Industrial Processes towards Food and Agro Industries commitment in Renewables

SHIP Project Value Chain SHIP2FAIR Stakeholders

Industrial Companies

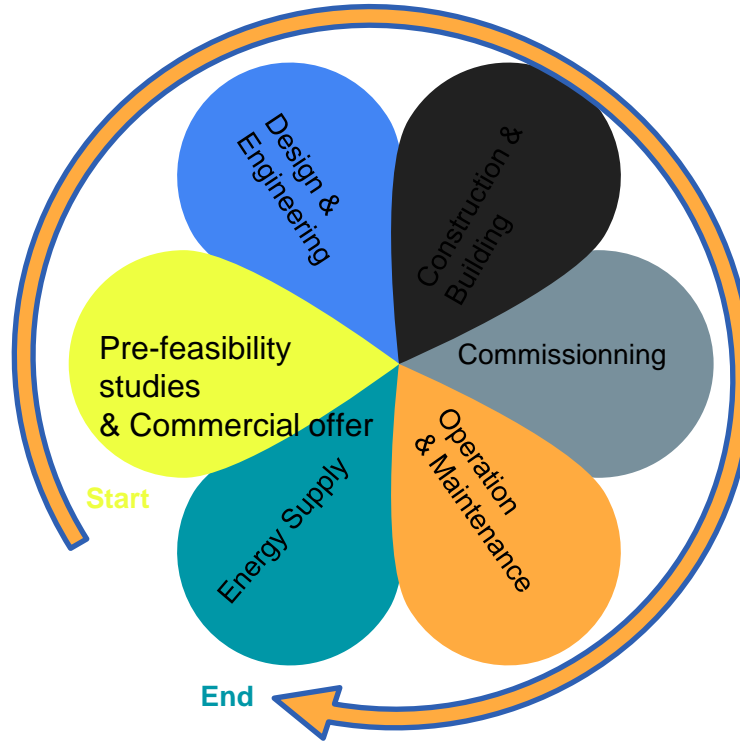
Industrial companies whose heat demand fits the range of application of solar thermal (i.e. the agro-food industry). They are the potential clients in the value-chain

Energy/Heat Suppliers

Companies that are supplying heat to their customers. They can also assume the role of facility operator

Government, Policy Makers, European organisations and national institutions

Policy makers in charge of changing regulation related to renewable heat sources. They shape the environment within the different players evolved. They provide guidance for the development of less traditional systems



Energy Consulting Companies

Companies that help their customers make informed choices about their energy consumption/provisions. They can also assist them in the building phase

Solar Thermal Equipment Manufacturers or suppliers

Companies that manufacture the different types of solar thermal equipment

Third party investors

investment companies that specialises in the third-party financing of renewable heat production projects and energy efficiency projects.

EPC Contractors and O&M

Third party in charge to physically build the installation once materials and detailed design are provided. This role could be assumed by the equipments manufacturers or supplier

Solar Heat for Industrial Processes towards Food and Agro Industries commitment in Renewables

SHIP Project Launch

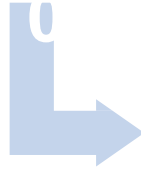
SHIP2FAIR

Sales engagement process flow

Phase

“Discovery Estimate”

- Quick assessment of the solar heat potential
- FREE



Phase

“Feasibility Study”

- Site-unseen engineering study
- FREE or on a fee basis (depending on the case)



Phase

“Engineering Study”

- Full-spec engineering study + bill of components
- On a fee basis



Phase

Turnkey Contract/ Heat Purchase Agreement

- Signed contract / agreement

BUSINESS MODELS

SHIP2FAIR Business Model SHIP2FAIR

Business Model Options

Build & Handover Model

- ❑ The industrial customer pays for & operates the solar thermal system
- ❑ Optional operation & maintenance contract

Build & Operate Model

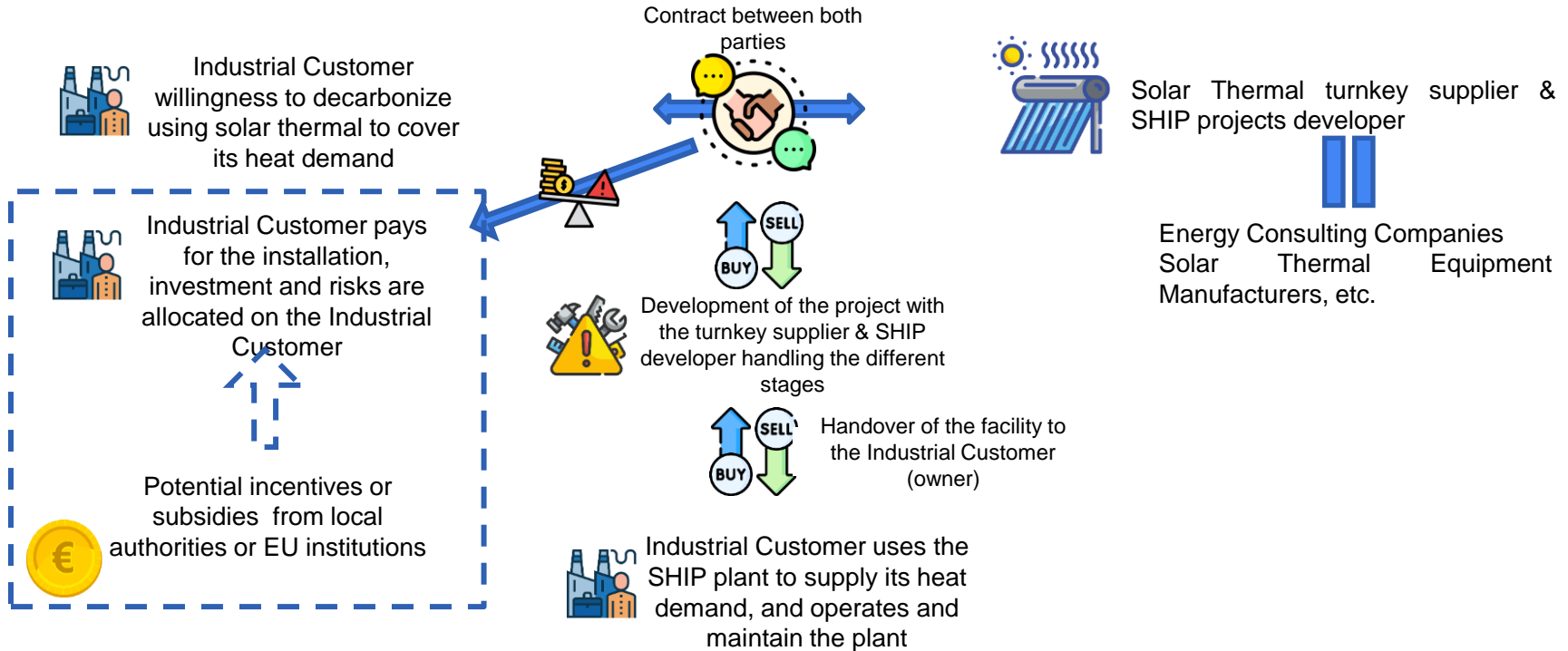
- ❑ SHIP project developer pays the investment cost, owns & operates the solar thermal system
- ❑ The industrial partner buys solar heat

Hybrid Model

- ❑ Like the Build & Operate model with one difference:
- ❑ After 10 or 15 years of operation the ownership of the solar thermal system is transferred to the industrial customer

SHIP2FAIR Business Model SHIP2FAIR

Business Model – Build & Handover



SHIP2FAIR Business Model SHIP2FAIR

Build & Handover: SHIP2FAIR Demo-sites

Business model:

- Build
- Demonstrate (fine-tune)
- Transfer the ownership (*not applied in RODA case)



O&M & R App. Turin agreement



BODEGAS
RODA
RIOJA ALTA

RODA, La Rioja, ES



Jean Larnaudie, Castelnaudary, FR

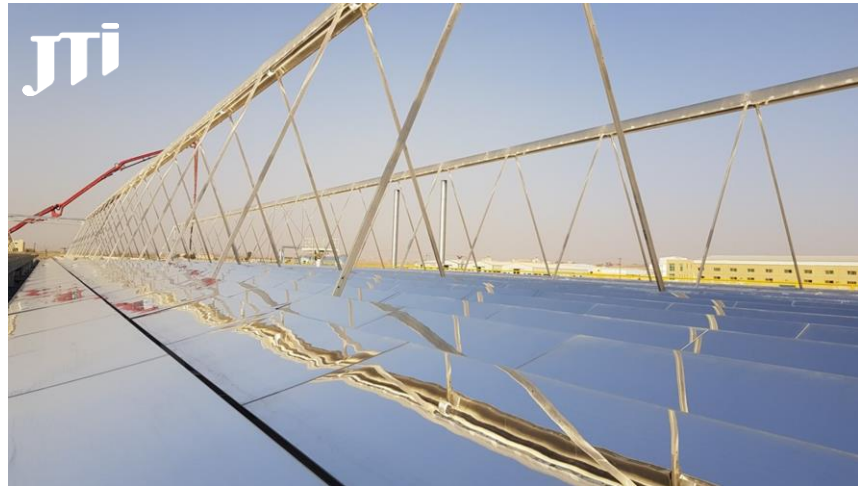


SHIP2FAIR Business Model SHIP2FAIR

Build & Handover: other examples

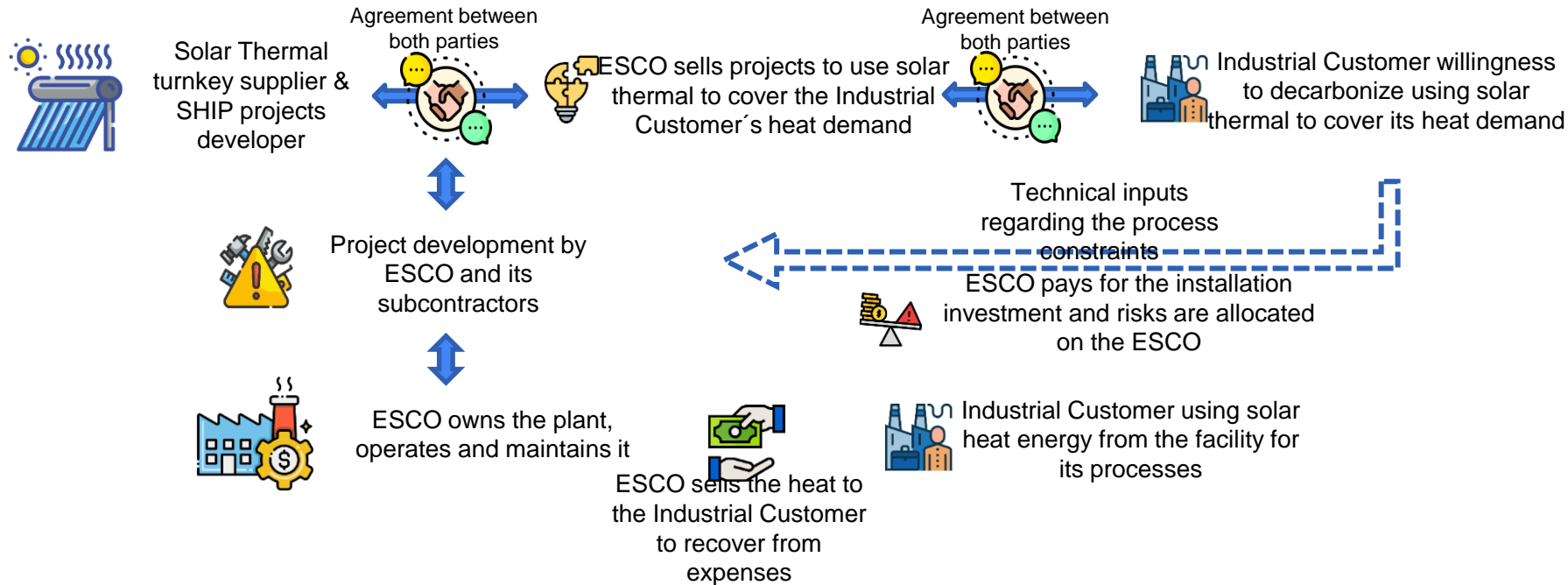
- Business model:**
- Build
 - Transfer of ownership
 - O&M support agreement in place since 2017

**JTI Jordan,
Amman**



SHIP2FAIR Business Model SHIP2FAIR

Business Model – Build & Operate



Also known as: HPA - Heat Purchase Agreements

SHIP2FAIR Business Model SHIP2FAIR

Build & Operate: Example of Solar District Heating

Dorkwerd project, Groningen, NL

Project developer:	Novar (Solarfields), NL
Connected consumers:	10'000 citizens
Annual solar share:	25% of heating needs
Solar field:	Tech provider: TVP Solar Capacity: 37MW Heat delivery: 25GWh/y Size: 48'000 m2



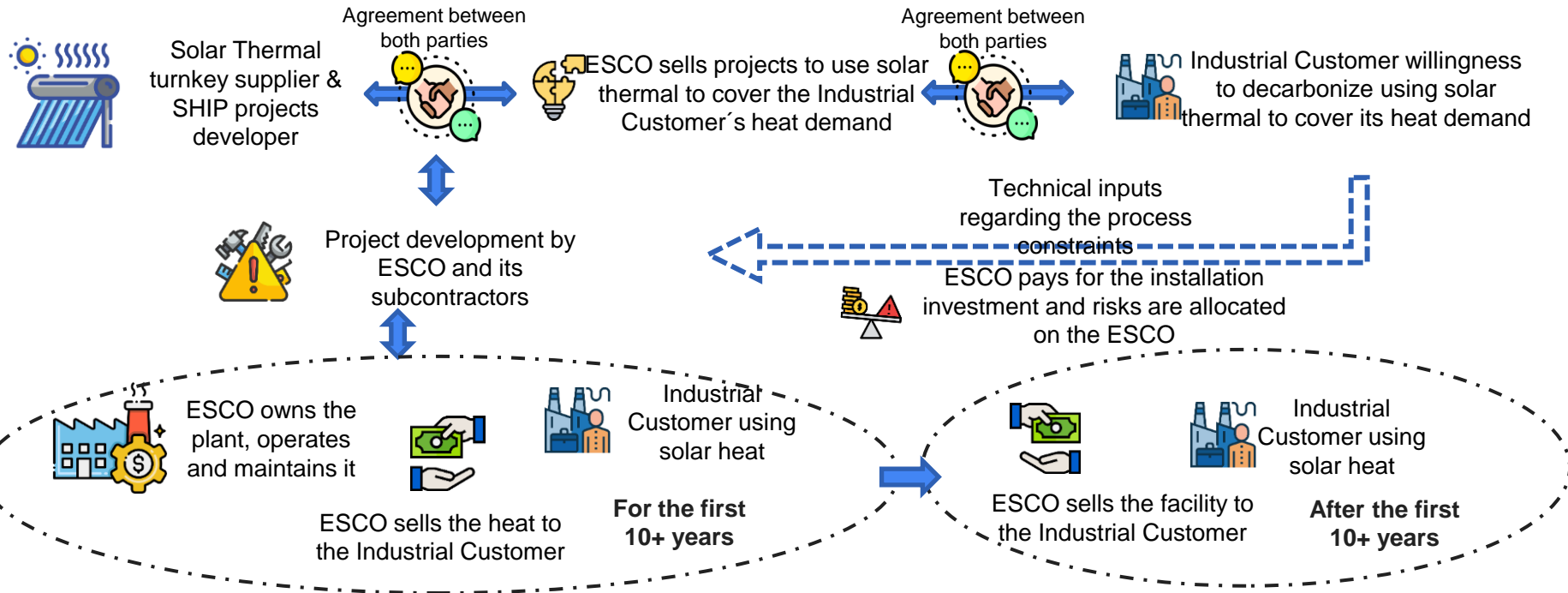
Business model

A Special Purpose Vehicle (SPV) was founded by the:

- ⇒ Project developer (Novar)
- ⇒ Investor (K3)
- ⇒ Technology provider (TVP Solar)

The SPV owns & operates the SDH system
A 30-year Heat Purchase Agreement (HPA) has been signed with local DHN operator (utility Warmtestad)

SHIP2FAIR Business Model SHIP2FAIR Business Model – Hybrid



Solar Heat for Industrial Processes towards Food and Agro Industries commitment in Renewables

Funding Programmes & Incentives

SHIP2FAIR Incentives for Solar Thermal

SHIP2FAIR Overview of funding schemes in Europe

European Funding Programmes

- ❑ [Innovation Fund](#)
- ❑ [LIFE](#)

Type of funding: grants
as a % on the project
eligible cost

National/ Regional Funding Programmes / Subsidies

- ❑ Using national financial resources
- ❑ Using a mix of national &
European financial resources

Type of funding: grants or subsidies
on the capital expenditure, tax
exemptions, loans under
advantageous conditions, feed in
tariffs, etc.

SHIP2FAIR Incentives for Solar Thermal SHIP2FAIR The Innovation Fund

Production and use of
Renewable energy

*including manufacturing plants for
components*

Carbon Capture Use and
Storage

Scaling up clean tech

Energy-intensive
industries

including substitute products

Energy storage

*including manufacturing plants for
components*

The IF supports:

- Highly innovative technologies
- Sufficiently mature
- With strong potential to reduce GHG emissions

Details [here](#)

Funding available for:

- Small-scale projects: projects with a capital expenditure between €2.5 and 7.5 million
- Large-scale projects: > €7.5 million

Key features

Volume of at least **EUR 38 billion** until 2030 (at EUR 75 carbon price)

Support of up to **60% of CAPEX**
(small-scale)

40% of grant disbursed at financial close

Financed from the revenues of the **EU Emissions Trading System**

Annual calls for large-scale and small-scale projects (CAPEX < EUR 7.5 million)

60% of grant disbursed during construction and 3-years operating period against GHG emission avoidance

SHIP2FAIR Incentives for Solar Thermal SHIP2FAIR

National funding institutions – EU examples

[Austria: BMK \(Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie\)](#)

[France: ADEME](#)

[Germany: BAFA \(Federal Office for Economic Affairs and Export Control\)](#)

[Italy: MISE \(Ministero Sviluppo Economico\)](#)

[Spain: IDEA \(Institute for Diversification and Energy saving\)](#)

Further fundings for commercial and R&D projects

[IEA Task 64: Collection of available solar process heat related national and trans-national research and funding programs](#)



Solar Heat for Industrial Process towards Food and Agro Industries commitment in Renewables

SHIP2FAIR Replication Studies

Giorgio Bonvicini / Irapuã Ribeiro

15.06.2023

Sustainable Places Workshop



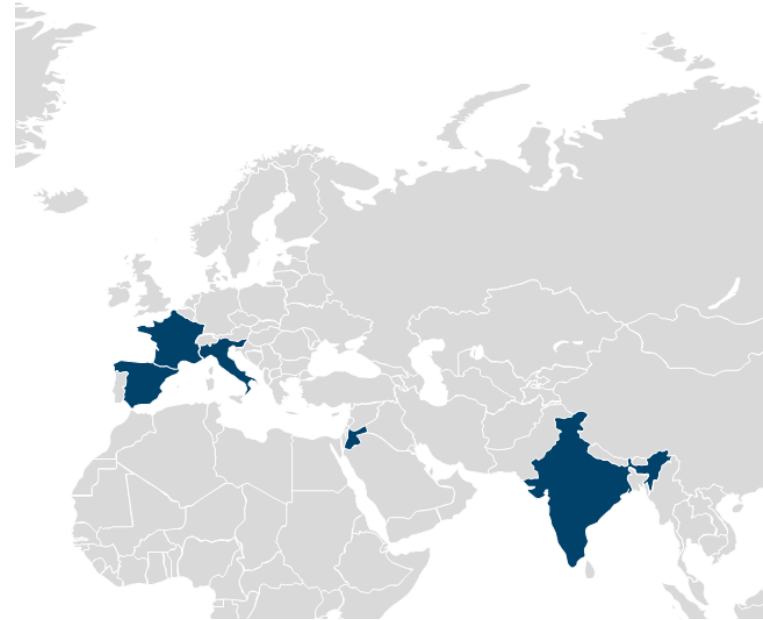
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SHIP2FAIR Replication Studies

SHIP2FAIR

- **10 industrial sites**
- **8 industrial sectors** (textile, chemical, wastewater treatment, dairy, meat curing, brewery, food, laboratory)
- **6 Countries** (Italy, Spain, France, Slovenia, Jordan, India)
- **Heat demand between 30°C and 195°C**

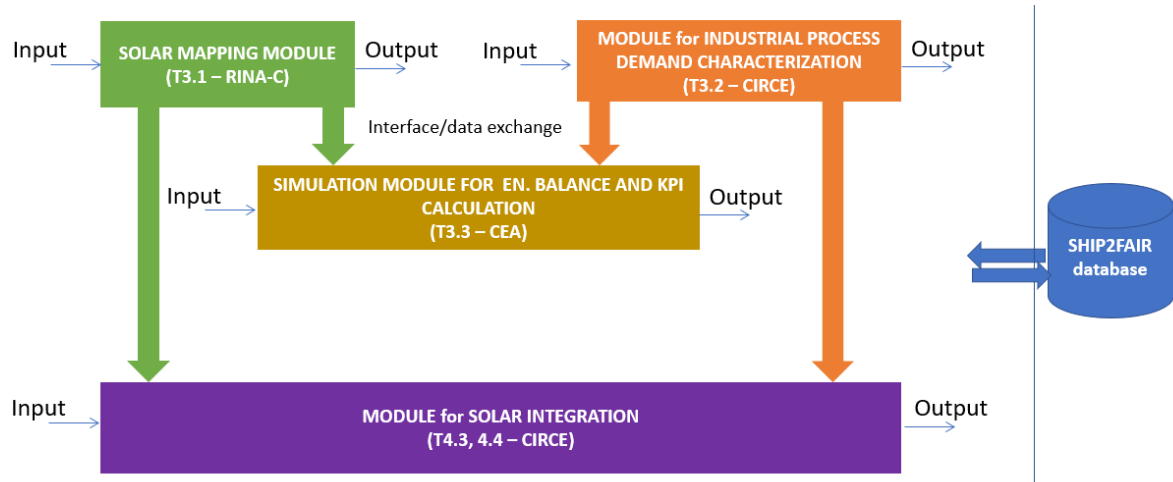


Scope of Replication Studies

Scope of the pre-feasibility studies:

1. **Preliminary analysis** of the potential for solar integration in the industrial processes
2. **Full pre-feasibility study** through the SHIP2FAIR Replication Tool
3. **Results discussed** and fine-tuned to find suitability to each case
4. **Direct contact with solar thermal technology providers** to proceed with further studies
5. **Discussion of results before publishing** the report and possibility to protect confidential data by avoiding any reference to the specific site

Replication Tool





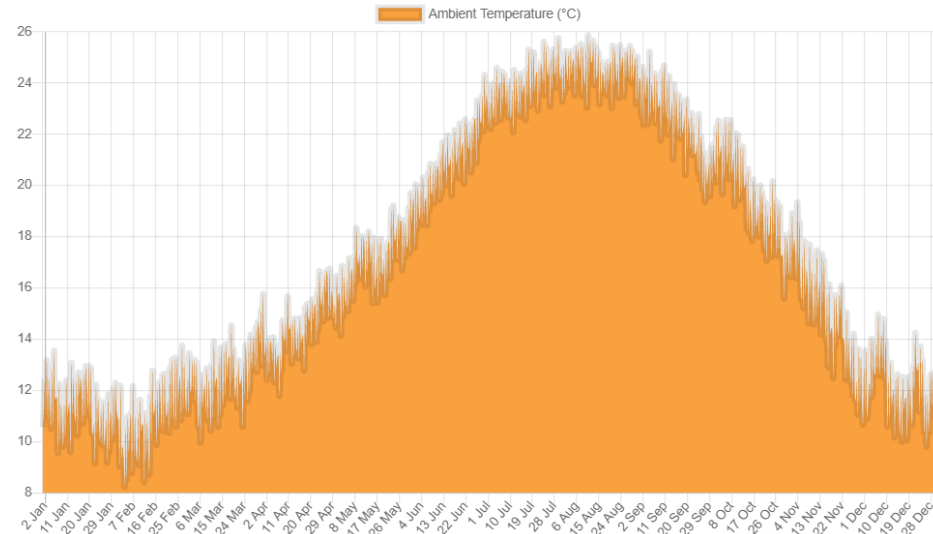
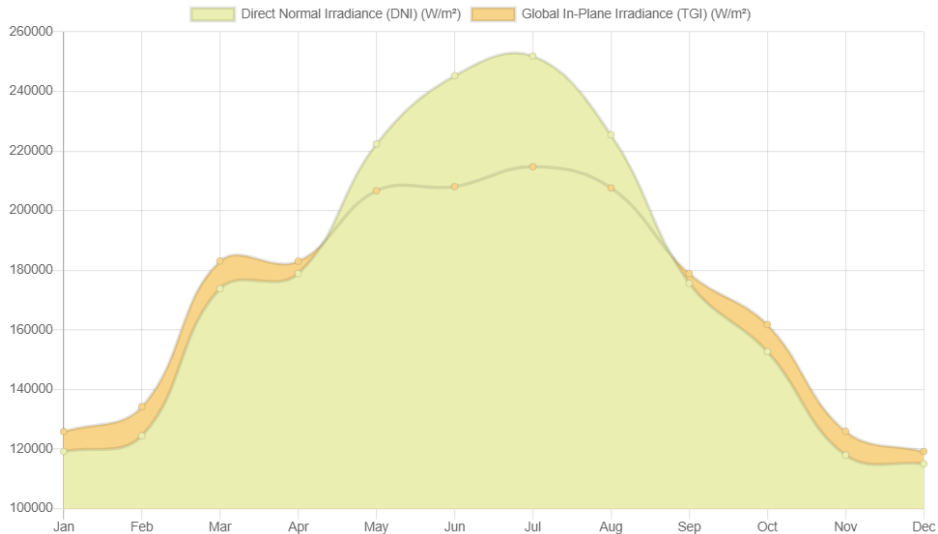
Replication Study: Chemical Industry

Replication Study – Chemical plant

- **Location:** Tarragona, Spain
- **Main products:** industrial cleaners, personal care products, and emulsionants.
- **Current heat supply:** natural gas steam boiler, 4 MW nominal power
- **Processes:**
 - ❑ several processes, running 24/7
 - ❑ analyzed process works at 195°C with steam at 13 bar
- **Annual thermal demand:** 13.205 MWh
- **Annual associated CO2 emissions:** 3401 tons

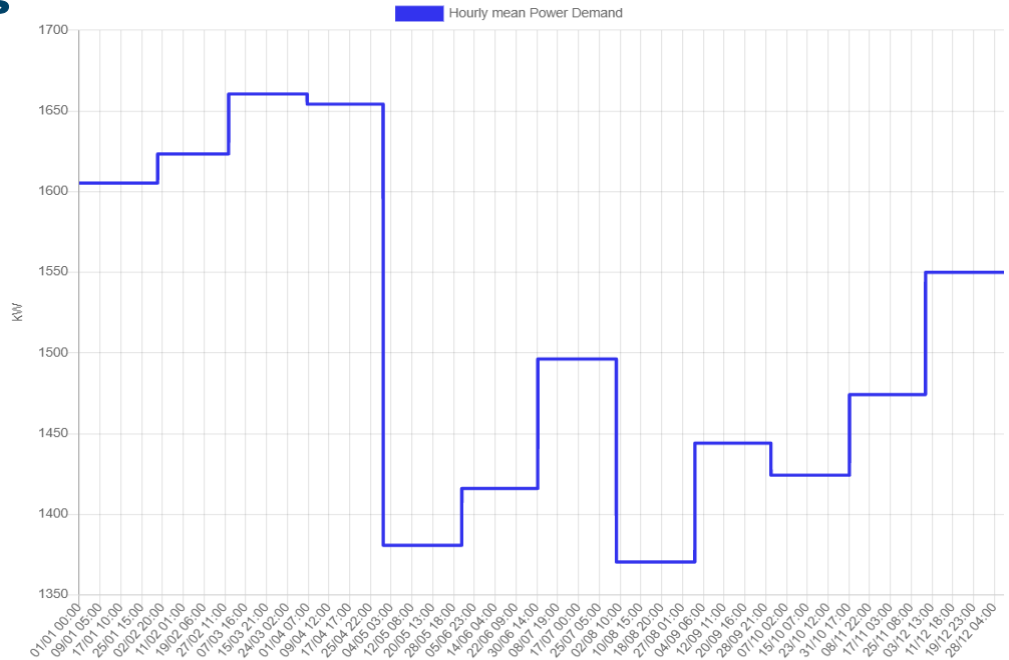
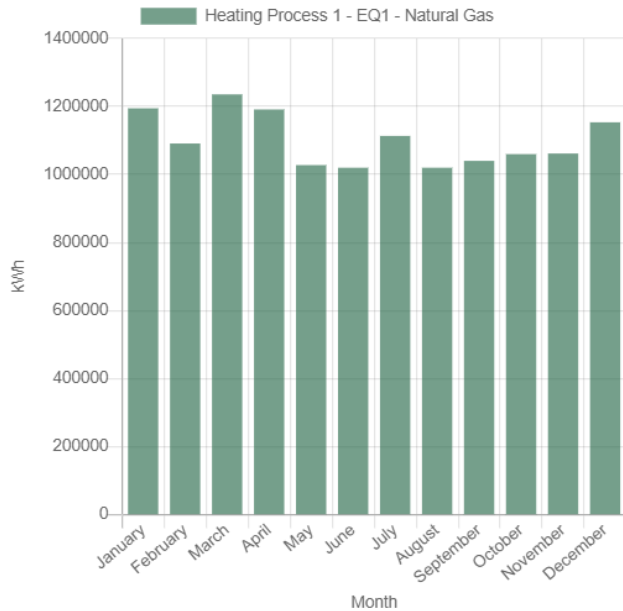
Replication Study – Chemical plant

Solar Mapping Module Results



Replication Study – Chemical plant

Thermal Demand Module Results



Replication Study – Chemical plant

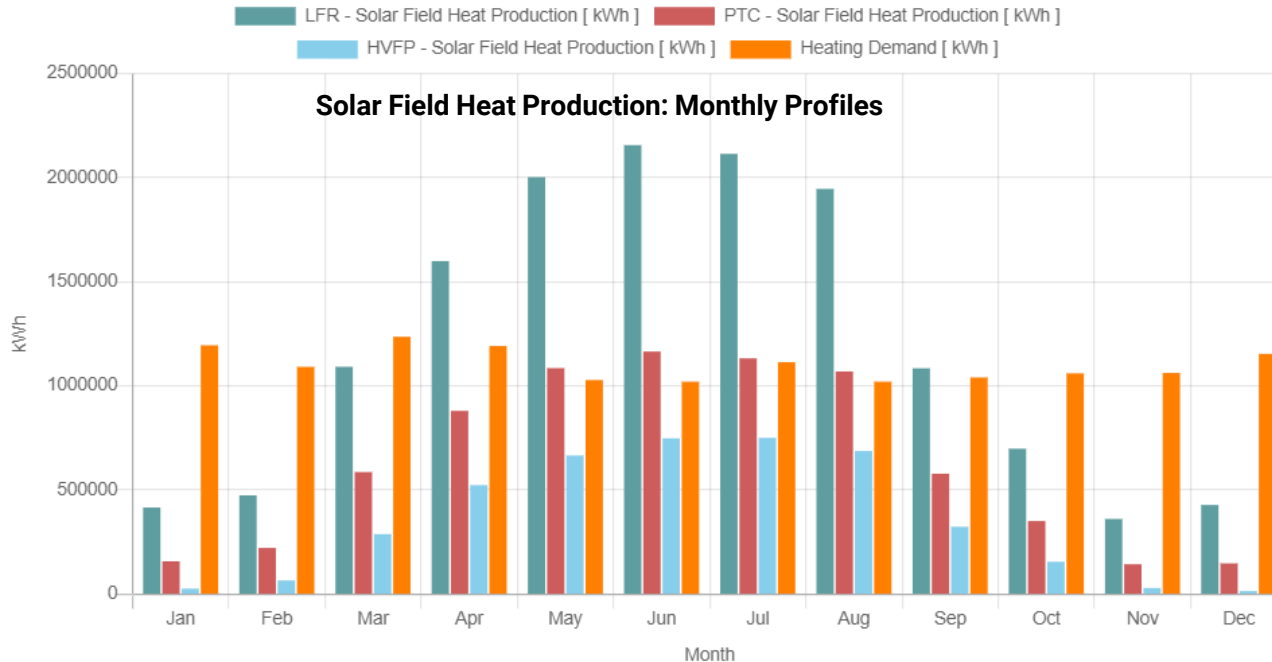
Simulation Module – Technology selection

Available area: ground 26.245 m²

Technology selected	Collector aperture area
Parabolic Trough Collectors (PTC) -----	13,123 m ²
Linear Fresnel reflectors (LFR) -----	19,684 m ²
High Vacuum Flat Plate (HVFP) -----	14,566 m ²

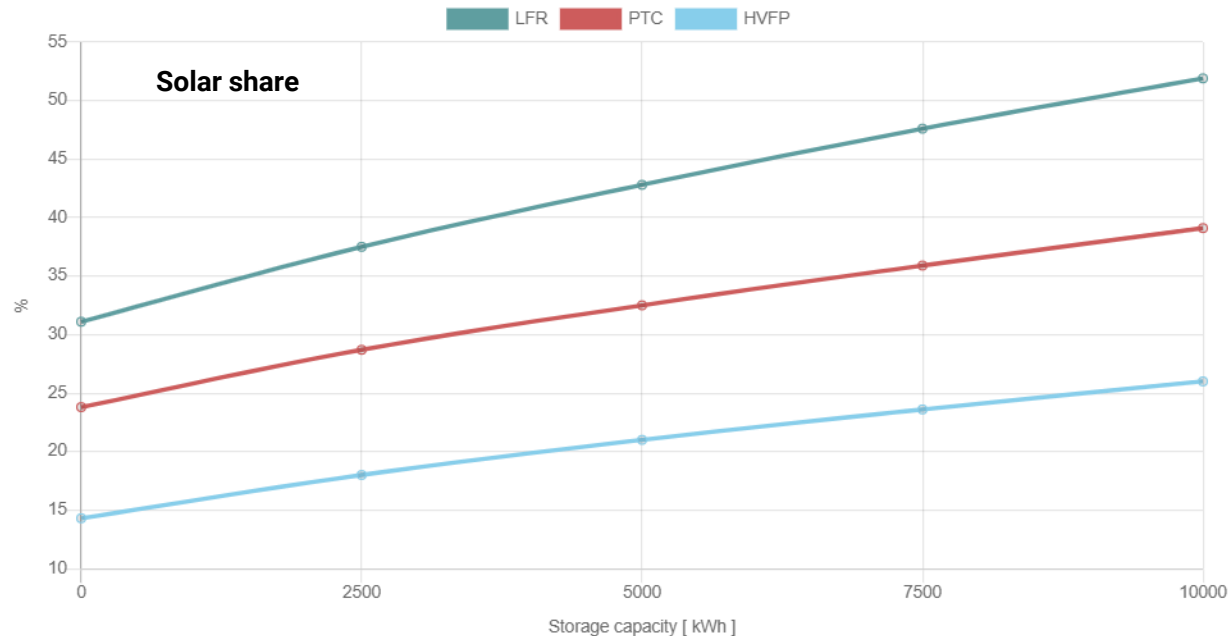
Replication Study – Chemical plant

Simulation Module Results



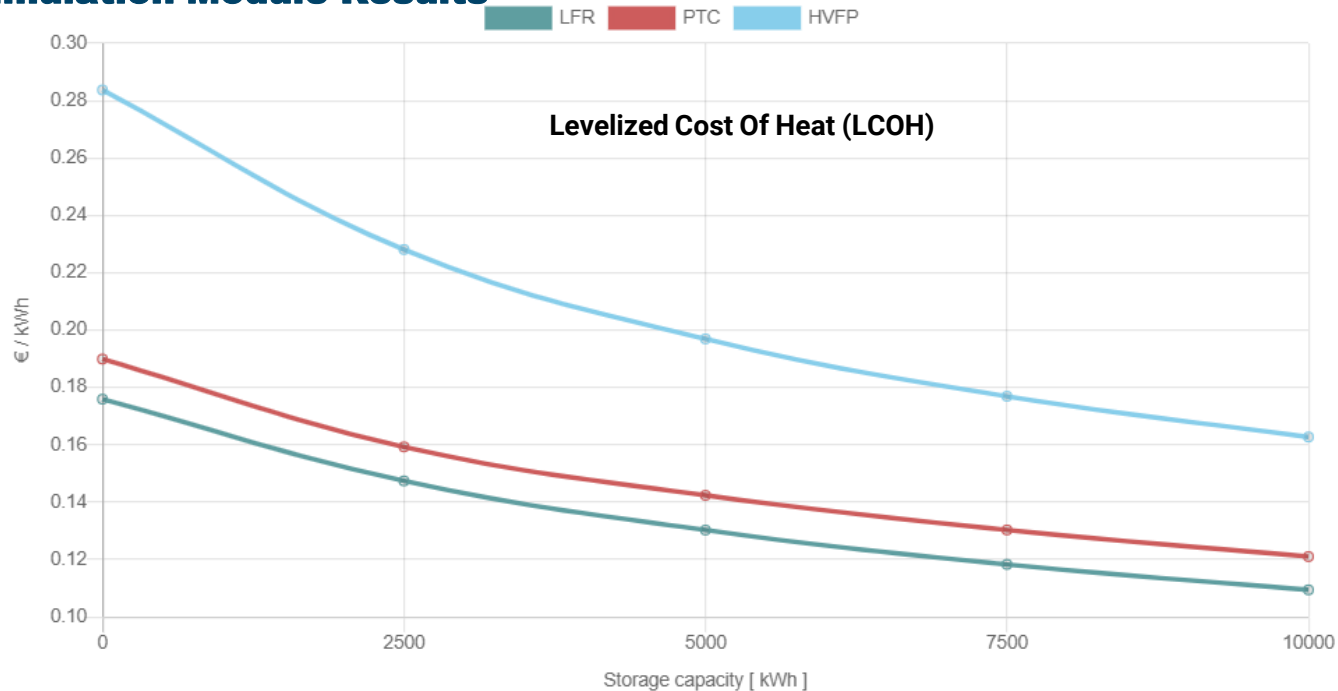
Replication Study – Chemical plant

Simulation Module Results



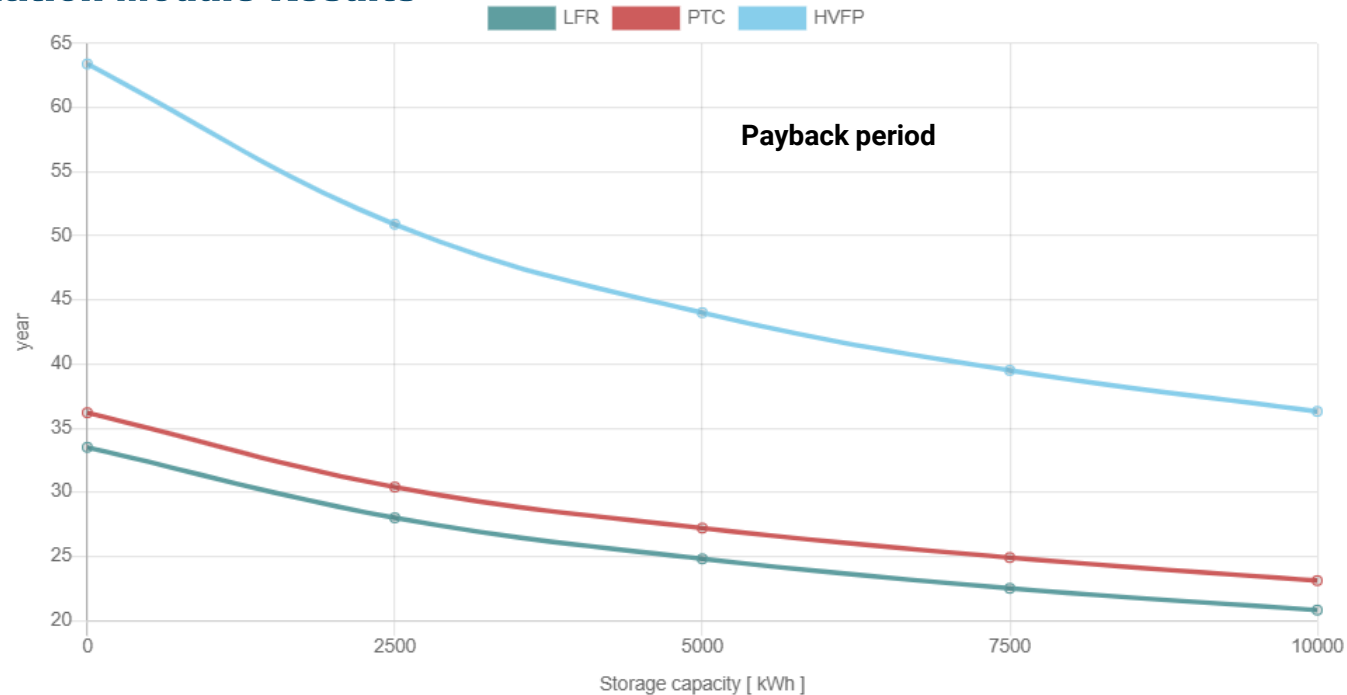
Replication Study – Chemical plant

Simulation Module Results



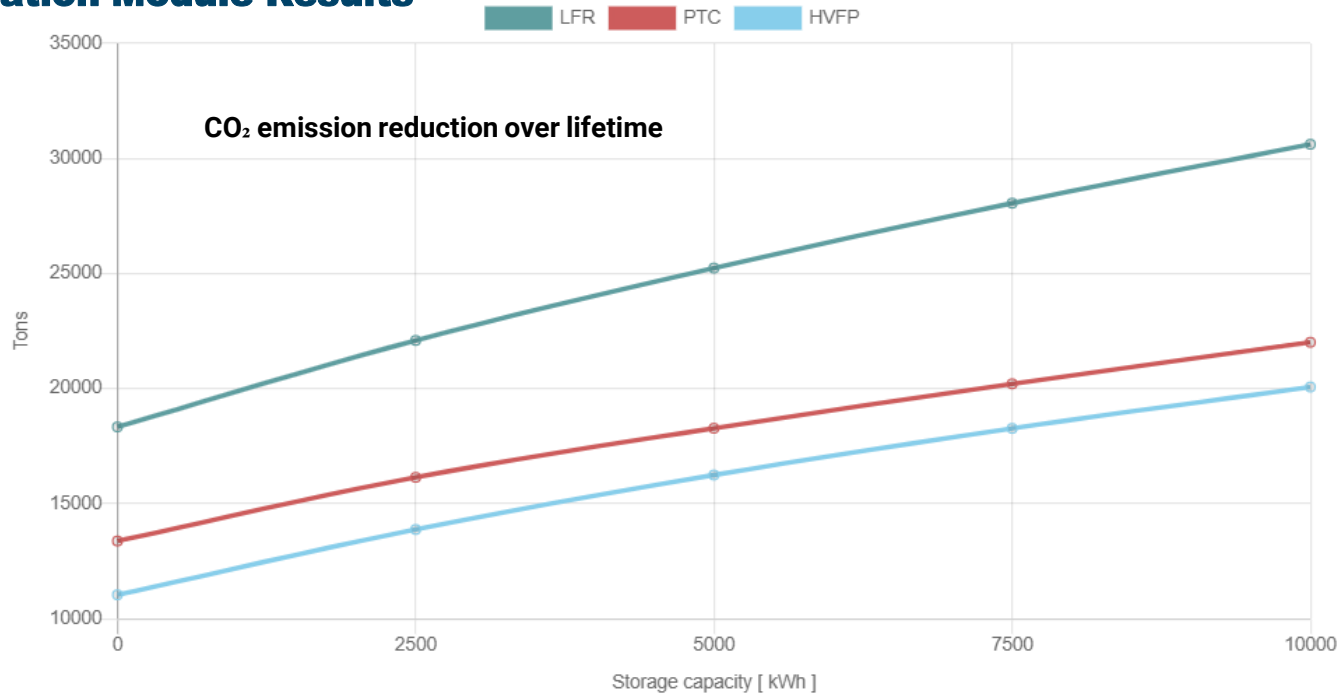
Replication Study – Chemical plant

Simulation Module Results



Replication Study – Chemical plant

Simulation Module Results



Replication studies: discussion

Summary of Replication Studies

	Thermal Demand Temperature	Best Technology Selected	Collectors Area	LCOH	PBT	Solar Share	GHG Emissions Avoided
	°C	-	m ²	EUR/MWh	y	%	tCO ₂ e/y
Case Study 1 – Textile, Italy	50-70	FPC	827	76.4	18.5	2.3	68
Case Study 2 – Chemical, Slovenia	130-180	LFR	25,981	44.9	11.0	6.0	2,315
Case Study 3 – Office/Laboratory, Italy	90-160	LFR	180	49.8	12.1	2.0	434
Case Study 4 – Waste Treatment, France	57-90	HVFPC	190	54.9	n.a.	n.a.	n.a.
Case Study 5 – Dairy, Spain	85	HVFPC	1,665	17.5	3.4	78.7	301
Case Study 6 – Meat Processing, France	55-96	HVFPC	2,200	44.0	12.0	18	520
Case Study 7 – Brewery, Spain	35-100	HVFPC	6,577	34.7	5.6	7.2	1,240
Case Study 8 – Food, Jordan	175	LFR	2,216	51.0	4.4	80.9	581
Case Study 9 – Chemical, Spain	195	LFR	19,684	109.0	20.2	51.9	1,224
Case Study 10 – Textile, India	170	LFR	17,100	16.8	8.0	4.3	7,633

Conclusions – Technical Aspects

- **High Vacuum Flat Plate Collectors (HVFP)** and **Linear Fresnel Reflectors (LFR)** are recurring as most suitable technologies:
 - HVFP for thermal demand slightly below 100°C
 - LFR for thermal demand between 100 and 200°C
- In most cases the limiting factor is **space availability**:
 - most industrial sites can satisfy only less than 10% of heat demand with solar thermal
 - sites having much space available, even on ground, can reach very high solar shares, between 50% and 80% of the total heat demand, also exploiting thermal storage
- **Avoided GHG emissions** are strongly correlated with the solar share, which influences the absolute amount of GHG emissions avoided together with the fuel used in the baseline (natural gas in practically all cases except for the Indian one, using coal)

Conclusions – Financial Aspects

- **Levelized Cost of Heat (LCOH)** and investment **Pay-Back Time (PBT)** are strongly variable, depending on:
 - ratio between the initial investment for the installation of the solar thermal plant (including storage) and the thermal energy production of the site during the year
 - baseline thermal energy production cost, in turn depending on type and price of fuel used and on boilers efficiency
- All replication studies were carried out considering “normal” **fuel prices**, i.e. those before 2022 energy crisis; considering 2022 natural gas prices, much better financial performances would be achieved
- No **public incentive** was considered in the evaluation of financial performance: this could further improve the investment profitability
- General conclusion: solar thermal has a **very good potential** for implementation in all industrial sectors characterized by thermal energy demand, provided that site-specific pre-requisites are met especially in terms of solar resource availability (depending on latitude and on local conditions like orientation/slope/obstacles) and of space availability for the installation of solar thermal collectors



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Solar Heat for Industrial Process towards Food and Agro Industries commitment in Renewables

Roadmap for the deployment of Solar Heating for Industrial Processes

Final Event , 15.06.2023



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Roadmap for the deployment of Solar Heating for Industrial Processes

SHIP2FAIR

Agenda

Day 1 – June 15th		
TIME	AGENDA	SPEAKER
11:55 h	<p>Roadmap for the deployment of Solar Heating for Industrial Processes</p> <ul style="list-style-type: none">• Main Objectives• Most promising use cases• Barriers• SHIP Deployment Roadmap• Conclusions	<p>LINKS Nicola Chiara, Innovation & Business Analyst</p>

Roadmap for the deployment of Solar Heating for Industrial Processes

SHIP2FAIR

Main Objectives



Tailor the project result to the most promising use cases

Identify and analyze the barriers

Present a possible roadmap of the replicability of SHIP2FAIR in other industrial sectors

Roadmap for the deployment of Solar Heating for Industrial Processes SHIP2FAIR

Most promising use cases

Target Market

Industrial sectors with process temperatures in the range between 50°C and 250°C

Identified Sectors

- Food & beverage
- Transport equipment
- Textile
- Machinery
- Pulp and paper industries
- Chemical industries

Technology

- Vacuum tube solar thermal technology for process heating & cooling
- High Vacuum Flat Panel - HVFP solar thermal technology for space heating (winter period) and process steam (summer period)
- HVFP technology for boiler pre-heating and process heat

Roadmap for the deployment of Solar Heating for Industrial Processes SHIP2FAIR

Barriers

Regulation Compliance

Start dealing with regulation compliance in parallel with the design phase, in order to avoid delays in commissioning phase

Language Barrier

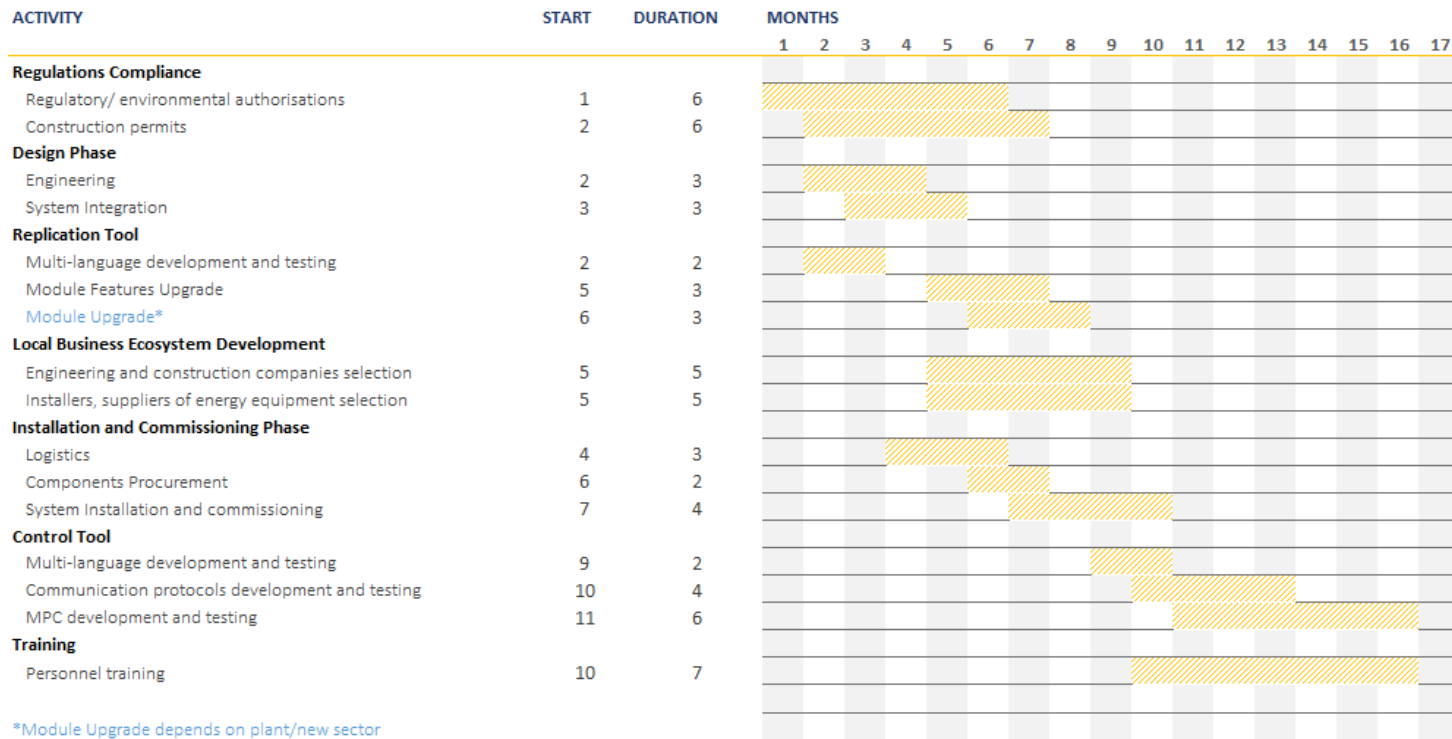
Include multi-language interface on the tools to facilitate replication and scale-up of SHIP2FAIR solution

Lack of specialized personnel

- Difficult to find specialized personnel in the energy and solar sector within SMEs
- Lack of an IT department in many SMEs

Roadmap for the deployment of Solar Heating for Industrial Processes SHIP2FAIR

SHIP Deployment Roadmap



*Module Upgrade depends on plant/new sector

Roadmap for the deployment of Solar Heating for Industrial Processes

SHIP2FAIR

Conclusions

- The collaboration of the actors involved in SHIP2FAIR experience generated new knowledge that can evolve in the future to form local value chains or business 'ecosystems' on applications of Solar Heat for Industrial Processes (SHIP).
- Training activities on each new SHIP plant will be key. In order to effectively replicate the SHIP2FAIR solutions, it is important that staff training is supported by a comprehensive guidebook. This manual should include operation and maintenance standard procedures/ work instructions covering the respective integrated energy systems.

Nicola Chiara – nicola.chiara@linksfoundation.com



Solar Heat for Industrial Process towards Food and Agro Industries commitment in Renewables

Renewable penetration in Spanish Industry

Sustainable Places 2023, 15 June 2023



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Background SHIP2FAIR

- Climate neutrality by 2050.
- Decarbonisation of the economy, stable strategic framework:
 - Climate Change Law.
 - Integrated National Energy and Climate Plan
 - Fair Transition Strategy

Integrated National Energy and Climate Plan

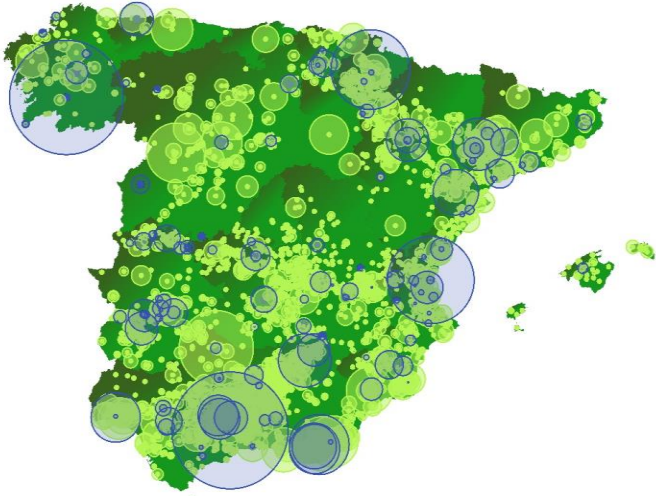
The following results are expected to be achieved:

- 21% reduction in greenhouse gas (GHG) emissions compared to 1990.
- **Significant growth in the penetration of renewable energies in Spain, reaching 74% in electricity and 42% in end use by 2030.**
- 39.6% improvement in energy efficiency.

Background SHIP2FAIR

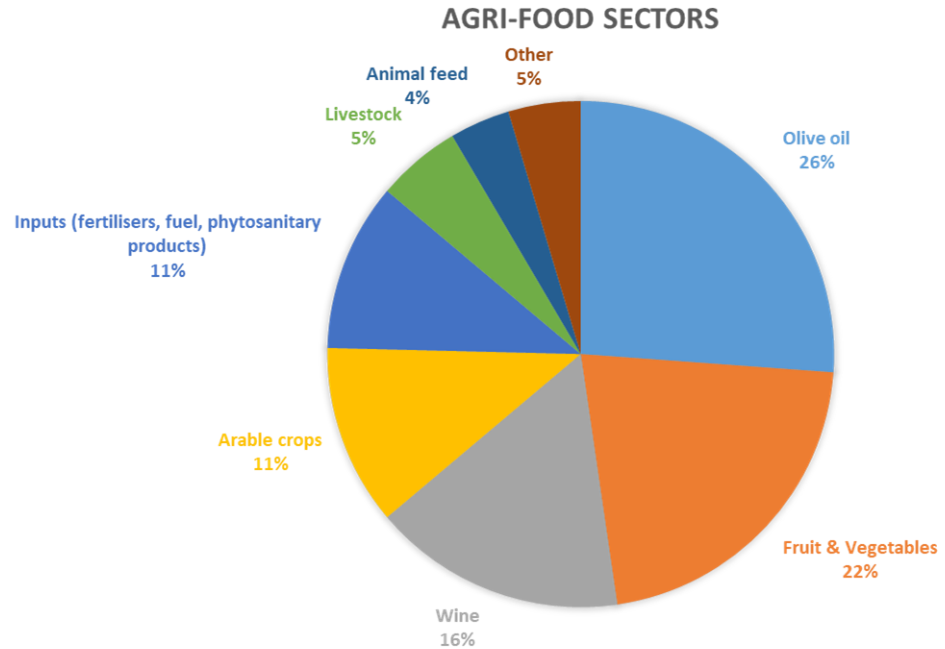
- The industrial sector is, after transport, the sector that consumes the most energy in Spain.
- Energy demands with a high thermal component.
- Need for change:
 - Decarbonised, circular and more sustainable economy model.
 - Greater weight of renewables.

What is happening in agri-food cooperatives? SHIP2FAIR



- > **3.669** cooperatives (**3.190** agricultural + **479** CEC).
- > **+ 1 Million** producer members.
- > Turnover: **33.880** Million € (38.428 M€ included investee capital companies).
- > **+123.700** direct employees.

What is happening in agri-food cooperatives? SHIP2FAIR Survey

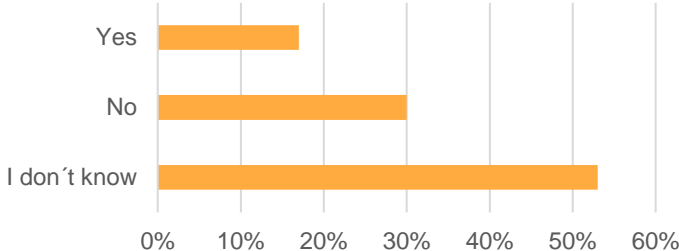


Solar Heat for Industrial Processes towards Food and Agro Industries commitment in Renewables

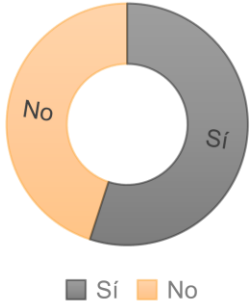
What is happening in agri-food cooperatives? SHIP2FAIR Survey

Annual energy consumption: 3 – 71,000 MWh (average 600 MWh)

Green energy certified supplier

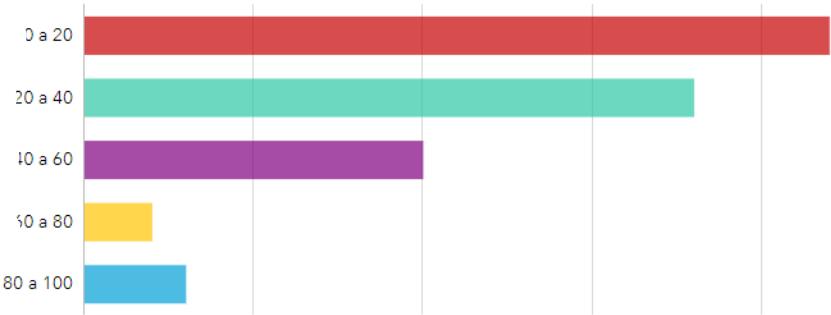


Any renewable technology installed?



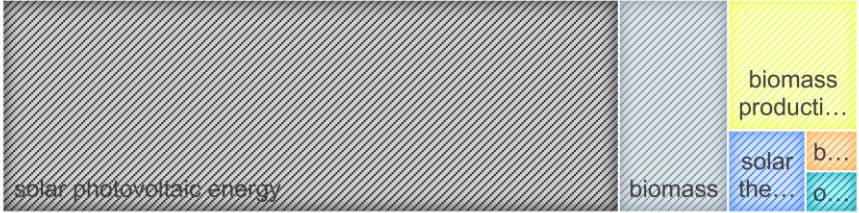
What is happening in agri-food cooperatives? SHIP2FAIR Survey

% energy used from renewable sources



Declared renewable energy installations

- solar thermal energy
- solar photovoltaic energy
- biomass
- biogas
- other
- biomass production



What is happening in agri-food cooperatives? SHIP2FAIR Survey

✓ Solar thermal energy.

- **Total installed capacity:** average 28 kW
- **Annual generation:** average 29,025 kWh.
- **Ownership of the installations:** own.
- **Use:** drying, cooling, hot water, sterilisation.
- **Average temperature obtained:** 90 ° C.
- **Location:** on roof.
- **Area used:** average 100 m².
- **Technology:** flat plate collector.

✓ Solar photovoltaic energy.

- **Total installed capacity:** 10- 2,500 kW
- **Annual generation:** 10,000-2,5 million kWh
- **Ownership of the installations:** own.
- **Use:** 88 % self-consumption, 12 % only to the grid.
- **Self-consumption:**
 - Use: refrigeration, air-conditioning, lighting, drying, pre-cooling, dehydrating,
 - Discharge to the grid: 32%.
- **Location:** on roof.
- **Area used:** average 2,150 m². max. 40,000 m².

What is happening in agri-food cooperatives?

SHIP2FAIR Survey

✓ Biomass consumption.

- **Total installed capacity:** 400-1,000 kW
- **Annual generation:** 100-16,000 kWh
- **Ownership of the installations:** own.
- **Use of biomass boilers:** Heat production
- **Use in industrial processes:** Drying, heating, oil shaking, heating of installations.

✓ Biogas

- **Use:** Heat production.

✓ Other technologies:

- Aerothermia.

✓ Biomass production:

- **Sources:** Olive pit>olive pomace>grape seeds>pruning
- **Annual production:** average 1,000 tons.
- **Destiny:** self-consumption, sale.

What is happening in agri-food cooperatives? SHIP2FAIR Survey

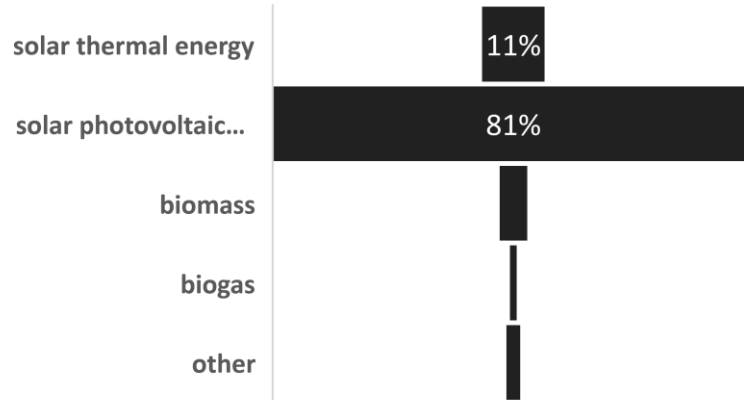
- Only 30% have carried out an energy audit.
- Around 50% have implemented energy efficiency measures.
- Between 50 - 60 %...
 - Has interest in energy communities.
 - Has an interest in agrovoltaics.
 - Considers that the cooperative should be a promoter of the deployment of both.

What is happening in agri-food cooperatives? SHIP2FAIR Survey

In the near future...

...66 % intend to expand their capacity or make use of other renewable technologies in 0-3 years.

Intentions in 0-3 years to install renewables



Susana Rivera.
rivera@agro-alimentarias.coop